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The Canada Water Act

Annual Report

2005–2006



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Minister of the Environment



Ministre de l'Environnement

Ottawa, Canada K1A 0H3

Her Excellency
The Right Honourable Michaëlle Jean,
C.C., C.M.M., C.O.M., C.D.
Governor General of Canada
Rideau Hall
Ottawa, Ontario
K1A 0A1

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 2005-2006, which was completed under my leadership.

Sincerely,

A handwritten signature in black ink, appearing to read "John Baird".

John Baird, 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 requires that a report on the operations under the Act be laid before Parliament after the end of each fiscal year. This, the 34th report, covers progress on these activities from April 1, 2005 to March 31, 2006.

The report describes a wide range of federal activities conducted under the authority of the Act, including participation on federal–provincial–territorial agreements and undertakings, significant water research, and a public information program. A map depicting Canada's major drainage areas and drainage flows is provided in Figure 1.

Provisions of the *Canada Water Act*

The following is a summary of the major provisions of the Act.

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, available at www.ec.gc.ca/CEPARegistry/gene_info/).

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.

Figure 1. Major Drainage Areas and Drainage Flows in Canada.



Comments on the Report

At the end of this report, a feedback form has been included to share your comments. Feedback on the report is appreciated and will help Environment Canada better understand the variety of audiences that read the report, as well as help shape future annual reports on operations under the *Canada Water Act*.

List of Acronyms

ACAP	Atlantic Coastal Action Program
AMAP	Arctic Monitoring and Assessment Programme
AOC	Area of Concern
CABIN	Canadian Aquatic Biomonitoring Network
CCME	Canadian Council of Ministers of the Environment
CEPA	1988 <i>Canadian Environmental Protection Act</i>
CEPA 1999	<i>Canadian Environmental Protection Act, 1999</i>
COA	Canada–Ontario Agreement Respecting the Great Lakes Basin Ecosystem
EEM	environmental effects monitoring
EIA	environmental impact assessment
EMAN	Ecological Monitoring and Assessment Network
GEM	Global Environmental Multiscale
GIS	geographic information system
HYDAT	Environment Canada's hydrometric database
IJC	International Joint Commission
INRE	Institut national de recherche sur les eaux
INRS	Institut national de la recherche scientifique
NEI	Northern Ecosystem Initiative
NGO	nongovernmental organization
NREI	Northern Rivers Ecosystem Initiative
NWRI	National Water Research Institute
PAHs	polycyclic aromatic hydrocarbons
PCBs	polychlorinated biphenyls
POPs	persistent organic pollutants
PPWB	Prairie Provinces Water Board
SOAER	State of Aquatic Ecosystem Report
ZIP	zone d'intervention prioritaire (priority intervention zone)

EXECUTIVE SUMMARY

Federal Programs

The *Canada Water Act* enables co-operative agreements for consultation and collaboration between the federal, provincial, and territorial governments in matters relating to water resources. Joint projects involve the regulation, apportionment, monitoring, or surveying of water resources, and the pre-planning, planning, or implementation of sustainable water resource programs. The planning studies encompass interprovincial, international, or other basins where federal interests are important. Implementation of planning recommendations occurs on a federal, provincial, territorial or federal-provincial-territorial basis. Agreements for specific water programs provide for the participating governments to contribute funding, information, and expertise.

Various federal programs are highlighted in this Annual Report. For example, the first national assessment of water quality in Canada was released in December 2005, as part of the Government of Canada's Canadian Environmental Sustainability Indicators initiative. As well, a number of federal-provincial-territorial water quality monitoring agreements have been developed since the early 1980s to provide data on water quality. Progress also continued on the work conducted by interjurisdictional boards, including the Ottawa River Regulation Planning Board, Prairie Provinces Water Board, and the Mackenzie River Basin Board.

In 2005–2006, the National Water Research Institute (NWRI) and other water science and technology groups in Environment Canada joined together to form the new Water Science and Technology Directorate. The Water Science and Technology Directorate leads initiatives across the country to protect and sustain Canadian water resources. Highlights of 2005–2006 include *Research into Action to Benefit Canadians*, a publication that presents a series of stories where benefits have been achieved; publication of a decade of pulp and paper environmental monitoring results; and new research studies, including the environmental role and economic value of wetlands and riparian zones in agricultural landscapes across Canada, national standards for waterborne pathogens (disease-causing micro-organisms) in agricultural watersheds across Canada; and several studies on the Great Lakes.

This report also highlights some of the public education programs, such as the Freshwater Website, Water Survey of Canada Website, and RésEau, an online project that demonstrates the sharing, discovery, access, and use of water information over the Internet.

Atlantic Region

The Atlantic Region consists of the provinces of Nova Scotia, New Brunswick, Prince Edward Island, and Newfoundland and Labrador. In this region, water quality monitoring, toxicological and ecosystem research, and integrated watershed management initiatives are the key components of *Canada Water Act* activities.

In 2003–2004, Fisheries and Oceans Canada began an environmental impact assessment with the province of New Brunswick to evaluate options for rehabilitating the Petitcodiac River estuary. In 2005–2006, the harmonized environmental impact assessment was completed and several options for restoration are being further examined.

A key watershed initiative in the region is the Atlantic Coastal Action Program (ACAP). ACAP is a community-based funding program designed to address environmental and sustainable development issues at a watershed level throughout Atlantic Canada. With broad, local support, non-profit organizations are incorporated at 14 sites across the region. ACAP organizations worked on a variety of projects within their local communities. Highlights of 2005–2006 progress include a multi-phased project to improve the environmental health of the St. Croix Valley, a study on the effects of urbanization on the aquatic environments of the Kennebecasis Valley, and a study of three rivers that flow through St. John's and Mount Pearl.

Quebec Region

In the Quebec Region, the St. Lawrence River and connected ecosystems are the main focus of the *Canada Water Act*. At the St. Lawrence Centre, which is the only federal research and development centre devoted entirely to the river ecosystem, specialists are involved in a number of studies and research programs aimed at better understanding how the ecosystems of the St. Lawrence River function and how to keep this knowledge up to date.

The State of the St. Lawrence Monitoring Program continued monitoring water quality, sediment quality, and biological resources in the St. Lawrence Basin, this year adding a usage and riverbanks component, which is currently being developed. A new communication tool was developed involving travelling display booths presenting both general and local information on the state of the St. Lawrence. A study was undertaken to evaluate terrestrial and aquatic species at risk on lands occupied by National Defence along the St. Lawrence.

In 2005–2006, work under the research program on river ecosystems continued on two main themes: urban effluents and biodiversity. Work on identifying and quantifying standard contaminants and emerging substances as well as their environmental fate also continued. The development of ecotoxicological evaluation tools carried on, and the urban effluents study data were developed for the evaluation of various waste treatment technologies. The biodiversity program produced several results on the spread and introduction of alien invasive species, the impact of environmental stress on aquatic productivity, and the links between environmental stress and health of organisms. Scientific documents from the St. Lawrence Centre were made more readily available on the website (www.qc.ec.gc.ca/csl/acc/csl001_e.html).

Specialists at the Meteorological Service of Canada continued their digital modelling of the St. Lawrence River. Simulations representing the hydrodynamics for various scenarios for water inflow into the St. Lawrence River were produced for the section of the river between Cornwall and Trois-Rivières. Modelling analyses also considered other physical parameters, such as those related to waves, light, and water temperature, in addition to biological models.

Ontario Region

Ontario Region's activities in the Great Lakes Basin under the federal Great Lakes Program are key components of Environment Canada's *Canada Water Act* deliverables. The activities of the partner government departments and agencies that participate in the federal Great Lakes Program are organized in relation to three main goals (healthy environment, healthy citizens, and sustainable communities) and seven objectives (restore Areas of Concern [AOCs], 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).

Through the 2002 Canada–Ontario Agreement Respecting the Great Lakes Basin Ecosystem (COA), accomplishments in 2005–2006 included progress towards rehabilitating ecological systems in all AOCs, significant reduction of harmful pollutants, release of the first biennial Progress Report under the 2002 COA, and initiation of the COA review.

The Canada–Ontario Water Use and Supply Project has made considerable progress throughout the past five years on a work-share basis and has completed many successful sub-projects as a result of the study. Within the region, water use and supply studies continued to focus on gathering information at the watershed level to help assess human and ecological sensitivities to changes in water availability and climate change within the Great Lakes Basin.

Prairie and Northern Region

The Prairie and Northern Region encompasses more than 50% of Canada's land mass and includes five jurisdictions: Alberta, Saskatchewan, Manitoba, Northwest Territories, and Nunavut.

A key project, the Northern Ecosystem Initiative, supports partnership-based efforts to improve understanding of impacts and adaptation to climate change, investigations of local contaminant concerns, improved management of resource use activities, and the development of a northern monitoring network in support of status and trend reporting. Selected water-related research projects in 2005–2006 include an investigation of how Great Bear Lake interacts with the atmosphere in relation to climate change and local meteorological events, a study investigating mercury levels in Lake Trout from Nunavik, and a study to collect and disseminate information on waste management and contaminated sites within the Yukon River Watershed.

The Prairie Provinces Water Board was established in this region to ensure that eastward-flowing interprovincial streams are shared equitably and that water quality at interprovincial boundaries is maintained at acceptable levels. The Board also facilitates a cooperative approach for the integrated development and management of interprovincial streams and aquifers to ensure their sustainability. Accomplishments in 2005–2006 included the finalization of a Charter and a Strategic Plan, development of a forecast of future water use, and completion of a study on the economic value of water in alternative uses.

The Mackenzie River Basin Board was created in 1997 to ensure a healthy and diverse aquatic ecosystem for the benefit of present and future generations within the Mackenzie River Basin. After completing and distributing the first State of the Aquatic Ecosystem Report (SOAER) in 2004, the Board made presentations to several associations in 2005–2006. The Board also began major preparations for the next cycle of SOAER reporting.

Pacific and Yukon Region

The Pacific and Yukon Region encompasses British Columbia and Yukon. The region is characterized by rugged terrain and variations in the amount, distribution, and form of water, resulting in a diverse climate.

The federal-provincial Georgia Basin Action Plan was announced on April 2, 2003, as a renewal of the Georgia Basin Ecosystem Initiative. The Action Plan is built upon a vision of “healthy, productive, and sustainable ecosystems and communities in the Georgia Basin” and is a key component of this region’s initiatives on water. Under the Action Plan, projects and research are funded to address threats to and pressures and impacts on the sustainability of the Georgia Basin. Priorities include habitat and species conservation, reduction of pollutants, remediation of shellfish growing areas, and improved local decision-making. Examples of work in 2005–2006 include monitoring stream condition assessment, monitoring emerging chemicals of concern in municipal wastewater, and promoting the Waterbucket.ca website, which provides information on integrated water management in British Columbia.

The Pacific Environmental Science Centre continues to conduct studies on the toxicology and chemistry of fresh and marine water in the Georgia Basin. The Pacific and Yukon Region also continues to promote several public information programs.

HIGHLIGHTS, 2005–2006

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

1. Federal–Provincial–Territorial Programs

This section describes federal, provincial, and territorial collaboration on:

- data collection and use;
- interjurisdictional boards; and
- ecosystem initiatives.

1.1 Data Collection and Use

1.1.1 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.

Under an initiative known as the partnership renewal process, the government partners have been reviewing the existing bilateral agreements in order to determine the best path forward for updating the 1975 agreements.

Work continued on re-engineering the collection of hydrometric data in order to minimize the associated field hazards. New field technologies became operational following several years of research and testing. Although funding under the Program Integrity initiative ended in March 2005, developmental efforts continued with other sources of funding.

Progress (to March 31, 2006)

Slow progress continued in finalizing the draft bilateral agreements. The provinces of Nova Scotia, and Newfoundland and Labrador opted to wait until the province of New Brunswick completed its review of the draft agreement and cost implications. New Brunswick proposed some minor changes to the draft for submission

to their committee review process, which is required before provincial Cabinet review of the agreement.

The four Atlantic provinces and Environment Canada held a workshop on monitoring, data sharing, and information management. This workshop was held under the umbrella of the Atlantic Competitive and Environmental Sustainability Framework. The workshop produced a statement of common principles and priorities, as well as a commitment to pursue monitoring proposals, including one for water monitoring.

Six discontinued hydrometric stations in Newfoundland and three in Nova Scotia were successfully decommissioned.

The focus of the Program Integrity initiative continued to be on research and development. Significant progress has been made in testing and evaluating hydroacoustic technologies for suitability as an operational tool within the water survey field program. Selected models of the acoustic Doppler current profiler, an instrument that has shown great promise in reducing the time expended and dangers encountered by field staff when conducting velocity and flow measurements, were introduced into the operational field program. Other technologies that are being investigated include in situ acoustic velocity meters, and non-contact stage, velocity, and flow meters using radar and laser systems. Additional progress was made in the development of hydraulic and hydrological techniques that will reduce the risks associated with field measurements and will allow for the extrapolation of data from existing hydrometric stations to estimate stream flows at ungauged sites.

Detailed discussions were held with federal, provincial, and private sector partners regarding the provision of gridded hydrological data products derived from the operational numerical weather prediction Global Environmental

Multiscale model, a numerical weather prediction tool. A select group of clients continued evaluations of advanced versions of a web-based data extraction tool and a web portal for disseminating specialized information about gridded data products to the hydrological community.

1.1.2 Water Use and Supply Data

Background

In the fall of 2000, Canada and the province of Ontario initiated a joint federal-provincial water use and supply project for the Great Lakes Basin. The primary objectives 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 the Environment, the Ontario Ministry of Agriculture, Food and Rural Affairs, Conservation Ontario, and Fisheries and Oceans Canada. Three technical working groups (water use, water supply, and ecological requirements) conduct the work.

Progress (to March 31, 2006)

The Canada–Ontario Water Use and Supply Project has made considerable progress throughout the past five years on a work-share basis and has completed many successful sub-projects as a result of the study.

In the past year, the Ecological Requirements Working Group continued efforts to assess ecological sensitivities to changes in water availability. The work has primarily focused on watersheds in the Lake Ontario Basin. One project developed a methodology to rank watersheds in the Lake Ontario Basin based on the sensitivity of their wetland resources to decreased water availability. Another project looked at the potential water quality impacts for select watersheds in the Lake Ontario Basin due to changes in water quantity.

The Water Supply Working Group completed the analysis of streamflow statistics for watersheds of the Great Lakes Basin using information from Environment Canada's streamflow monitoring network. Watersheds were also ranked based on their low flow characteristics using an indicator called the base flow index.

The Water Use Working Group continued efforts to complete the Water Use Report and the Demand Forecasting Report. Future efforts by the working group will include attempts to report water use for smaller watershed areas.

In the coming year, members of the Canada–Ontario Water Use and Supply Project will look at ways to integrate the water supply, water use, and ecological requirements information to identify the relative sensitivity of watersheds across the Great Lakes Basin.

1.1.3 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), Northwest Territories (1995), Prince Edward Island (1989), Quebec (1983), and Yukon (1995).

The agreement with New Brunswick was revised in 1995 when the provincial government undertook to collect, analyze, and manage the data for the water quality monitoring program. The agreement with Prince Edward Island was incorporated into the Canada–Prince Edward Island Water Annex in 1996, which expired in 1999 and was replaced with the Canada–Prince Edward Island Memorandum of Agreement on Water signed in May 2001. Water quality monitoring continues under this new agreement.

The agreement with Quebec was terminated in 1995 because activities were similar to those in the St. Lawrence Action Plan. A specific framework agreement was negotiated with Quebec for the monitoring of the state of the St. Lawrence River, including long-term water quality monitoring. The agreement marks the first partnership between Environment Canada–

Quebec Region, Fisheries and Oceans Canada—Quebec Region, the Quebec Ministry of the Environment, and the Société de la faune et des parcs du Québec. St. Lawrence River water quality monitoring stations are shared by Environment Canada and the Quebec Ministry of the Environment. In 2005–2006, discussions resumed between Environment Canada and the Department of Sustainable Development, Environment and Parks concerning the development of a long-term agreement on water quality monitoring, including several St. Lawrence tributaries.

Progress (to March 31, 2006)

In New Brunswick, 10 long-term surface water quality stations continued to be monitored under the federal-provincial agreement. These stations were used to report on freshwater quality in the 2006 Canadian Environmental Sustainability Indicators (CESI) report.

In Newfoundland and Labrador, 90 water quality sites continued to be sampled under the federal-provincial agreement. Water quality monitoring at a selected network of Labrador ashkui sites (the term ashkui refers to the first open water area in the spring) were sampled for the last time in the spring of 2005, even though future reporting needs will identify these sites as essential for this northern area. A new study under the Northern Ecosystem Initiative investigated the impact of the third phase of the Trans-Labrador highway on water resources in the Mealy Mountains of Labrador. The national Water Quality Indicators Project begins to utilize stations in preparation for the Water Quality Index report. The National Wetlands and Canada and Newfoundland-Labrador Aquatic Link/RésEau Projects are identified under the Water Quality Agreement. For the 2006 CESI report, data from more monitoring stations were used to calculate water quality.

Lake water quality monitoring continued in New Brunswick, Nova Scotia and western Newfoundland for Environment Canada's ongoing Long-range Transport of Airborne Pollutants Program. Water quality monitoring continued in New Brunswick in support of long-term multi-agency research projects on the impacts of forestry operations on water quality at Catamaran Brook.

Annual meetings were held by representatives for the Canada–PEI Memorandum of Understanding on Water. Within this agreement it was agreed that the five-year review document would be produced, highlighting projects during the 2003–2005 period. Samples were taken at 5 federal-provincial hydrometric stations, 8 groundwater stations, 10 marine/estuary stations, and 14 freshwater stations. Benthic sampling (sampling biota that live in the sediment) occurred at a reduced rate with emphasis placed on ensuring the program is maintaining Canadian Aquatic Biomonitoring Network (CABIN) standards. A selection of data from stations was made available to the public through the provincial and RésEau websites. Information from this water quality network was used in the 2006 CESI report.

In Quebec, the cooperative effort arising from the Canada–Quebec agreement on the St. Lawrence and the federal-provincial agreement on the State of the St. Lawrence Monitoring Program led to the third year of a joint study on pesticides in Lake Saint-Pierre and tributaries, the region of Quebec where the risks associated with farming are the highest. This project involved monitoring problematic tributaries on the St. Lawrence River (Yamaska, Nicolet, and Saint-François) to identify types of pesticides, their concentrations, and their temporal distribution mode. The data from the second year of sampling were covered in the initial report on the project. In 2005–2006, a triennial report was produced.

Environment Canada and Manitoba Water Stewardship continued to support the Canada–Manitoba Water Quality Monitoring Agreement. Environment Canada monitored water quality each month on five rivers at sites located on either interprovincial or international boundaries. Ions, nutrients, metals and pesticides are monitored in water under the Agreement. In addition to this monthly program, automated Water Quality Monitor is operated on the Red River at the international boundary, providing near real-time information via satellite on dissolved oxygen, conductivity, pH and temperature. In response to the operation of the constructed outlet from Devils Lake, North Dakota, weekly water quality samples are collected and analyzed for ions and nutrients during the open water season.

Environment Canada and the British Columbia Ministry of Environment jointly conducted bi-weekly or monthly water quality monitoring at 37 stream or river sites in British Columbia. This included two stations that were added to the network due to additional resources from the federal Water Quality Indicator fund and matching funds from the province. At least two more stations are also being considered. This network expansion has improved spatial water quality representation in the province. Cooperative arrangements to test groundwater quality at wells continued where cost-effective. Environment Canada monitored water quality at an additional six stream or river sites in British Columbia and seven sites in Yukon Territory. Many of these sites were monitored in cooperation with the Parks Canada Agency. Four of the Yukon sites were added in 2005–2006 with Water Quality Indicator funding and sampled in cooperation with Yukon Territory. The water quality web project, which was developed as a pilot in 2002–2003, in cooperation with the Canadian Information System for the Environment, continued to evolve with support from RésEau and Georgia Basin Action Plan funding. Water quality data and associated information are available on the website (www.waterquality.ec.gc.ca/EN/home.htm). Developments in 2005–2006 included the design of a station webpage that contains annual descriptive statistics for Water Quality Indicator calculations, update of National Pollutant Release Inventory information, site-specific guideline and objective information accessible through the data graphing function, and a freshwater quality indicator section with links to the Canadian Council of Ministers of the Environment website on water quality indicators.

1.1.4 Petitcodiac River Estuary Restoration

Background

In 1968, a one-kilometre causeway and dam with five sluice gates was 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 issues related to fish passage, levels of nutrients and dissolved oxygen, pollution, and channel sedimentation.

Progress (to March 31, 2006)

The first draft of harmonized environmental impact assessment (www.petitcodiac.com) was completed. The overall conclusions were:

- For fish passage to be re-established on the Petitcodiac River for nine important species, the Status Quo and Project Option 1 (replacing the fishway) and Project Option 2 (gates open during peak migration) will not achieve this. Only Project Option 3 (gates open permanently) and Project Option 4 (replace the causeway with a partial bridge) with modifications do.
- Option 3 would be the least costly to build and operate, but would not have the enhanced benefits (increased sediment erosion and tidal exchange) of Project Option 4(A-C).
- Project Option 4A is another way of achieving the same result as Project Option 3, but will have less of an environmental effect on traffic patterns during the construction phase.
- Project Option 4B affords a greater degree of flexibility should predicted sediment erosion and increased tidal exchange be found to be less than predicted under Project Options 3 or 4A.
- Project Option 4B can start with just opening the control structure and, later, widen the causeway beyond the control structure if the tidal exchange needs to be enhanced. If this is not required, then the additional cost of widening the opening can be avoided.
- Project Option 4C would be the most costly Project Option and would have inherent construction risks (dredging or cofferdam failure and proximity to the former Moncton Landfill immediately downstream) that would be much greater than the other Project Options.

1.1.5 Canadian Environmental Sustainability Indicators

Background

Following the recommendations of the 2003 National Round Table on the Environment and the Economy Report, the Government of Canada

committed in the federal budget in March 2004 to develop and report better environmental indicators on clean air, clean water, and greenhouse gas emissions.

Progress (to March 31, 2006)

Using a water quality index that summarizes the extent to which water quality guidelines for the protection of aquatic life (plants, invertebrates, and fish) are exceeded in Canadian rivers and lakes, the first national assessment of water quality in Canada was released in December 2005, as part of the Government of Canada's CESI initiative. The freshwater indicator chapter of the CESI report was based on a preliminary assessment of monitoring data from 345 federal, provincial, and federal-provincial monitoring stations across Canada, including the Great Lakes, and involved cooperation across several federal departments and the provinces. A complementary, online tool (www.environmentandresources.gc.ca/indicators) was also released to provide indicator results and supporting information in a user-friendly format, including interactive maps that allow users to directly access monitoring station metadata used to develop the water indicator.

Work is presently underway with Statistics Canada and other departments to expand the current water quality monitoring network so that a more representative distribution of water bodies (northern, rural, and protected areas) and water uses (aquatic life, agriculture, and drinking sources) can be covered by the national indicator. Environment Canada and Statistics Canada are also collaborating to improve interpretation of the new water indicator through surveys on household and environment (2006), industrial water use (2007), and agricultural water use (2008). Opportunities to link the indicator to the surveys and to other national databases to enhance analysis and modeling capabilities are also being investigated. The second annual CESI report is scheduled for release in November 2006 and, for the first time, will report on freshwater quality in northern Canada.

1.2 Interjurisdictional Boards

1.2.1 Ottawa River Regulation Planning Board

Background

In 1983, Canada, Quebec, and Ontario concluded an Agreement Respecting 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 Montréal 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 regulatory 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 Mille-Îles River in the Montréal region.

Progress (to March 31, 2006)

There was no significant flooding along the main stem of the Ottawa River during the spring of 2005. However, water levels did exceed the flooding threshold for four days in the Lake of Two Mountains area near Montréal. Prudent management of the reservoirs, including use of storage volumes for flood reserves, was successful in reducing the magnitude of peak flows.

The Board convened four meetings during the year in Ontario and Quebec. The meetings dealt with typical agenda items such as activities of the Ottawa River Regulating Committee, enquiries from outside organizations and the general public, and progress of projects planned or underway along the Ottawa River.

The seventh annual public meeting was held in Pembroke, Ontario on August 23, 2005. There was considerable interest from members of the public regarding regulation of the inter-provincial reach of the river from Mattawa to Arnprior, and issues of water levels and erosion on Lake

Temiscaming. This was one of the largest public meetings with approximately 100 attendees.

1.2.2 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. Schedules A and B provide general principles to apportion water between the provinces. Lodge and Battle Creeks in southwestern Saskatchewan are apportioned under Article 6, Schedule A, of the Master Agreement and the 1921 Order of the International Joint Commission (IJC) under the terms of the 1909 Canada–United States Boundary Waters Treaty. Under Schedule C, the Prairie Provinces Water Board was reconstituted to administer the provisions of the Master Agreement. Schedule E specifies acceptable water quality objectives in each river reach along the interprovincial boundaries and further defines the duties of the board with respect to its water quality mandate.

Progress (to March 31, 2006)

During 2005, runoff was well above normal across the Prairies with record flows on some systems. As a result, apportionment was met on all watercourses. On the South Saskatchewan River, where there is the largest amount of development of all eastward flowing watercourses, Alberta delivered about 93% of the natural flow to Saskatchewan.

In 2005, the Board completed work that was initiated in 2004 with a multi-agency workshop and subsequent work by a special Board committee of agency representatives. The refinement of the Board's role and responsibilities has provided a renewed consideration of the accountability of the Board and its supporting committees. As a result of this process, the Board has become more focused on its core responsibilities: ensuring apportionment is met, identifying exceedences to water quality objectives, and determining any threats to transboundary aquifers.

The Board continued its role in helping to ensure coordination of water management and planning that may have transboundary

implications. The Board also coordinated a very successful workshop on instream flow needs. Representatives from a number of agencies with an interest in instream flow needs were brought together to share information on approaches in general use within the Prairies. Such a workshop highlights an important role the Board can play in helping convene forums for the exchange of information.

Other Board developments included completion of a study on the economic value of water in alternative uses, and the development of a forecast of future water use. Presentations at Board meetings on a new land and water information system under development by Prairie Farm Rehabilitation Administration, and the new drought study by the University of Saskatchewan and other universities helped to keep the Board informed of new and emerging issues.

Each of the three standing committees for Hydrology, Water Quality, and Groundwater held at least one face-to-face meeting and additional conference calls, as necessary, and each continued to advance knowledge in their particular areas of interest.

The Committee on Hydrology continued to look at ways to refine and improve the extensive hydrometric network to ensure the accurate determination of apportionment. The Committee started the process of re-assessing its data management and computational infrastructure in 2006.

The Committee on Water Quality revised its method for reporting on water quality objective exceedences, revised and updated its Spill Response Plan, and continued its work on the development of nutrient objectives.

The Committee on Groundwater finalized its project on the mapping of transboundary aquifers, and initiated the development of a framework plan for aquifer management.

1.2.3 Mackenzie River Basin Board

Background

The governments of Canada, British Columbia, Alberta, Saskatchewan, the Northwest Territories, and Yukon signed the Mackenzie River Basin Transboundary Waters 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. When these bilateral agreements are complete, they will 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. The secretariat is located near the center of the Mackenzie River Basin in Fort Smith, Northwest Territories.

The website (www.mrbba.ca) went online in 2002. News items, maps, and reports can be downloaded. The website plays a role in providing public information about water in the basin.

Progress (to March 31, 2006)

The Mackenzie River Basin Board has a major responsibility under the Master Agreement to produce a State of Aquatic Ecosystem Report (SOAER) for the Mackenzie River Basin every five years. After completing and distributing the first SOAER in 2004, the Board reorganized its

Technical Committee and mandated it to provide technical support and advice to the Board, address monitoring and reporting requirements of the Master Agreement and bilaterals, and provide support and advice to the preparation of the next SOAER. The Technical Committee developed terms of reference and began the development of a Hydrological Model of the Basin.

The Board also reorganized its SOAER Committee. The SOAER Committee began planning for the next cycle of State of the Aquatic Ecosystem reporting. The next SOAER will be prepared in fiscal year 2007–2008 and published in 2008–2009.

The Secretariat made presentations based on the SOAER to the Northern Territories Water and Waste Association, the Peel Watershed Planning Commission, the Canadian Water Resources Association, the Mackenzie Study Group of the Global Water and Energy Cycle Experiment, and a Peace–Athabasca Delta workshop.

1.3 Ecosystem Initiatives: Watershed and Water-related Activities

During 2005–2006, Environment Canada continued the implementation of its Ecosystem Initiatives. They have been developed with a wide range of partners to respond to the unique and complex environmental and sustainability issues of targeted ecosystems across Canada. Through the application of an ecosystem approach, the objective is to attain the highest level of environmental quality within targeted ecosystems as a means to enhance the health and safety of Canadians, preserve and enhance natural resources, and optimize economic competitiveness.

Ecosystem Initiatives achieve results by relying on measurable environmental results, aligned and coordinated efforts, collaborative governance mechanisms, integrated science and monitoring, community involvement, sharing information and experiences, and informed decision making. A wide variety of products, tools, and information was produced by each initiative this year. However, the focus of this report is primarily on water-related activities and their interjurisdictional arrangements.

1.3.1 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 were 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, atmospheric emissions, toxics, and natural habitat.

Progress (to March 31, 2006)

ACAP organizations delivered projects on a variety of issues within their local communities. In southern New Brunswick, the St. Croix Estuary Project is undertaking an ongoing, multi-phased project to improve the environmental health of the St. Croix Valley. They worked with the Town of St. Stephen to clean up the waterfront. They also worked on the local water supply to address high bacterial counts, chlorination, and negative impacts on the protected water of the Dennis Stream, its aquifers, and, in turn, the St. Croix River.

ACAP Saint John studied the effects of urbanization on the aquatic environments of the Kennebecasis Valley. Mapping the concentration of contaminants and several water quality parameters in the river and along two streams flowing into the river will serve in monitoring both point source and non-point source pollution. A dye study was also conducted to determine the potential fate of contaminants entering the Kennebecasis River from Taylor's Brook.

In eastern Newfoundland, Northeast Avalon ACAP partnered with the Department of Environment and Conservation, and the Department of Chemistry at Memorial University to conduct a study on three rivers that flow through St. John's and Mount Pearl. The main focus of the study is to determine the amount of road salt that enters these rivers during the winter months.

1.3.2 St. Lawrence Plan

Background

Originally launched in 1988, the St. Lawrence Plan (SLP) is a Canada–Quebec ecosystem initiative to protect, preserve, and restore the St. Lawrence River ecosystem. This five-year plan has been renewed three times 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, ZIP (Zone d'intervention prioritaire [priority intervention zone]) committees, nongovernmental organizations, and riverside communities. Efforts are focused on the St. Lawrence River and its major tributaries, from Lake Saint-François at the Quebec–Ontario border to the eastern end of the Gulf of St. Lawrence.

The new 2005–2010 Canada–Quebec Agreement was signed in November 2005. This fourth phase of the SLP continues the collaborative implementation of several measures dedicated to conservation, protection, and restoration of the ecosystem and recovery of use. It also initiates the implementation of a new governance mechanism—integrated management of the St. Lawrence (IMSL).

Progress (to March 31, 2006)

Accomplishments in 2005–2006 included:

- *Integrated Management of the St. Lawrence* — The Intergovernmental Working Group on IMSL completed the first phase of its mandate — preparation of a technical document describing the governance mechanisms and how IMSL is to be implemented by agencies currently working on the St. Lawrence River. The document is the product of consultation and partnership involving the community, including the ZIP committees and *Stratégies Saint-Laurent*, as well as the federal and provincial departments that are partners in the SLP.
- *Portrait of Community Action* — A portrait of community action over the 15 years of the St. Lawrence Action Plan has been completed. It shows the progressive participation by St. Lawrence riverside communities and their increased involvement in the achievement of SLP results.

- *Community Interaction Program* — During 2005–2006, the Community Interaction Program supported the implementation of 40 projects, 15 of which were carried out by ZIP committees and are related to the Ecological Restoration Action Plans in their intervention zones. A supporting team comprising ten Environment Canada scientists was set up to improve the scientific and technical support provided to ZIP committees and communities.
- *Youth Education Programs* — Community involvement has also led to support for youth education programs at the Biosphère and the first Sommet jeunesse sur l'eau et le Saint-Laurent, organized in cooperation with the Établissements verts Brundtland and the Club 2/3. A youth magazine entitled *Fleuve Action* was produced, and collaboration started with Moncton University on the production of two new environmental education programs aimed at primary and secondary schools students. Youth engagement activities continued through the Adopt a River project in cooperation with the Comité de valorisation de la rivière Beauport and the Freshwater Fish Ecowatch Network.
- *Sediment Remediation Projects* — The sediment remediation projects in the Saint-Louis River and in Sector 103 of the Port of Montréal, put forward by sustained collaborative ZIP committee efforts over several years, received the necessary government authorizations and should get underway in the spring of 2007. Project development for remediation of the contaminated aquatic site at Sandy Beach in the Gaspé harbour area continued.
- *Monitoring the State of the St. Lawrence Program* — The Monitoring the State of the St. Lawrence Program expanded its activity to include an increased spatial coverage of its indicators for toxic substances and certain emerging substances, sediments in Lake Saint-Pierre and Lake Saint-Louis, the diet and productivity of the Northern Gannet and contamination of freshwater fish species by toxic substances. New indicators make it possible to monitor land use and the benthic communities of Lake Saint-Pierre, while others that relate to uses, invasive plant species, bank erosion and potential for swimming are being developed in collaboration with communities. Six fact sheets presenting the results of monitoring indicators were updated in preparation for Rendez-vous St. Lawrence, a public event to be held in June 2006 to report on new findings and the changing state of the St. Lawrence. A travelling information booth on the state of the St. Lawrence was also developed in collaboration with representatives of riverside communities and the Biosphère.
- *Ecological Integrity* — In the area of ecological integrity, metals discharged in urban effluents were identified and quantified and their environmental fate was modelled. In addition, the ecotoxicological potential of pharmaceutical products in the dispersion plume of Montréal urban effluent was documented. The working group on the environment and wetlands officially concluded its work with the publication of the final report of the International Lake Ontario–St. Lawrence River Study Board, submitted to the IJC in March 2006. An environmental synthesis covering water availability issues for the St. Lawrence is being prepared and should be published in 2006–2007.
- *Navigation Committee* — The Navigation Committee is continuing its collaborative activities in the maritime environment by applying the principles of the Sustainable Navigation Strategy. The Committee worked with the Ouranos Consortium, which focuses on the anticipated effects of climate change, to produce a discussion paper evaluating the various adaptation options to the effects of climate change for commercial shipping in the event of a decrease in water levels.
- *Agriculture Projects* — In the area of agriculture, projects intended to generate knowledge on ecological resources in farmland areas and strategic planning aimed at improving the quality of sensitive habitats by reducing non-point pollution and bank erosion have begun. Studies on the atmospheric and aquatic dispersion of formerly and presently used pesticides have also begun.

1.3.3 Great Lakes Program

Background

The Government of Canada launched the Great Lakes Action Plan in 1989 to integrate its efforts

to restore the health of the Great Lakes Basin ecosystem. This is a coordinated effort among federal departments to ensure that Canada's commitments under the Canada–United States Great Lakes Water Quality Agreement (GLWQA) are met. The federal Great Lakes Program has evolved through subsequent renewals in 1994 as Great Lakes 2000, in 2000 as Great Lakes Basin 2020, and the most recent announcement in 2005, which is focused on continuing work to restore AOCs.

The federal Great Lakes Program is a partnership of seven federal departments and one federal agency, whose goals are a healthy environment, healthy citizens, and sustainable communities. Program partners include Agriculture and Agri-Food Canada, Environment Canada, Fisheries and Oceans Canada, Health Canada, Natural Resources Canada, Parks Canada Agency, Public Works and Government Services Canada, and Transport Canada. This important coordinated federal program significantly bolsters Canada's efforts to protect and restore the Great Lakes Basin ecosystem, particularly in combination with Environment Canada's Great Lakes Basin Ecosystem Initiative, which is one of five national priority ecosystem initiatives to address and solve complex environmental, economic, and social issues.

In addition, the Great Lakes Basin 2020 initiative provides \$40 million over five years (i.e., \$8 million annually until March 2005) to restore environmental quality in significantly degraded AOCs designated under the GLWQA. The Government of Canada, in early 2005, renewed its Great Lakes Program funding of \$40 million over five years. This funding renewal will allow program partners to build on past achievements to improve the ecological integrity of the Great Lakes and continue work on the environmental restoration of key AOCs.

Federal partner departments' activities are integrated with those of the province of Ontario through the 2002 Canada–Ontario Agreement Respecting the Great Lakes Basin Ecosystem (COA). The governments of Canada and Ontario signed their first COA in 1971 to demonstrate their joint commitment to stemming the tide of environmental degradation within the basin. The COA has been renewed several times to reflect new challenges and changing conditions within the basin.

The successive COAs represent a successful model of federal-provincial cooperation that recognizes the shared jurisdiction surrounding many of the issues faced within the Great Lakes Basin, establishes common goals and results, and coordinates actions to eliminate overlap and optimize use of resources for maximum results. Achievements include reduced levels of many pollutants, improved water quality, and restored species and their habitats.

The 2002 COA is guided by the vision of a "healthy, prosperous, and sustainable Great Lakes Basin for present and future generations." It has enabled the continuation of progress on priority issues. Through the COA, both governments have set out environmental priorities and specific goals and actions for the enhancement and preservation of the basin's ecosystem. The 2002 COA focuses on four major environmental priorities that will benefit from federal-provincial cooperation and coordinated action. For each priority, the COA sets out a series of desirable goals and actions to be achieved over the five-year duration of the agreement. The four major environmental priorities are:

- cleanup of the remaining AOCs within the basin;
- significant reduction or virtual elimination of harmful pollutants within the basin;
- implementation of a series of binational lakewide management plans to address problems unique to each of the Great Lakes; and
- improve monitoring and information management.

Signatories to the COA include eight federal departments and agencies (Agriculture and Agri-Food Canada, Environment Canada, Fisheries and Oceans Canada, Health Canada, Natural Resources Canada, Parks Canada Agency, Public Works and Government Services Canada, and Transport Canada) and three provincial ministries (Ontario Ministry of the Environment, Ontario Ministry of Natural Resources, and Ontario Ministry of Agriculture, Food and Rural Affairs).

Progress (to March 31, 2006)

Canada and Ontario have been working cooperatively to implement the 2002 COA. It will take considerable time, effort, and resources to achieve the extensive results set out in the agreement. In 2005–2006, the fourth year of work under the 2002 COA, over 650 projects were underway. Steady progress has been made in relation to all COA results.

Accomplishments in 2005–2006 included:

- *Biennial Progress Report* — The first biennial Progress Report under the 2002 COA was released in June 2005. It describes Canada's and Ontario's achievements during 2002 and 2003 and highlights the roles played by local and regional governments, industry, and community and environmental groups in carrying out projects that contribute to the protection of the entire Great Lakes Basin ecosystem.
- *COA Review* — In fall 2005, Canada and Ontario launched a review of the current COA to assess how it has worked and how well it has been implemented. Consultation with Great Lakes stakeholders consisting of surveys, interviews, and focus groups of about 200 internal and external participants was conducted. The review is to be completed in spring 2006.
- *Management of Contaminated Sediment* — COA agencies made great strides developing a risk-based decision-making framework for contaminated sediment in AOCs, with input from international and national government experts as well as non-government experts. This tool will allow for scientific consensus and pave the way for the management of contaminated sediment, a long-standing issue in the Great Lakes and a factor that contributes to degraded environmental conditions and beneficial use impairments at numerous AOCs.
- *Infrastructure Improvements* — Funding support from federal and provincial governments enabled a new series of infrastructure improvements, including upgrading the Town of Nipigon's sewage treatment plant from primary to secondary treatment. The Town of Nipigon is located in the Nipigon Bay AOC.
- *Dental Wastes: Best Management Practices Guide for the Dental Community* — In April 2005, a best management practices guide was published to inform members of the dental community on how to properly manage hazardous wastes in order to minimize the release of toxic substances, in particular mercury, into the environment.
- *Auto Switch-out Program* — As of July 1, 2005, the Auto Switch-out Program, a voluntary program across Canada collecting mercury-containing switch pellets from vehicles before they enter the waste stream, involved more than 450 Canadian automobile recyclers participating in the program, and collected close to 80 000 switches.
- *Burn it Smart!* — In 2005–2006, over 500 people attended Burn it Smart! workshops in Ontario. These workshops help users make their wood-burning for heating or recreational purposes safer, cleaner, and more efficient.
- *Identifying and Developing Strategies for Canada's and Ontario's Response to Emerging Substances in the Great Lakes Basin* — A joint Canada–Ontario workshop on emerging substances was held in March 2006 in Toronto, Ontario. Approximately 100 federal and provincial representatives participated in the workshop. The purpose of the workshop was to share knowledge regarding the research, assessment and management of emerging substances; identify challenges and data gaps; and discuss potential strategies and approaches that could inform future work under the COA.
- *Great Lakes Sustainability Fund* — The Great Lakes Sustainability Fund provided \$5.6 million for fish and wildlife habitat rehabilitation, contaminated sediment management, and urban and rural wastewater control projects. Project partners contributed an estimated \$13.5 million to 100 projects to advance restoration in the Great Lakes AOCs.
- *Great Lakes Binational Monitoring Inventory* — The Monitoring Inventory was launched as a first step towards implementing a long-term Information Management Strategy for monitoring programs in the Great Lakes Basin. Accomplishments in 2005–2006 included:

- content was exchanged between the Great Lakes Commission and the IJC's Council of Great Lakes Research Managers Inventories;
 - the Council of Great Lakes Research Managers Inventory home page now directs contributors to the Great Lakes Binational Monitoring Inventory if they are submitting monitoring programs, and vice-versa for research programs;
 - the monitoring inventory contains 1069 entries to date;
 - the monitoring inventory has been upgraded to accept files with each project submitted, which allows for the sharing of maps, data, protocols, reports, and images;
 - user privileges have been upgraded, which allows submitters to modify their content at any time; and,
 - the inventory has been upgraded to allow for the production of printer friendly text, and Extensible Markup Language (XML) based output to facilitate the sharing of data across different information systems, particularly systems connected via the Internet.
- *Great Lakes Cooperative Monitoring Initiative* — The Great Lakes Cooperative Monitoring Initiative attempts to address key information needs, as identified by the Lakewide Management Plan working groups, through new monitoring and research on a specific Great lake. The expertise and participation of agency staff and academia is actively sought in designing a program to address that need; coordinating these new activities to the extent possible with ongoing programs; providing seed money and, in some cases, grants to conduct the work; arranging for technology transfer and sharing of equipment and expertise; and, as necessary, arranging for data sharing agreements. The Initiative focuses on one lake at a time, according to a Binational Executive Committee's endorsed rotational cycle. The focus for 2005 was Lake Superior, where numerous projects were conducted. In one project a multi-media approach was used. Samples were collected in air, water, lake and tributary sediments; fish; and the lower food web. The samples were analysed for a wide range of organic compounds including new and emerging chemicals, allowing scientists to look at concentrations from the same time period in the sampled media. Investigators also had the opportunity to better understand the impact of invasive species on the lower food web. A herptile (amphibian and reptile) monitoring pilot study was also initiated in the Lake Superior Basin.
 - *Lakeviews* — Lakeviews is an interoperable system of distributed databases linked by web services and mapping technologies, which serves as a discovery, access, visualization, and decision support tool for information regarding trends in environmental quality. It is designed to provide easy access to environmental information using an interactive mapping tool and provides a snapshot of environmental programs. In 2005–2006, web services to report on Lakewide Management Plan and State of the Lakes Ecosystem Conference indicators were developed and development of web-mapping applications for these indicators were initiated. Also, a user-interface was developed, which will facilitate the creation of content for the proposed web-mapping applications.
 - *Great Lakes Innovation Committee* — In November 2005, the Great Lakes Innovation Committee, a multi-stakeholder advisory group, delivered its recommendations on overcoming the challenge of governance as it relates to land use and monitoring to the COA Management Committee.
 - *Publications* — *Forest Birds in Urban Areas*, the latest in the *How Much Habitat is Enough?* series, was produced to guide habitat restoration efforts in the Great Lakes Basin. *Beyond Islands of Green: A Primer for Using Conservation Science to Select and Design Community-based Nature Reserves*, a report of the Ecological Gifts Program, was also released. This report fulfills the identified need for basic scientific guidelines to assist non-governmental organizations in securing or acquiring conservation lands. In addition, the fourth *Highlights Report under the Great Lakes Wetlands Conservation Action Plan* was prepared to document and highlight wetland conservation efforts throughout the

basin. The second in a series of educational, curriculum-based posters titled, *Wetlands Mean Life—The Hudson and James Bay Lowlands* was also produced.

- *Status of Aquatic Wildlife* — Two reports on the status of aquatic wildlife in the Niagara River and Lake Huron were produced. These reports will allow high priority areas in the watersheds to be targeted for protection and restoration. These reports will also assist in identifying suspected source areas of contaminants of concern, and developing appropriate remedial measures.
- *De-listing Criteria for Beneficial Use Impairments* — A technical review of the delisting criteria for Beneficial Use Impairments for wildlife populations was completed for the Niagara River AOC. This information will be used to better define the de-listing criteria as benchmarks to assess progress towards the restoration of use impairments within the Niagara River watershed.
- *Wildlife Health within Lake Erie* — A summary of various investigations into wildlife health within Lake Erie was produced. This report summarized the current state of knowledge on the chemical concentrations of contaminants in wildlife along with their physiological status within the Canadian Lake Erie AOC. These data will be incorporated within a larger Fish and Wildlife Health Effects and Exposure Study.

1.3.4 Northern Ecosystem Initiative

Background

The Northern Ecosystem Initiative (NEI) was launched in 1998 and renewed for a second five-year mandate in 2003. NEI supports partnership-based efforts to improve understanding of impacts and adaptation to climate change, investigations of local contaminant concerns, improved management of resource use activities, and the development of a northern monitoring network in support of status and trend reporting. NEI supported projects that addressed science and capacity-building needs throughout the Canadian North, including Yukon, the Northwest Territories, Nunavut, the 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 promote the use of local and traditional knowledge systems in combination with western scientific knowledge and methodologies.

Progress (to March 31, 2006)

With funding support from NEI, a number of water-related projects were underway in 2005–2006:

- *Investigation of How Great Bear Lake Interacts with the Atmosphere in Relation to Climate Change and Local Meteorological Events* — Progress to date includes successful field measurements at this remote location, community-level support and participation in the project, and a three-day community level workshop.
- *Community-led Research on Climate Change Impacts on Drinking Water Quality in Nunatsiavut (the Inuit land-claim region of Labrador)* — This project involves merging scientific and traditional knowledge. Progress to date includes the initial scoping of key water issues at the community level, completion of the first series of water microbiological analyses, and development of a questionnaire.
- *Multi-year Project to Develop Tools for Setting Thresholds and Ensuring the Sustainable Development of Freshwaters in Canada's North* — Initial results are consistent with model predictions regarding the relationship between land use activities, water quality, and benthic communities in the studied northern lakes.
- *Multi-year Study on Better Understanding Climate-driven Trends in Freshwater Systems (Physical, Biological, Geochemical) and Evaluation and Refinement of Selected Indicators for Ongoing Monitoring* — The study will contribute to a network of key representative freshwater sites for inter-comparative process and modelling studies in Canada's North and larger circumpolar north. Work to date has focused on the Mackenzie Delta Region in the Northwest Territories. Initial results indicate permafrost degradation is introducing a significant and distinct supply of carbon to the study lakes, although more

work is needed. Also, the scope of the study has been expanded to include more lakes due to the degree of variation among lakes.

- *Multi-year Study Investigating Potential Linkages Between a Warming Climate and Increased Levels of Mercury in Northern Biota* — The study involves the analysis of mercury and other toxic metals in archived and newly collected landlocked Arctic Char from lakes in Canada's North. The project continues to expand the locations and numbers of landlocked char collected and analyzed. Results are indicating that mercury and selenium concentrations are relatively high in comparison to other metals such as cadmium and lead.
- *Two-year Study Investigating Mercury Levels in Lake Trout from Nunavik, Northern Quebec* — This study is investigating mercury chemical concentration in lake trout and the potential related risk exposure to communities.
- *Two-year Study to Collect and Disseminate Information on Waste Management and Contaminated Sites within the Yukon River Watershed* — With the study completed, results included new information about previously known contaminated sites and the identification of 22 new sites of concern among nearby First Nations communities. The new information was incorporated into maps and helped update an existing database.

1.3.5 Georgia Basin Action Plan

Background

The federal-provincial Georgia Basin Action Plan (2003–2008) was announced on April 2, 2003, and is a renewal of the Georgia Basin Ecosystem Initiative (1998–2003). The Georgia Basin Action Plan is built upon a vision of “healthy, productive, and sustainable ecosystems and communities in the Georgia Basin” that is shared by Environment Canada, Coast Salish First Nations, Fisheries and Oceans Canada, Parks Canada Agency, and the British Columbia Ministry of Environment. The Georgia Basin Action Plan focuses on the following departmental priorities as they pertain to clean water:

- conservation and protection of habitats and species;
- reduction of pollutants (including persistent organic pollutants and other toxics) in municipal wastewater and in urban and agricultural non-point sources;
- remediation of shellfish growing areas; and
- development and transfer of science, tools, and knowledge to support improved decision-making towards sustainability in the Georgia Basin.

Regional and transboundary relationships were strengthened through the Georgia Basin Action Plan. Examples include the Environment Canada–U.S. Environmental Protection Agency Joint Statement of Cooperation on the Georgia Basin and Puget Sound Ecosystem, the Fraser Basin Council, the Coast Salish Sea Initiative, the Pacific Coast Joint Venture, and the emerging Biodiversity Conservation Strategy for the Greater Vancouver Regional District.

Progress (to March 31, 2006)

Accomplishments in 2005–2006 included:

- *Stream Condition Assessment* — The CABIN approach continues to be implemented and expanded in the region and the country for assessing aquatic ecosystem health. This approach is based on assessing the structure of stream benthic communities. Sixteen sites were sampled in 2005. Twelve of these sites were re-sampled for within-season and within-site variation to better understand variability in the biological assessments. The relationship between water quality assessment based on physical-chemical measurements and CABIN was evaluated for selected sites in the Georgia Basin area. There was agreement in assessment (i.e. good or fair water quality) among most sites. Sites that resulted in a different assessment with the CABIN approach indicated that the biological community was reacting to variables not considered in the Water Quality Index. This initial comparison indicates the value of using both physical-chemical and biological variables in assessing ecosystem condition. Adoption of the CABIN approach was promoted through training workshops,

presentations, and advice to various interested groups and agencies. The agreement between Environment Canada and the North American Benthological Society to develop and sustain a bi-national Taxonomic Certification Program was continued, with other contributors, such as the U.S. Environmental Protection Agency and the U.S. Geological Survey.

- *Abbotsford Aquifer Groundwater Monitoring* — Groundwater samples taken from 23 locations in the Abbotsford aquifer were monitored monthly for nitrate from non-point source pollution. Non-point source pollution cannot be pinpointed to a source, but includes manure, fertilizer, or pesticides applied to farm fields; oil leaks from cars; and household cleaners that seep into groundwater, rivers, and creeks. Elevated nitrate concentrations have been measured for many years at locations in the aquifer. Recent results from the monitoring program are available on Environment Canada–Pacific and Yukon Region’s Environmental Indicators website at www.ecoinfo.ec.gc.ca/env_ind/region/nitrate/nitrate_e.cfm and on the water quality website at www.waterquality.ec.gc.ca/EN/home.htm.

Since 1996, Environment Canada has implemented, in partnership with other federal, provincial, and municipal agencies, projects to educate the public on groundwater stewardship. The Department supported a multi-stakeholder survey of the nutrient status of Fraser Valley agricultural soils in 2005, which included berry fields on the aquifer. Environment Canada is currently working with researchers at Simon Fraser University to develop a model that will be used to assess the environmental impacts of land use practices and land management strategies. Phase One was a groundwater flow model, and Phase Two models contaminant transport in the groundwater. Environment Canada continues to work with other agencies and stakeholders to prevent nitrate contamination of the aquifer.

- *Waterbucket.ca* — The waterbucket website (www.waterbucket.ca) has made great progress since 2004–2005. The website is a partnership initiative led by the Water Sustainability Committee of the British Columbia Water and Waste Association. The

site is stand-alone, yet is hosted by and integrated with the Stewardship Centre for British Columbia website. The Centre is part of a national coalition of government and non-government organizations that functions under the Stewardship Canada umbrella. The website is designed to provide the complete story on integrated water management — why, what, where and how — with the objective of being a "Water Portal for British Columbia." It publicizes case studies, success stories, tools, and lessons learned from partnership initiatives.

The site has developed seven Communities of Interest, which evolve to discuss and communicate ideas around a specific issue. Communities of Interest include Water Centric Planning, Water Use and Conservation, Rainwater Management, Green Infrastructure, Agriculture and Water, Convening for Action and the Water Sustainability Committee. Each Community of Interest is a self-managing website that provides easy access to a variety of information modules. This dynamic information source is developed on a collaborative, non-proprietary site that allows emerging communities to leverage the investment of existing partners, and use communication and web development resources effectively.

- *Watershed Modelling* — A modelling approach that will result in predictive scenarios of stream flow and water quality is being developed and evaluated to support local decision-making on small watersheds. Hydrologic modelling has begun for two watersheds in the Saanich Inlet on Vancouver Island and three streams in the Lower Fraser Valley. Algorithms for a predictive water temperature sub-model and for a predictive fecal coliform sub-model have been designed.
- *Monitoring the Performance of Stormwater Source Controls in the Silver Maples Subdivision* — The year 2005–2006 was the second year of a three-year project to monitor the performance of stormwater source controls in a residential development located in the subdivision of Maple Ridge. The project monitors the hydrologic performance of an integrated system of rain gardens, infiltration swales (ditches or channels with permeable

soils that permit infiltration into groundwater), and detention facilities (storage ponds) installed as stormwater source controls in a 393-unit residential subdivision. The site drains to Anderson Creek and Blaney Bog, both of which are considered environmentally sensitive. The source controls have been designed as an alternative to conventional curb-and-gutter stormwater systems and are designed to achieve runoff volume reduction targets established in the provincial Stormwater Planning Guidebook. Preliminary results suggest that the combination of source controls is reducing the runoff volumes from the subdivision through base and storm events. Comprehensive findings will be provided once the final year of monitoring in 2006–2007 is complete.

- *Municipal Wastewater Impacts from Greater Vancouver Regional District and Capital Regional District—Emerging Chemicals of Concern* — Municipal wastewater samples were taken at key outfall sites in the Greater Vancouver Regional District and Capital Regional District. Analysis is ongoing to determine emerging chemicals of concern (e.g. pharmaceuticals, toxic chemicals) and their impacts on marine, freshwater, and terrestrial resources in the Georgia Basin.

2. Water Research

This section describes selected research activities conducted by the Water Science and Technology Directorate; St. Lawrence Centre; Pacific Environmental Science Centre; as well as other research highlights.

2.1 Water Science and Technology Directorate

Background

In 2005–2006, the NWRI and other water science and technology groups in Environment Canada joined together to form the new Water Science and Technology Directorate. The Water Science and Technology Directorate leads initiatives across the country to protect and sustain Canada's aquatic ecosystems, aquatic biodiversity, and the quality and quantity of Canadian water resources. The Directorate collaborates with partners from governments, universities, and the private sector to confront

Canadian and global freshwater problems, and restore damaged sediments, lakes, rivers, groundwater, and wetlands. A primary goal is to make timely water science information available to science users, providing the targeted research results needed by environmental policy-makers and managers to address specific environmental problems.

Progress (to March 31, 2006)

Environment Canada Water Research Benefits Canadians

Environment Canada's water science and technology provides the environmental information essential for development of regulations, guidelines, policies, and international agreements. These, in turn, bring tangible economic and health benefits to Canadians. The publication, *Research into Action to Benefit Canadians*, (www.nwri.ca/researchintoaction/intro-e.html) details of some of the areas where benefits have been achieved:

- Protecting the Environment from Acid Rain;
- Reducing Nutrient Impacts on the Environment;
- Pesticides – The Case of Tributyltin (TBT);
- Persistent Organic Pollutants – The Stockholm Convention;
- Road Drainage – Securing Public Safety, Economic Competitiveness and Enhancing Environmental Sustainability;
- Taste and Odour in Drinking Water;
- Pharmaceuticals in the Environment – An Emerging Threat?;
- Zebra Mussels, Nutrients and the "Dead Zone" – The Great Lakes Debate;
- Flame Retarding Chemicals – A Cause for Environmental Concern;
- Quenching the Peace–Athabasca Delta; and
- Sediment Remediation Technology.

A Decade of Pulp and Paper Environmental Monitoring Results Published

In 2005, the National Environmental Effects Monitoring Office released the fifth report in the NWRI Scientific Assessment Report Series, *National Assessment of Pulp and Paper Environmental Effects Monitoring Data: Findings from Cycles 1 through 3*. Pronounced improvements in effluent quality were observed during the early- to mid-1990s, although some effects continue to be measured in receiving environments. The field survey response patterns observed for effluent-exposed fish and benthic invertebrates have shown a high degree of consistency over the last decade, with the predominant effect being one of nutrient enrichment, and reductions in gonad size in fish. Efforts are currently underway to better understand and address these effects. (www.ec.gc.ca/eem/English/Whatsnew.cfm)

Water and Agriculture — Protection, Sustainability, and Economic Value

Environment Canada is one of the federal partners in a new three-year project designed to improve our understanding of the environmental role and economic value of wetlands and riparian zones in agricultural landscapes across Canada. Led by Ducks Unlimited Canada, and conducted under the Advancing Canadian Agriculture and Agri-Food Program, the project entitled, *Management of Agricultural Landscapes with Wetlands and Riparian Zones: Economic and Greenhouse Gas Implications*, involves a consortium of academic, government, and conservation group partners in five provinces: Alberta, Saskatchewan, Manitoba, Ontario, and Nova Scotia.

Ultimately, the project will support agricultural sustainability by increasing our capacity to assess the environmental and economic performance of agricultural management practices and respond to environmental issues through practices, programs, and policy. (www.soilcc.ca/articles/2006-02.html)

War on Waterborne Pathogens

Pathogens are disease-causing micro-organisms that can enter the water supply from sources such as municipal wastewater and agricultural wastes. Between 1974 and 1996, more than 200 reported outbreaks of infectious diseases related

to drinking water occurred in Canada. Water Science and Technology Directorate researchers with expertise in this field are leading the National Agri-Environmental Standards Initiative waterborne pathogen research team, composed of scientists from Agriculture and Agri-Food Canada, Health Canada, Environment Canada, and the province of Alberta.

Over the next three years, they will develop national standards for waterborne pathogens in agricultural watersheds across Canada, based on evaluation of microbial water quality indicators for predicting the occurrence of waterborne pathogens. In 2005–2006, they began research in three watersheds: Little Bow, Alberta; South Nation, Ontario; and Bras D'Henri, Quebec. (www.agr.gc.ca/env/naesi_e.php)

Science to Sustain the Great Lakes

- *Bi-national Indicator Project with the U.S. Fish and Wildlife Service* — NWRI became co-chair of a bi-national project team working on aquatic ecosystem indicators in the Detroit River–Western Lake Erie area. The team will compile and interpret long-term data, translate the information into understandable terms for policy-makers and managers, and make these indicator data and trends readily available to the public. The report, *Contaminants in Western Lake Erie Sediments*, has been adopted as an indicator, providing an overview of NWRI research on spatial distribution and long-term trends in contaminants in sediments in western Lake Erie and the Detroit River corridor. These programs have contributed to an increased understanding of sources of toxics in western Lake Erie, and have assisted in assessing the effectiveness of management actions to reduce the presence of these compounds in the environment. A description of the project, the current partners and the five available indicator reports (three of which came from Canadian sources) can be found at www.epa.gov/med/grosseile_site/indicators/index.html. An additional 17 indicator reports are anticipated.
- *Bacteria on the Beaches* — Researchers from NWRI are working with provincial and local governments, conservation authorities, and environmental associations to investigate the problems of bacteria and

beach closures throughout the Great Lakes. In summer of 2005, for example, a study showed that high numbers of fecal coliform, often above the Provincial Recreational Water Quality Guidelines occurred in the nearshore waters along the Tiny Township Beaches, Georgian Bay. Results indicated that the source may be located at the beach-lake-groundwater interface, rather than within the watershed or away from the beach. Research on this problem will continue at various locations throughout the Great Lakes.

- *Is Urban Runoff a Cause of Noxious Shoreline Algae?* — For several years, shorelines of Lake Ontario have been plagued by accumulations of odorous, filamentous algae. Research at University of Waterloo and NWRI showed alien mussels are now recycling nutrients in a way that makes the lakeshore more sensitive to nutrients that stimulate algae. NWRI studies showed elevated levels of nutrients near the shore in the spring, just when the algae begin their growth. Moreover, the nutrients were associated with salt, an indication of urban runoff.

This year, researchers helped Halton Region design a study of some of the 100 drains discharging into the lake from Halton and confirmed that the phosphorus load from urban runoff is as large as that from sewage plants. In addition, much of the load is at potentially damaging concentrations and released at the most damaging place: the shoreline. The costs of treatment for urban runoff nutrients would be very large; offshore discharge might help. Reduction of fertilizer usage may be the best, first action. These considerations are being further examined to aid local government in deciding on a path forward.

- *Contaminants in Siskiwit Lake* — As part of the U.S.–Canada Cooperative Monitoring Program, NWRI researchers and partners began a new study of Siskiwit Lake, the largest lake on Isle Royale in Lake Superior. It receives contaminants solely by long-range atmospheric transport and deposition and has no development on its shores. Siskiwit Lake has served as a background site for previous work by several research groups on a wide range of contaminants, including dioxins, toxaphene, and polycyclic aromatic

hydrocarbons. Samples of water, sediment cores, and biota will be analyzed for pollutants identified under the Lakewide Management Plan and emerging contaminants. Preliminary results were made available in April 2006.

- *Transfer of the Great Lakes Fish Contaminants Surveillance Program* — A Letter of Understanding was signed by Environment Canada and Fisheries and Oceans Canada to transfer the Great Lakes Fish Contaminants Surveillance Program to Environment Canada, as part of the Great Lakes Studies Section. This program will complement Environment Canada's ongoing toxic chemical monitoring programs in air, water, sediment, and wildlife in the Great Lakes Basin.

2.2 St. Lawrence Centre

Background

The St. Lawrence Centre 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. In 2002–2003, the plan was reviewed and updated and the Centre introduced a new program that is focusing on the evaluation of urban effluents, in-depth understanding of environmental stress impacts on the biodiversity of the St. Lawrence River, and the long-term monitoring of the state of the river. This year, the St. Lawrence Centre has evolved towards a new structure that is more consistent with new national directions.

Progress (to March 31, 2006)

In 2005–2006, work concluded on the impacts of water-level changes related to regulation of Lake Ontario and the St. Lawrence River. An initial summary of water availability issues was prepared and should be completed in 2006–2007. This summary will comprise various chapters, including one broken down by major ecological components (e.g. aquatic plants, fish, amphibians, hydrology, uses), and a discussion of current water availability issues for the St. Lawrence River (freshwater).

Three regulation options were evaluated in collaboration with the Ontario Region and United States partners, in support of the IJC decision-making. The final report and its annexes were published in March 2006.

The Quebec and Ontario Regions initiated an environmental study on the project to redevelop the St. Lawrence Seaway through the Great Lakes and the St. Lawrence River.

State of the St. Lawrence River

Activities related to the state of the St. Lawrence were carried out through federal-provincial collaboration involving long-term monitoring of the main environmental components of the St. Lawrence River system.

In 2005–2006, Environment Canada developed a new communication tool—a series of travelling display booths on the state of the St. Lawrence. This initiative was developed in response to a request from the communities and required the collaboration of the Biosphère.

Water quality, wetland, and sediment monitoring continued and the area of data collection expanded in certain cases. Environment Canada, in close collaboration with the Department of Sustainable Development, Environment and Parks, contributed to the first CESI report with respect to water quality.

With regard to sediments, an initial historical database on the geochemistry of St. Lawrence sediments was completed and made available online. This database made it possible to recover and revalidate data from various sources within Environment Canada.

In the case of wetlands, a 30-year assessment was completed based on previous studies of wetland areas and types. In addition, community representatives were involved in initial field work focusing on invasive plants in aquatic and semi-aquatic environments.

The first information campaign was conducted on a consolidated network of sampling stations for the CABIN indicator for benthic communities in Lake Saint-Pierre.

Fluvial Biodiversity

Two studies were conducted and published in 2005–2006:

- impact of physical variables on algal biomass density; and
- discovery and identification of a new, potentially invasive introduced species.

Urban Pollution

In 2005–2006, new data were collected in collaboration with the Montréal Metropolitan Community. Work accomplished included:

- evaluation of the contribution of urban effluents to the metal load in the St. Lawrence as well as the fate and bioavailability of these substances in the river;
- exposure of mussels to urban effluents in a tributary with primary treatment to determine toxic and endocrine effects;
- combined effects of parasitism and pollution on fish physiology (yellow perch and yellow walleye); and
- study of parasitism linked to swimmers' dermatitis.

New projects have also focused on pollution from agricultural watersheds:

- detection of toxins and a genetically modified variety of *Bacillus thuringiensis*, a pesticide.
- persistence of transgenic corn genes in aquatic environments; and
- risks and impacts of avermectines (antiparasitic substances) on freshwater ecosystems.

The ongoing Urban Effluents Program at the St. Lawrence Centre is leading projects related to new environmental issues carried out in cooperation with the Montréal Metropolitan Community, the Institut national de recherche sur les eaux—Institut Armand-Frappier, and the Government of Quebec (Quebec Ministry of the Environment and Société de la faune et des

parcs du Québec. Concordia University, the Université de Montréal, and the Université du Québec à Montréal were also involved. A partnership was consolidated this year, with the Réseau de recherche en écotoxicologie du Saint-Laurent, including cooperation with the Maurice Lamontagne Institute (Mont-Joli) and the Institut scientifique des Sciences de la mer (Université du Québec à Rimouski) to facilitate the integration of approaches in freshwater and marine environments. There were also collaborations with NWRI, the Institute for Inland Fisheries in Potsdam-Sacrow, Germany, St. Mary's University in Halifax, the University of Waterloo, Environment Canada's Moncton office, and the National Wildlife Research Centre in Ottawa.

Long-range Transport of Airborne Pollutants

In 2005–2006, the St. Lawrence Centre was heavily involved in preparing a national report on acid rain. A chapter on the effects on forests and watershed soil was drafted. The Centre also contributed to the chapter on the effect of acid rain on the quality of lake water. It has also begun studies on atmospheric distribution of mercury and pesticides used in agriculture.

Partnerships

Under a program to study the impacts of water level fluctuations, research projects were completed with the Quebec provincial government (Société de la faune et des parcs du Québec), universities (Université de Montréal and Université du Québec à Montréal), and Environment Canada (St. Lawrence Centre, Meteorological Service of Canada, and the Canadian Wildlife Service). Close scientific cooperation also exists with Environment Canada–Ontario Region in order to give direction to next steps following the current review of the Lake Ontario and St. Lawrence River regulation plan.

With respect to biodiversity, many partnerships have been established in the various research areas with Quebec universities (McGill, Laval, Université de Montréal, Université du Québec à Montréal, and Université du Québec à Trois-Rivières). Post-graduate students have continued to take part in the development of research and, in doing so, have increased their expertise. The Pesticide Science Fund has also contributed.

2.3 Pacific Environmental Science Centre

Background

The Pacific Environmental Science Centre of Environment Canada's Science and Technology Branch conducted a number of studies since 2003 on the toxicology and chemistry of fresh and marine water in the Georgia Basin. As projects under the Georgia Basin Action Plan, these studies have focused on emerging environmental concerns to water, such as endocrine disruptor effects on aquatic organisms as a result of exposure to varying concentrations of municipal, agricultural, and industrial effluents.

Progress (to March 31, 2006)

A particular focus of these studies has been the emerging toxicological issue of endocrine disruptor effects on fish as a result of exposure to low level concentrations of pharmaceuticals and personal care products in water bodies. Effluents and receiving waters were tested to measure biological genetic effects on fish using the state-of-science gene microarray technology (genomics). Chemical analysis profiling to determine concentrations of acid-based drugs, antibiotics, estrogenic compounds, and fragrance compounds has always been conducted in parallel with the assessment of biological response endpoints. Results from these studies will determine if receiving water concentrations of effluent are capable of causing genomic level effects in fish. Resulting chemical changes, either depression or increases in genetic signals can be used as an indicator or predictor of deleterious effects at the genomic level. The studies were conducted in cooperation with the Capital Regional District of Victoria and the Greater Vancouver Regional District. Fish exposure testing on the above effluents was completed and the genomic analysis of the various tissues is underway. Preliminary gene array data has been shared with Capital Regional District of Victoria and the Greater Vancouver Regional District.

The Pacific Environmental Science Centre laboratory is also working with the University of Victoria to study amphibian-based molecular effects of effluents on thyroid hormone action. This work is supported by a Natural Sciences and Engineering Research Council strategic grant. Studies have included the genomic

effects, at receiving water concentrations, of select pharmaceuticals and personal care products such as the bactericidal agent triclosan, and the fragrance compound galaxoide.

Ongoing and new research programs include the following activities:

- *Bacterial Source Tracking in Marine and Freshwater Systems* — Using a DNA-based method, samples from fresh and marine water from locations in British Columbia are tested to identify sources of fecal contamination. This unique water quality tool helps pollution abatement managers at Environment Canada's Marine Water Quality Monitoring Program, British Columbia Ministry of Environment, First Nations, Capital Regional District in Victoria, Nova Scotia Department of Environment, Department of Fisheries and Oceans in Newfoundland and Labrador and several regional health authorities to determine sources of fecal contamination. This is the final year of a three-year project in collaboration with researchers at the University of Victoria under a Canadian Institutes of Health Research grant to further develop the method. A report is being prepared on work done at Salt Spring Island and the Okanagan Valley.
- *Validation of the Water Effects Ratio and Biotic Ligand Model Approach* — This study involved the collection of Sumas River water and well water from the Pacific Environmental Science Centre and spiking each with concentrations of copper corresponding to water quality criteria concentrations prescribed by the Canadian Council of Ministers of the Environment (CCME), British Columbia Ministry of Environment, and federal site-specific criteria. Several acute and chronic freshwater toxicological tests were conducted using concentrations bracketing the above values. Analytical chemistry was also conducted in tandem with the bioassays. The site-specific guidelines will be used in the calculation of the CCME Water Quality Index, which is used for reporting nationally on water quality in the Canadian Environmental Sustainability Indicator reports. The Water Quality Index is calculated by comparing concentrations of key water quality parameters to guidelines for the protection of aquatic life. At some sites, the national CCME guidelines are not appropriate because of unique background conditions and

site-specific guidelines must be developed. Additional work is scheduled for 2006–2007 using chromium as the target element.

2.4 Other Research Highlights

Environment Canada conducts many water-related investigations in addition to the research undertaken at the major institutes. Interdisciplinary studies or projects are often fostered in partnership with educational institutions, or 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 the activities being undertaken.

2.4.1 Hydrometeorology and Arctic Laboratory

The Hydrometeorology and Arctic Laboratory (HAL) officially began operating in Environment Canada's Prairie and Northern Region on April 1, 2004. The lab is co-located with NWRI in Saskatoon.

Much of the activity in the laboratory during the previous 18 months has been devoted to putting the required infrastructure in place and in staffing positions.

A science plan for the laboratory was developed during the spring and summer of 2005, which outlines five key areas for research and development during the next few years. The five key areas and accomplishments in 2005–2006 are:

- *Improve Development and Use of Hydrometeorological Products and/or Applications* — A prototype website has been set up and HAL, along with the Water Survey of Canada, is making data available to a select group of clients.
- *Develop and Implement a Coupled (Atmospheric-Hydrological) Model* — Model development is still underway in Saskatoon and Montréal. Test runs within the Great Lakes Basin were held using an ensemble prediction system to improve the accuracy of forecasts. An ensemble prediction system involves multiple predictions from a group of

slightly different initial conditions and/or various versions of computer models. Ensembles can be used by forecasters as a tool to help measure the probability or likelihood of a forecast.

- *Improve Land Surface and Hydrological Predictions* — Developed a working team to look at prediction in ungauged basins, including directing efforts within the Water Survey of Canada towards a Monitoring Research Basin Network.
- *Improve Representation of the Land Surface in Coupled Atmospheric-Hydrological Models* — Ongoing collaboration with NWRI scientists focused on snow processes, scaling, and lateral transport of water in Inuvik, Y.T., and Baker Creek, N.W.T.
- *Improve Understanding of the Land Surface and Atmospheric Components of the Hydrologic Cycle to Aid in the Prediction of High Impact Weather* — HAL is participating in the Drought Research Initiative; the National Agri-Environmental Standards Initiative water availability programs focused on the South Saskatchewan Basin; and improved algorithms for radar-precipitation estimates over the Prairies.

As part of improving the understanding of the land-surface component of the hydrologic cycle, HAL will provide support to the Drought Research Initiative. This is a multi-year research program funded by the Canadian Foundation for Climate and Atmospheric Science and undertaken by a consortium of Canadian universities to examine all aspects of drought across the Canadian Prairies. In its first stage, it will examine the recent drought and attempt to characterize its features, understand its large scale and internal structure, and provide guidance to the prediction community for later application.

HAL will also focus on a program funded by the National Agri-Environmental Standards Initiative that is assessing water availability in the South Saskatchewan River Basin using the current suite of coupled atmospheric hydrological models. The water availability sub-component focuses on the development and testing of a framework to predict available water supplies, including precipitation, snowmelt, soil moisture and surface water availability, in agriculturally-

dominated watersheds at the scale of the current Numerical Weather Prediction system which is 15 kilometres. The model will be applied to a specific watershed: the South Saskatchewan River Basin.

2.4.2 Integrated Modeling of the St. Lawrence River

Background

Since 1997, the Hydrology Section of the Meteorological Service of Canada–Quebec Region has been working with partners on numerical modeling of the St. Lawrence River between Cornwall and Trois-Rivières. The models 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 the following:

- Pressures resulting from climate change and from natural and anthropogenic changes (e.g. hydro-electric developments and construction of port infrastructures). With the implementation of the website of Quebec's climate change impacts and adaptation resource centre (www.criacc.qc.ca) in 2000, it is possible to more closely monitor climate change in Quebec, and more specifically in the St. Lawrence watershed;
- Physical characteristics of the river environment (e.g. flows, levels, currents, temperatures, substrates, and banks);
- Chemical characteristics of the water (e.g. turbidity, colour, and presence of pollutants); and
- 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.

In its research and development of the St. Lawrence River ecosystem, the Hydrology

Section of the Meteorological Service of Canada–Quebec Region collaborates with several organizations, including the Société de la faune et des parcs du Québec, the Quebec Ministry of the Environment (Water Medium Directorate), the regional branches of Environment Canada (Conservation Branch, Canadian Wildlife Service, St. Lawrence Centre), the Canadian Coast Guard (Laurentian Region), universities (Université du Québec à Trois-Rivières, Institut national de recherche scientifique–Eau, et École Polytechnique), and the IJC.

Progress (to March 31, 2006)

In 2005–2006, the development of a fluvial hydrodynamic model for diverse hydrological conditions was continued. The hydrodynamic model was refined to improve the integration of aquatic plants and wetlands impacts on flow. The calibration of a transport-diffusion sub-model has been undertaken for use with the model simulating the sedimentation of fine material and water temperature. A variety of simulations under different conditions were undertaken based on previous model development.

An ecosystem response model was developed by integrating physical modeling, and biological data, and was used for estimating the changes on the ecosystem due to changes in the discharge regulation. Following this development, in collaboration with many federal and provincial partners, the IJC assessed a variety of regulation options related to impacts of flow management of the St. Lawrence River.

2.4.3 Climate Change, Impacts, and Adaptation

In 2005–2006, an initial series of specific studies was carried out on water level conditions that are critical to commercial shipping and to a certain number of potential adaptation options to the effects of climate change. The purpose of this work was to provide the St. Lawrence Plan Navigation Consensus Building Committee with technical and scientific support. Research studies on the impacts of varying water levels on aquatic ecosystems produced interesting results that are useful to climate change issues.

An integrated river basin water management (planning) model has been developed and implemented for the South Saskatchewan River

Basin as a pilot case. The model uses socio-economic, physical, and climatic data, as well as policy options to project future water demands. These demands are then integrated with projections of future water supplies for basin water budget assessment. The vulnerability of the water resources of the basin to any long-term changes in the climate is determined through integration of the resulting changes in water demand and water supply. This work is being expanded under the National Agri-Environment Standards Initiative, in collaboration with the Canadian Meteorological Centre and NWR, with the aim of producing a cutting-edge technology that allows for the prediction of future water availability at the basin level for given climate projections.

2.4.4 Quebec Region – Atmospheric Mercury Deposition

As part of an action plan to measure mercury in precipitation, an agreement was reached between Environment Canada and the Quebec Ministry of the Environment (2001–2004) at the request of the Conference of New England Governors and Eastern Canadian Premiers. The agreement was extended for 2005–2006. Under the agreement, mercury is measured in precipitation in Quebec at two sites along the St. Lawrence River, Saint-Anicet and Mingan, and also at a station in the north, Kuujuarapik. The measurements will be incorporated into the North American Mercury Deposition Network.

An analysis was performed on data from a number of atmospheric monitoring stations to evaluate spatial and temporal trends of precipitation and mercury deposition. Data were used from 13 stations in the National Atmospheric Deposition Program, Mercury Monitor Network (MMN) (1996–2002), and an event-based monitoring site near Underhill, Vermont (1993–2002). More precipitation and mercury deposition occurred in the southern and coastal MMN sites, except for the Underhill site, which received more mercury deposition than surrounding sites. Regionally, higher concentrations of mercury were recorded during the late spring and summer months. High precipitation periods contributed significantly to annual loads, at times up to 60 percent. Southern and coastal sites measured more frequent periods of high deposition than inland sites. Recent regional reductions of mercury emissions were not reflected in the regional

mercury concentrations or deposition data. Most sites did not show a linear relationship between the concentration of mercury in precipitation and

acid rain co-contaminants, i.e., sulphates and nitrates.

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

Background /Progress (to March 31, 2006)

1. Freshwater Website

The Freshwater Website (www.ec.gc.ca/water) continues to provide basic information on a wide range of water-related topics, comprehensive educational materials (e.g. water fact sheets, *A Primer on Fresh Water*, *Explore Water with Holly Heron*, and *Let's Not Take Water for Granted — A Resource Guide*), and the full text of key water publications (e.g. the *Federal Water Policy*, the *Canada Water Act Annual Report*, and reports on water use and pricing). In addition, the links to specific issues at other governmental and non-governmental sites across the country continue to be regularly updated and expanded, as does the calendar of water-related conferences and events.

The “Water Policy and Legislation” section of the website underwent a major revision and update, and included the addition of new content on the Federal House and the First Nations Water Management Strategy.

The site is heavily used (averaging over 106 000 visits each month) and is often referenced on other websites and in print material produced by other agencies.

2. Water Survey of Canada Website

The Water Survey of Canada is the national agency responsible for the collection, interpretation, and dissemination of standardized water resource data and information in Canada. In the case of Quebec, the province collects water resource data for the Water Survey of Canada. The Water Survey of Canada plays a major role in the activities of numerous international and interprovincial boards and commissions involved in the management of Canada’s water resources. It is the designated agency responsible for water resource monitoring in support of interjurisdictional agreements and treaties.

Each year, Environment Canada produces a national HYDAT CD-ROM, which provides access to the National Water Data Archive. The

archive contains daily, monthly, and instantaneous (peak) data for stream flow, water level, and sediment data for over 2500 active and 5500 discontinued hydrometric monitoring stations across Canada. Using a Windows-based software interface, users have the ability to retrieve, view, subset, download, and print selected data from the CD-ROM. The HYDAT software page contains tips for users, answers to frequently asked questions, and information on the latest version of the software. The data contained on HYDAT can also be downloaded directly from the Water Survey of Canada website (www.wsc.ec.gc.ca/products/main_e.cfm?cname=products_e.cfm).

3. Environment Canada’s Biosphère

Environment Canada’s Biosphère is an interpretation centre designed to help young Canadians become aware of water and ecosystem issues in the Great Lakes and the St. Lawrence. In 2005–2006, 54 000 visitors, including 23 000 children, took part in educational programs or toured exhibitions.

Environment Canada’s Biosphère maintained its museum-related activities by offering the exhibitions “Moving Giant” and “Water Wonders!” It also added two photo exhibitions related to water — one on the beauties of the St. Lawrence with l’Escale nautique, a recreational boating journal, and the other on the voyage of the Canadian vessel *Amundsen* in the Arctic.

The Biosphère also began to reflect on the scope of its actions and programs, which were initially planned mainly for the Quebec Region. The basis for a national Biosphère, with partners and activities from all regions of Canada, is being planned for the future.

4. RésEau – Building Canadian Water Connections

The RésEau prototype (www.environmentandresources.gc.ca/reseau) was launched in March 2006. Water data are now accessible online through one portal which includes a selection of federal government monitoring programs for water quality and

quantity, as well as programs on groundwater availability, groundwater contamination, water use, and water and human health (disease outbreaks). In addition, data has been made available from a network of 16 partner groups including provinces, non-governmental organizations, community groups and high schools.

The RésEau portal provides pre-defined maps for general users, as well as search and query functions that create dynamic maps in real time for more advanced users. A module called “Know Your Watershed” allows Canadians to easily discover which watershed they live in and find customized watershed profiles to learn more about water-related activities in their area.

5. Canadian Digital Drainage Area Framework

A partnership between Environment Canada, Statistics Canada, Natural Resources Canada, and Agriculture and Agri-Food Canada was initiated in 2001 to collaborate on the development of the Canadian Digital Drainage Area Framework. The framework is a spatial database consisting of several layers of hydrological features, including rivers, lakes, and watershed boundaries, that is designed to support water-related research and analysis.

The framework was released online in June 2003, the result of nearly three years of federal collaboration and consultation with several provincial agencies. This national framework is a welcome tool for the planning, analysis, and management of environmental monitoring networks and is also an excellent means of reporting data, information, and knowledge about watersheds at regional, national, and even continental scales. The data can be easily imported into standard geographic information system. The framework is being maintained by the Natural Resources Canada and is available at www.geogratis.cgdi.gc.ca/clf/en.

6. Pacific and Yukon Region

The Water Quality Monitoring Office, Science and Technology Branch encouraged environmental stewardship amongst the public by informing them of emerging environmental issues, ecological connections in the environment, and human impacts through stewardship programs including:

- *An Interactive Pollution Model* — This website provides a do-it-yourself guide for building an interactive pollution model of a community (www.pyr.ec.gc.ca/EN/IPM).
- *Discover Your Estuary* — This online resource provides a guide to understanding and exploring the aquatic environment of the Fraser River Estuary (www.pyr.ec.gc.ca/EN/DYE/index.shtml).
- *The Pacific and Yukon Water Quality Monitoring Program* — This website provides access to federal-provincial-territorial water quality data, guidelines, reports, publications, links to stewardship programs, and online resources for designing a water quality monitoring program (waterquality.ec.gc.ca/EN/home.htm).
- *Workshops on Environment Canada's CABIN Network* — CABIN training workshops have been given in the Pacific and Yukon Region since 2003 to a wide audience to encourage the use of the standardized protocols for collection and analysis of data for stream bioassessment (cabin.cciw.ca/application/welcome.asp?Lang=en).
- *Columbia Basin Trust* — The Pacific and Yukon Region participates in Columbia Basin Trust meetings with involved stakeholders and coordinators to determine where the Aquatic Section in conjunction with other Environment Canada groups can be most useful. Helped to develop A Columbia Basin Water Quality Primer, a key water quality communication product (www.cbt.org/about/main.asp?fl=1&pg=about).

APPENDIX A

AGREEMENTS

The following *Canada Water Act* Agreements¹ were ongoing during 2005–2006:

Apportionment and Monitoring Programs

- Agreements on water quantity surveys with all provinces and with Indian and Northern Affairs Canada for the 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 and Labrador, New Brunswick, Manitoba, Yukon, and Northwest Territories

- Agreement Respecting Ottawa River Basin Regulation
- Canada–Quebec State of the St. Lawrence Monitoring Program (www.slv2000.qc.ca/plan_action/phase3/biodiversite/suivi_ecosysteme/accueil_a.htm)

Water Management Programs

- Mackenzie River Basin Transboundary Waters Master Agreement

¹ For which *Canada Water Act* authority exists (in most cases, by Order in Council).

APPENDIX B

FOR MORE INFORMATION

Selected Web Sites

Clean Water

www.ec.gc.ca/water_e.html

Centre de Ressources en Impacts et Adaptation
au Climat et à ses Changements—CCIACC (in
French only)

www.criacc.qc.ca/index_e.html

Environment Canada Freshwater (including
Canada Water Act annual reports)

www.ec.gc.ca/water/e_main.html

Weather and Meteorology

www2.ec.gc.ca/weath_e.html

Research Institutes

National Water Research Institute

www.nwri.ca/nwri-e.html

St. Lawrence Centre

www.qc.ec.gc.ca/csl/acc/csl001_e.html

Ecosystem Initiatives

Atlantic Coastal Action Program

<http://atlantic.web1.ns.ec.gc.ca/community/acap/>

Canada—Quebec Agreement St. Lawrence
Vision 2000

www.slv2000.qc.ca

Georgia Basin Ecosystem Initiative

www.pyr.ec.gc.ca/GeorgiaBasin/index_e.htm

Great Lakes 2000 Program

www.on.ec.gc.ca/water/greatlakes/intro-e.html

Northern Ecosystem Initiative

www.pnrrpn.ec.gc.ca/nature/ecosystems/nei-ien/index.en.html

Northern Rivers Ecosystem Initiative

www.pnr-rpn.ec.gc.ca/nature/ecosystems/nrei-ien/index.en.html

Other Federal Departments

Agriculture and Agri-Food Canada

www.agr.gc.ca/index_e.php

Fisheries and Oceans Canada

www.dfo-mpo.gc.ca/home-accueil_e.htm

Health Canada

www.hc-sc.gc.ca/index_e.html

Indian and Northern Affairs Canada

www.ainc-inac.gc.ca/index_e.html

Natural Resources Canada

www.nrcan-rncan.gc.ca/inter/index_e.html

Federal—Provincial

Canadian Council of Ministers of the
Environment (CCME)

www.ccme.ca/about

Interprovincial River Boards

Lake of the Woods Control Board

www.lwcb.ca/

Mackenzie River Basin Board

www.mrbba.ca

Ottawa River Regulation Planning Board

www.ottawariver.ca/emain.htm

Prairie Provinces Water Board

www.pnr-rpn.ec.gc.ca/water/fa01/index.en.html

International

Arctic Council
www.arctic-council.org

International Joint Commission
www.ijc.org/en/home/main_accueil.htm

United Nations Environment Programme:
GEMS/Water Global Environment Monitoring
System
www.gemswater.org

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/home_e.asp

Ecological Monitoring and Assessment Network
(EMAN)
www.eman-rese.ca/eman

Federation of Canadian Municipalities
www.fcm.ca/english/main.html

Great Lakes Information Network
www.great-lakes.net/

HYDAT (Meteorological Service of Canada)
[www.wsc.ec.gc.ca/products/
main_e.cfm?cname=products_e.cfm](http://www.wsc.ec.gc.ca/products/main_e.cfm?cname=products_e.cfm)

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

WaterCan
www.watercan.com/

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Publications (Public Information Program)

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Canada Water Act Annual Report

Comments

Thank you for reading the *Canada Water Act* 2003–2004 Annual Report. While Environment Canada is legislatively required to report annually on operations under the *Canada Water Act*, we endeavour to publish a report that is both informative and useful to a variety of audiences. Your feedback is appreciated, and your opinions provided below will help shape future annual reporting under the *Canada Water Act*.

Please rate the report on the following:

	Excellent	Good	Satisfactory	Unsatisfactory	Suggestions for Improvement
Clarity					
Level of Detail					
Usefulness of Information					
Format					
Overall Presentation					

In what capacity did you read the report?

- Environmental Manager
- Government/Regulatory Authority
- Employee of a Research/Educational Facility
- Representative of an Environmental NGO/NPO
- Member of the Press
- Student
- Other (please specify) _____

Comments and Suggestions:

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