



Environment  
Canada

Environnement  
Canada

# The Canada Water Act Annual Report

1985-86

---

GB  
707  
C36  
1985/86  
c. 1

la



Environment  
Canada

Environnement  
Canada

**The Canada Water Act**

**Annual Report**

**C. C. I. W.  
LIBRARY**

**1985-86**

---

W 1 5 0  
Y 4 0 2 1  
1 2 1 0 2 1 1

Published by authority of  
the Minister of the Environment

© Minister of Supply and Services Canada 1986

Cat. No. En 36-426/1986

ISBN 0-662-54719-5

Minister of the Environment



Ministre de l'Environnement

Ottawa, Canada K1A 0H3

Her Excellency  
The Right Honourable Jeanne Sauvé  
Governor General and Commander-in-Chief of Canada

May it Please Your Excellency:

I have the honour herewith, for the information of Your Excellency and the Parliament of Canada, to present the annual report on operations under the Canada Water Act for the fiscal year ended March 31, 1986.

Respectfully submitted,

A handwritten signature in black ink, appearing to read "Tom McMillan".

Tom McMillan, P.C., M.P.  
Hillsborough

Minister of the Environment



Deputy Minister  
Environment Canada

Sous-ministre  
Environnement Canada

Ottawa, Canada  
K1A 0H3

The Honourable Tom McMillan, P.C., M.P.  
Minister of the Environment  
Ottawa, Ontario

Sir:

I have the honour to submit the Annual Report on operations  
under the Canada Water Act for the fiscal year ended  
March 31, 1986.

Respectfully submitted,

G.A. Sainte-Marie

# TABLE OF CONTENTS

INTRODUCTION.....	1
PROVISIONS OF THE CANADA WATER ACT.....	2
ACTIVITIES UNDER THE CANADA WATER ACT - 1985-86.....	3
Inquiry on Federal Water Policy.....	3
Great Lakes Water Levels Communication Centre.....	4
PART I:    Comprehensive Water Resource Management.....	5
Federal-Provincial Cooperation.....	5
Interdepartmental Committee on Water.....	5
Federal-Provincial Water Resource Management Programs.....	6
Regulation, Apportionment, Monitoring and Survey Programs..	6
Water Management Programs.....	11
Flood Damage Reduction Program.....	13
Water Research Under the Canada Water Act.....	25
Other Water Management Activities.....	34
PART II:    Water Quality Management.....	36
PART III:   Regulating Nutrient Inputs.....	37
PART IV:    Public Information Program.....	37
PRINCIPAL FEDERAL-PROVINCIAL COOPERATIVE ARRANGEMENTS UNDER THE CANADA WATER ACT.....	39
REGULATION, APPORTIONMENT, MONITORING AND SURVEY PROGRAMS.....	40
WATER MANAGEMENT PROGRAMS.....	46
FLOOD DAMAGE REDUCTION PROGRAM.....	51
COOPERATIVE ARRANGEMENTS FUNDED FROM SOURCES OTHER THAN THE CANADA WATER ACT.....	53

## TABLES

Table 1	Status of Federal and Federal-Provincial Water Management Programs .....	7
Table 2	Programs or Studies Completed Under the Canada Water Act.....	8
Table 3	Designations Under the Flood Damage Reduction Program.....	15
Table 4	Federal-Provincial Flood Damage Reduction Agreements.....	17
Table 5	Current and Projected Release Dates of Final Reports Arising from Canada Water Act Studies.....	38

## INTRODUCTION

The Canada Water Act, proclaimed on September 30, 1970, provides the framework for joint federal-provincial management of Canada's Water resources. Section 36 of the act requires that a report on operations under the Act be laid before Parliament as soon as possible after the end of each fiscal year. This, the fourteenth annual report, covers operations to March 31, 1986.

On September 30, 1985, the Advisory Committee appointed to undertake an Inquiry on federal water policy presented its report to Mr. McMillan.. More details on that report appear on page 3.

Up to and including fiscal year 1975-76, Canada Water Act funding was provided on the basis of individual projects. In fiscal year 1976-77, Treasury Board established a ceiling on expenditures cost-shared with the provinces (for river basin planning and implementation, and flood damage reduction) at about an \$18 million per year level. Subsequently, budget reductions and consequent adjustments to the program have lowered the ceiling in 1984-85 to about \$11 million. This total fell to \$9.2 million for 1985-86 and further temporary reductions are expected to bring it below \$9 million for 1986-87.



## PROVISIONS OF THE CANADA WATER ACT

Part I of the Act provides for the establishment of federal-provincial consultative arrangements for water resource matters (Section 3); and for cooperative agreements with the provinces for the development and implementation of plans for the management of water resources (Section 4 - 7). This part also enables the Minister, directly, or in cooperation with any provincial government, institution, or person, to conduct research, collect data, and establish inventories associated with the water resources.

Part II envisages federal-provincial management where water quality has become a matter of urgent national concern. This part permits the establishment of joint federal-provincial incorporated agencies (although existing federal and provincial corporations might alternatively be used) to plan and implement approved water quality management programs.

Part III of the Act provides for regulations banning the manufacture or import for use or sale in Canada of any cleaning agent or water conditioner that contains a nutrient in a greater concentration than that prescribed by regulations. This is one of the principal means of reducing the rate of eutrophication of water bodies.

Under Part IV are provisions for the general administration of the Act. In addition, it 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.

## ACTIVITIES UNDER THE CANADA WATER ACT

### Inquiry on Federal Water Policy

In January 1984, a three-member Advisory Committee was appointed by the Environment Canada Minister under section 26 of the Canada Water Act in response to a growing environmental consciousness and concern about the management of Canada's freshwater resources. Some of the emerging issues which prompted the Inquiry are growing water supply/demand imbalances in the Prairie Provinces, the related question of climate change and its effect on the water resources, and growing interest in southward diversions; increasing public interest in the water export controversy; and the rapid proliferation of toxic substances in the environment leading to a perceived loss of confidence amongst Canadians about the quality of the drinking water.

Under its terms of reference, the Inquiry was required to assess the adequacy of federal water policy and the capacity of federal institutions to respond to changing circumstances. In particular, consideration was to be given to the nature of emerging issues, the state of the resource, future requirements for water, interjurisdictional matters, and scientific and research expertise. The views of as many Canadian as possible were to be sought.

In the fall of 1984, the Inquiry held public hearing at seventeen locations across Canada, and received over 300 written submissions from individuals and organization. Numerous federal, provincial and territorial officials were consulted to ensure a broad range of facts, viewpoints and advice. In addition, studies and research projects on special problems were commissioned.

Early in 1984, the Inquiry set the scene for the public hearings by publishing "Water Is A Mainstream Issue" which set out initial impressions of the issues to be examined. Following the public hearings, the Inquiry released "Hearing About Water" in April 1985 to synthesize the perceived problems, issues and solutions. The final report "Currents of Change" was published in September 1985 in part to respond to the terms of references but also to promote understanding and heighten awareness of the problems and opportunities in water management. Informative reports were also published for the 22 special research projects commissioned.

Immediately following release of the Inquiry's final report on September 30, 1985, it was distributed to federal and provincial governments and non-government organizations.

Shortly thereafter, Environment Canada organized and chaired several meetings of an Interdepartmental Water Policy Task Force to seek the views of other federal departments on the Inquiry's recommendations. These meetings were interspersed with similar meetings within Environment Canada's agencies.

Provincial Ministers discussed the Inquiry's final report at a meeting of the Canadian Council of Resource Ministers in October 1985 while a similar meeting for non-government organizations was held in November 1985 in conjunction with Environment Canada's annual public consultations.

At the end of March 1986, responses by the federal Task Force to the 55 recommendations made by the Inquiry were essentially completed.

The Task Force is expected to report to the Environment Minister in July 1986, providing advice on the Inquiry's recommendations as well as the scope and nature of an appropriate federal water policy. Enunciation of such a policy will occur later.

#### Great Lakes Water Levels Communication Centre

Excessive inflows have raised Great Lakes levels to record high proportions and thus pose a serious threat to lakeshore facilities, especially during periods of high winds. To meet this problem, Environment Canada has established the Great Lakes Water Levels Communication Centre at the Canada Centre for Inland Waters in Burlington. It is now the nerve centre for all federal activities and programs related to flooding on the Great Lakes. The Centre is designed to gather and coordinate all relevant information from all federal departments and it is in contact with other government agencies, including some in the United States. In addition to coordinating the collection of relevant data, the Centre rapidly analyses and disseminates the data as quickly as possible for use by governments, planners, and individual citizens alike.

## PART I: Comprehensive Water Resource Management

### Federal-Provincial Cooperation

The Canada Water Act calls for joint consultation between the federal and provincial governments in matters related to water resources. Discussed briefly in the following are joint programs under the national Flood Damage Reduction Program as well as other projects involving the regulation, apportionment, monitoring or survey of water resources, and the preplanning, planning or implementation of Water Management Programs.

Agreements for specific water programs provide for the participating governments to contribute funding, information, and expertise in agreed ratios. For ongoing activities such as the water quantity survey agreements with each province, cost sharing is in accordance with each party's need for the data. For study and planning agreements, it is usual for the federal government to meet half the costs and the provincial government(s) the other half. The planning studies encompass interprovincial, international or other basins where federal interests are important. Cost sharing for implementation is in proportion to federal and provincial responsibilities and often includes a contribution from local governments.

### Interdepartmental Committee on Water

The Interdepartmental Committee on Water (ICW) was established in 1968 to promote coordination and to advise on all federal water programs. Since then, ICW has actively pursued its mandate and, in March 1986 held the 56th meeting since its inception.

A total of 21 departments and agencies with an interest in water matters are represented on this 25-member committee. Subcommittees and Working Groups are set up as required. Currently there are five subcommittees whose areas of interest are 1) the Canada-U.S., and Canada-Ontario Great Lakes Water Quality Agreements, 2) water quality, 3) floods, 4) the preparation of responses to IJC reports and 5) the coordination of federal activities in the Mackenzie River basin.

In addition to the work of these subcommittees, issues or subjects of interest brought to the attention of ICW over the past year included; the Inquiry on Federal Water Policy, large scale water diversions (specifically the Grand Canal proposal), the IJC report on Great Lakes consumptive uses, the Canada/Ontario working group on Great Lakes water apportionment, the South Saskatchewan River basin study, the Yukon River basin study, the Interdepartmental Committee on Toxic Chemicals action plan on drinking water, the Arctic marine conservation policy, the interdepartmental operational plan for the Great Lakes Water Quality Agreement, the Canada/Saskatchewan Memorandum of Understanding on irrigation-based economic development, the Canada/PEI subsidiary agreement respecting water resource management and development, and the proposed Rafferty Dam.

## Federal-Provincial Water Resource Management Programs

Table 1 shows a breakdown of current cost-shared federal-provincial water management programs and indicates the stage each has reached. Each of the programs is referred to briefly in the following few pages and described in more detail later in this report. Table 2 is a record of the achievements under the Act since its inception in 1970.

Regulation, Apportionment, Monitoring and Survey Programs: Although most federal-provincial agreements carry a time limit within which the objectives of the agreement are likely to be reached, there are some agreements involving monitoring and survey responsibilities which are projected to continue into the foreseeable future without termination. One such program, was recently inaugurated on a national scale to coordinate both federal and provincial water quality surveys.

The federal government has been involved in the collection of water quantity data since the late 1800s. In earlier years, hydrometric networks were operated under informal arrangements with all provinces except Quebec. The 1922 agreement with Quebec was rescinded in 1964 when the Quebec government took responsibility for most of the hydrometric network in that province. Beginning in April 1975, uniform cost-sharing Water Quantity Survey Agreements were implemented with all provinces and with the Department of Indian and Northern Affairs for the territories. It is recognized that water quantity data are essential to water management and, since the costs of collecting water data are substantial, the efficiency of data collection programs is enhanced significantly by combining networks and standardizing methodology. These agreements recognize that water quantity data may be collected to meet federal needs, provincial needs, or a combination of needs. Hence funding for the operation of the networks is provided according to each party's needs. The water quantity networks and cost-sharing data are determined annually by Federal-Provincial Coordinating Committees. Also, a national meeting of all Federal-Provincial Coordinating Committees is convened regularly to review annual progress reports and to discuss any concerns arising under the Agreements. During the year, a total of 2854 gauging stations were operated under the Agreements in Canada, 2694 by the federal government and 160 by the Province of Quebec. Data from these stations as well as from 669 stations operated mainly by other provincial agencies are contained in the national water data bank - HYDAT; the data bank also contains data for another 3744 discontinued stations. Under the terms of the Agreements, Canada is responsible for maintaining the computer data base and for publishing the data. All hydrometric data are provided free of charge upon request.

In a move to improve upon data collection associated with the hydrometric survey, a five-year program to acquire and install 350 data collection platforms (DCPs) at remote hydrometric sites across Canada received Treasury Board approval effective April 1, 1983. Through

TABLE 1 - STATUS OF FEDERAL AND FEDERAL-PROVINCIAL WATER MANAGEMENT PROGRAMS

REGULATION, APPORTIONMENT, MONITORING AND SURVEY PROGRAMS

<u>Under Negotiation</u>	<u>New During 1985-86</u>	<u>Ongoing During 1985-86</u>
Water Quality Monitoring Agreements with Alberta, Saskatchewan, Newfoundland, Manitoba, New Brunswick and Ontario	Water Quality Monitoring Agreement with British Columbia	Water Quantity Surveys with all provinces Prairie Provinces Water Board Mackenzie River Basin Committee Water Quality Monitoring Agreement with Quebec Lake of the Woods Control Board* Ottawa River Regulation Planning Board Ottawa River Water Quality Coordinating Committee

WATER MANAGEMENT PROGRAMS

<u>Under Negotiation</u>	<u>New During 1985-86</u>	<u>Ongoing During 1985-86</u>
South Saskatchewan Study		Winter River Basin Waterford River Urban Hydrology (Planning) Study Mercury in Churchill River Diversion System
	Channel - Port aux Basques Water Improvements** Fraser River Estuary Management Program Implementation Lower Fraser Valley Flood Control Amendments	Lower Fraser Valley Flood Control Canada-Ontario Agreement on Great Lakes Water Quality Qu'Appelle Conveyance Regina - Moose Jaw Water Treatment Plant**

FLOOD DAMAGE REDUCTION PROGRAM

<u>Under Negotiation</u>	<u>New During 1985-86</u>	<u>Ongoing During 1985-86</u>
Initial Agreements with Alberta, British Columbia and Yukon Territory Amending Agreements with Saskatchewan, Quebec and Northwest Territories		Mille Iles Control Structure Montreal Region Agreement for Flood Control on the Saint-François River in Richmond Amending Agreements with Newfoundland, Nova Scotia, New Brunswick, Ontario and Manitoba Memorandum of Understanding Indian Lands Manitoba Flood Protection Projects

\* Established under the Lake of the Woods Control Board Act.

\*\* Not a Canada Water Act Agreement but included here in the interest of completeness. Special funds were made available for this project under Economic and Regional Development Sub-Agreements.

TABLE 2 - PROGRAMS OR STUDIES COMPLETED UNDER THE CANADA WATER ACT

Peace-Athabasca Delta Planning	1972
Qu'Appelle River Basin Planning	1972
Saskatchewan-Nelson Basin Planning	1973
Okanagan Basin Planning	1974
Saint John Basin Planning	1975
Lake Winnipeg, Churchill and Nelson Rivers Planning	1975
Great Lakes Shore Damage Survey	1975
Fraser River Upstream Storage Planning	1976
Churchill River Basin Planning (Sask.-Man.)	1976
Montreal Region Flow Regulation Planning Study	1976
Peace-Athabasca Delta Implementation	1976
Northern Ontario Water Resources Planning	1978
Southeastern New Brunswick Dyking Implementation	1978
St. Lawrence Water Quality Planning Study	1978
Souris Basin Planning	1978
Metropolitan Toronto Flood Control Implementation	1978
Lower Saskatchewan Basin Preplanning	1979
Southwestern Ontario Dyking Implementation	1979
Upper Thames Flood Control Implementation	1979
Yukon Basin Preplanning	1979
Ottawa River Regulation Planning Report	1980
Thompson Basin Preplanning	1981
Great Lakes Shore Damage Survey Implementation	1981
Dykes and Flow Regulation Works - Montreal Region	1981
Mackenzie Basin Planning	1982
Shubenacadie-Stewiacke Basin Planning	1982
Ottawa River Water Quality Report	1982
Okanagan Basin Implementation	1982
Prairie Provinces Water Board's Water Demand Study	1983
North Shore (St. Lawrence) Ecological Inventories	1983
Winter River Preplanning	1983
Qu'Appelle Basin Implementation	1984
Wabigoon-English Mercury Contamination Study	1984
Yukon River Basin Planning Study	1984
Flood Prevention within the City of Quebec	1984
Fraser River Estuary Planning	1984
Studies and Implementation of Dykes and Flow Regulation Works - Montreal Region	1984

the use of satellites, the DCP permits the real-time acquisition of hydrometric data. Effectiveness of operation and cost savings were key items in the original proposal, with the output of greatest value to navigation, reservoir operation, water allocation, flood forecasting and similar purposes. When necessary, DCPs are being equipped with sensors to provide information required by the Atmospheric Environment Service and the Canadian Forestry Service. As of March 31, 1986, 210 DCPs had been delivered, a total of 190 instruments had been installed and 153 had been activated. Currently, data from the DCP network are being retrieved from a U.S. receive station via an automatic dial-up system. The establishment of a ground receive station in Canada is being investigated. Installation of this facility will greatly improve the efficiency of distributing real time data required for network operations.

Environment Canada has been negotiating water quality monitoring agreements with interested provinces to provide for sharing of costs, exchange of data and a Canada-wide quality control program. To date, agreements have been signed with Quebec and British Columbia; an agreement with Newfoundland is scheduled to be signed April 29, 1986; negotiations with Alberta are nearing completion; discussions with Manitoba, Saskatchewan, New Brunswick and Ontario are under way; Prince Edward Island has been invited to begin negotiations, and an initial meeting with the Department of Indian and Northern Affairs was held to explore the establishment of a similar agreement for the Yukon. By 1986-87, if all provinces join the program, the new network is expected to incorporate 450 existing stations of federal interest, upwards of 2000 existing stations of provincial interest, and about 180 new stations of joint interest. In addition, some Agreements may include cost-shared surveys or special studies to best address existing or emerging issues of joint concern. The proposed stations exclude Great Lakes water quality stations which are administered under other agreements. In March 1983, Treasury Board approved the resources required to implement the agreements.

The Prairie Provinces Water Board, a federal-provincial board which administers the Prairie Provinces Master Agreement on Apportionment, continued to provide recommendations to Canada, Alberta, Saskatchewan, and Manitoba concerning the equitable apportionment of eastward flowing interprovincial prairie rivers. During the year, the Board's Committees on Hydrology, Water Quality and Groundwater continued to recommend procedures for natural flow determination for apportionment purposes and for evaluating the effect that proposed projects might have on the balance of interprovincial waters. A four-year study of historic and current water demands in the three prairie provinces was completed in February 1983 and that information is now being updated on a continuous basis. The Board also has approved the report on Administration of the Apportionment Agreement and has implemented the recommendations on apportionment of the flow of Battle, Lodge and Middle Creeks at the Alberta-Saskatchewan boundary. The Board is now evaluating



site-specific water quality requirements that have been proposed for three of the eleven interprovincial sites where water quality is monitored on a continuing basis. Similarly, the Board's Committees have prepared a profile of ground water potential at the Alberta-Saskatchewan boundary and are developing an approach to deal with the interprovincial problems related to upstream drainage.

The Mackenzie River Basin Committee, with representation from Canada, Alberta, Saskatchewan, British Columbia and Yukon and Northwest Territories, met during the year to fulfill its liaison responsibilities and to consider study designs, budgets and agreements associated with implementation of Recommendations 2 and 5 contained in the Mackenzie River Basin Study Report of 1982. The Committee also is considering a general agreement which would supersede the 1977 Memorandum of Understanding which formed the Committee; the new agreement would reconstitute the Committee, and give full member status to the Northwest Territories and Yukon Territory.

The Ottawa River Regulation Planning Board has a mandate to plan and recommend criteria for regulating the Ottawa River, taking into account hydro-power production, flood protection, navigation, low water problems, water quality needs and recreation. Studies were under way to ensure reserve storage for the operation of the Mille Iles dam and to develop risk management methodology for the Ottawa River basin.

The Ottawa River Water Quality Coordinating Committee was established early in 1983 to be responsible for reviewing data needs and for coordinating data collection through a joint monitoring program. The Board's first annual report, under preparation at year's end, contains an analysis of monitoring data from the past several years. It also makes recommendations for tentative water quality objectives and for future monitoring and special studies for the river.

An evaluation of automatic monitors, and preliminary interpretation of data acquired from water quality monitoring stations (on the Souris River) related to the Garrison Diversion project, were completed. Discussions have taken place with provincial, state and U.S. federal officials with regard to the establishment of water quality objectives at both international boundary crossings of the Souris River. A background report is being prepared by Environment Canada in order to allow further consideration by the parties involved.

The Lake of the Woods Control Board continued to regulate certain waterways in the Winnipeg River basin so as to balance the requirements of the various and sometimes conflicting interests that depend upon the water in the basin. The Board was established under the Lake of the Woods Control Board Act, well before the Canada Water Act was passed, and is described here only to complete the picture on federal-provincial water management in Canada. Basin conditions were extremely wet in 1985 with inflows ranking as the second highest since records began in the early 1900s. Much time was spent managing these flows and keeping the public advised of high water levels and hazardous conditions. Apart from direct regulation activities, the Board is

continuing to improve its data collection and analysis procedures and has plans to introduce mathematical modelling to assist it in its deliberations.

Water Management Programs: Depending upon the nature of the work being conducted, water management programs can fall within any of the three stages - preplanning studies, planning studies or implementation activities. During 1985-86, several water management programs were continued, one new program was initiated to guide economic development while protecting environment of the Fraser River Estuary, and a project to improve the water supply available to the Town of Channel-Port aux Basques was initiated under an ERDA subsidiary agreement.

Preplanning Studies: Preplanning studies normally arise as a result of public representation to resolve one or more problems which are perceived at the local level. The preplanning study has become the vehicle with which to investigate the concerns expressed, and also to examine briefly all of the emerging and potential opportunities and problems of the area in question and to make recommendations as to the desirability of a longer-term planning study. There were no formal preplanning studies under way in 1985-86, although a joint assessment of water problems and management improvement opportunities for the South Saskatchewan basin in Saskatchewan was completed in support of negotiations towards a study agreement with Saskatchewan.

Planning Studies: Planning studies generally are directed towards the development or management of the water resources for the social betterment and economic growth of the basin or area under study. There were no new planning studies initiated during the year but, as mentioned above, a Canada-Saskatchewan study of the South Saskatchewan River basin has been under negotiation and an agreement for a water management plan in the Saskatchewan portion of the basin is expected soon.

A preplanning study of the Winter River basin (Prince Edward Island) was undertaken during the period 1977-1983 to determine the reliability and sensitivity of the existing water supply system in Charlottetown, Prince Edward Island. A planning study was subsequently arranged through an exchange of letters. Funding sought from Canada Water Act and MSERD sources was not approved and the study is being completed under a work-shared arrangement.

In Yukon Territory, field activities were completed in 1984 in the Yukon River basin under the \$2.2 million Canada-British Columbia-Yukon planning agreement. Joint studies were conducted for purposes of formulating a planning framework under which development alternatives in the basin can be evaluated. On January 24, 1985, the Yukon River Basin Committee submitted its Yukon River Basin Study Report to the signatories of the Agreement. The report was officially released on March 26, 1986.

An exchange of correspondence confirmed the start of a Canada-Newfoundland urban hydrology study in the Waterford River basin of Newfoundland early in 1980-81. Federal input is in the form of work sharing. Field and office work in project areas was completed.

Canada, Manitoba, Manitoba Hydro and the Northern Flood Committee, which comprises the five Indian Bands of Cross Lake, Nelson House, Norway House, Split Lake and York Landing, signed the Northern Flood Agreement in December 1977. This Agreement, which is not under the Canada Water Act, is administered federally by the Department of Indian and Northern Affairs to provide compensation for the effects of Nelson River hydro-power developments, specifically Lake Winnipeg regulation and the Churchill River diversion. It also provides an opportunity for renewed economic and social development in the communities. Article 17 of the Agreement commits Canada, Manitoba, and Manitoba Hydro to joint action for the implementation of the recommendations of the Lake Winnipeg, Churchill and Nelson Rivers Study Board Report which deals with ecological concerns and to report annually to the Band Councils on progress made. As part of this process, a consent order was issued following arbitration proceedings initiated by the Northern Flood Committee in 1981 that obliged Canada and Manitoba to implement appropriate studies of mercury contamination in the diversion system. This resulted in the Canada-Manitoba Canada Water Act Agreement on the Study and Monitoring of Mercury in the Churchill River Diversion which expired March 31, 1986 and cost \$760 000 shared equally by the two governments. Work under this Agreement has progressed well to date with draft reports submitted for all of the possible 14 projects. The agreement makes provision for expenditures in 1986-87 for preparation of the final report, scheduled for presentation by September 30, 1986.

Implementation Programs: An agreement to guide economic development while protecting the environment of the Fraser River Estuary was signed in October 1985. Also, a federal-provincial agreement was signed in July 1985 under which Environment Canada coordinates a federal contribution to a water supply system serving the Town of Channel-Port aux Basques, Newfoundland; this is an ERDA agreement, however, and falls under legislation other than the Canada Water Act.

An agreement Respecting a Fraser River Estuary Program was signed in October 1985 by Environment Canada, the Minister of Environment for British Columbia, Fisheries and Oceans Canada, the Fraser River Harbour Commission and the North Fraser Harbour Commission. To cost \$1 250 000 over five years, the program is based on a study conducted between 1977 and 1982.

To improve the water of the Town of Channel-Port aux Basques, the Newfoundland and federal governments signed an ERDA Sub-Agreement on July 31, 1985, under which the federal government will provide a maximum of \$6.5 million or 90% of costs (whichever is less) towards the \$7.222 million agreement.

To complete the conveyance work begun under the 1974-1984 Qu'Appelle Implementation Agreement, the Qu'Appelle Conveyance Agreement was signed by Canada and Saskatchewan in June 1984. Extending to March 31, 1989, the \$4.75 million Agreement is cost-shared equally by the two governments. The program is designed to improve the channel carrying capacity in restricted areas of the river. When completed, the improved channel will convey larger quantities of water with less overbank flooding. During 1985-86, right-of-way agreements were signed with the Piapot Indian band and with private land owners.

To improve the water supply to Regina and Moose Jaw, the Saskatchewan and federal governments signed an ERDA Sub-Agreement on May 1, 1984, under which the federal government will provide a maximum of \$5 million or 33 1/3% of costs (whichever is less) towards the expected \$15 million cost for the granular activated carbon water treatment facility. The plant was officially commissioned in June 1985.

The Canada-British Columbia construction program, designed to reduce damages due to floods in the lower Fraser Valley of British Columbia, continued during the year. Some \$119 million of a total joint commitment of \$120 million was spent up to the end of March 1986. In October 1985, an amended agreement was signed extending the Agreement to March 1995 at an increased cost of \$41 million, for a total commitment of \$161 million.

A renewed Canada-Ontario Agreement on Great Lakes Water Quality, retroactive to March 31, 1985, and extending to March 31, 1990, was signed on March 6, 1986. This agreement provides for the cost-sharing of surveillance, upgraded sewage treatment and phosphorus control and reflects the commitments undertaken by Canada in the 1978 Canada-U.S. Great Lakes Water Quality Agreement. It also re-emphasizes the cooperative phosphorus control and Great Lakes surveillance programs and, in accordance with the 1978 agreement, outlines programs for dealing with toxic substances and hazardous materials in the Great Lakes. On October 16, 1983, Canada and the United States signed a supplement to the 1978 Agreement for the purpose of lowering phosphate levels in Great Lakes waters.

Flood Damage Reduction (FDR) Program: During 1985-86, this program was actively supported throughout most of Canada.

OBJECTIVE: The Flood Damage Reduction Program follows the cooperative federal-provincial approach of the Canada Water Act. Its overall aim is to reduce flood damages. The first step is to identify flood risk areas and discourage further flood vulnerable developments in those areas. Where existing development warrants it, a second step may be to provide remedial measures.

When joining the program, the provinces sign a General Agreement and a Mapping Agreement (or a combined agreement). The General Agreement outlines the basic approach that will be taken

to reduce flood damages. The respective governments and their agencies agree not to engage in, or provide assistance to undertakings vulnerable to flood damage in designated flood risk areas. In such areas, federal disaster assistance will be restricted to structures built before designation and, in some circumstances, new structures which are flood proofed. Zoning on the basis of the flood risk is encouraged.

The Mapping Agreement provides for the flood risk mapping and designation of the areas to which the policies in the General Agreement will apply. Forming part of this agreement is a list of communities in the province which are to be mapped and specifications to be followed in conducting the hydrotechnical and mapping work. When maps not meeting these specifications are available, interim designation may be applied until such time as new maps are prepared. This agreement also requires that information pertaining to the designated area be made available to governments, zoning authorities, the public and anyone contemplating development in or near these areas. As a matter of course all flood risk maps and reports are distributed to key federal departments represented on the Treasury Board Advisory Committee on Federal Land Management and to a number of federal departments whose programs could be affected by FDR Program designations. Designations to March 31, 1986 are listed in Table 3.

In some cases existing developments in designated areas will still require protection against flood damages and, for this reason, further agreements to study such problems can also be negotiated with the provinces. Where benefits exceed costs and where there is a national interest, federal-provincial agreements may subsequently be reached on implementation action. This action could include flood forecasting and warning, flood proofing, works to control flows and levels, acquisition of property, easements or land use planning. It should be noted that, in examining alternatives, the best choice will be made on the basis of effectiveness, cost, and environmental impact. This could mean allowing some flooding to occur.

**DURATION:** The original agreements generally covered a ten-year period, but an Amending Agreement in 1980-81 extended the General Agreement with Manitoba beyond the ten-year period. Similar extensions occurred in 1981-82 with the signing of an Amending Agreement with New Brunswick and in 1982-83 with the signing of an Amending Agreement with Ontario. In 1983-84 the General and Mapping Agreements with Newfoundland, the Mapping Agreement with Quebec and the Flood Forecasting Agreement with Manitoba were amended. In 1984-85 the General, Mapping, and Studies Agreements with Nova Scotia were amended. In 1985-86 the Mapping Agreement with Ontario and the General, Mapping, Studies, and Ring Dyke Upgrading (now Canada-Manitoba Flood Protection Projects) Agreements with Manitoba were amended. Amendments to the Saskatchewan Agreements proposed in 1984-85, and to the Manitoba Flood Forecasting and Quebec Mapping Agreements proposed in 1985-86, are discussed in the following sections.

TABLE 3 - DESIGNATIONS TO MARCH 31, 1986 UNDER THE FLOOD DAMAGE REDUCTION PROGRAM

<u>LOCATION</u>	<u>NUMBER OF COMMUNITIES MAPPED</u>	<u>NUMBER OF PUBLIC INFO. MAPS</u>	<u>POPULATION<sup>1</sup></u>	<u>DATE OF DESIGNATION</u>
<u>NEWFOUNDLAND</u>				
Stephenville	2	1	9 000	June 84
Steady Brook	2	1	570	Mar. 85
Placentia	2	1	2 840	Mar. 86
Badger	1	1	1 090	Mar. 86
<u>Rushy Pond</u>	<u>1</u>	<u>1</u>	<u>20</u>	Mar. 86
5 designations	8	5	13 520	
<u>NOVA SCOTIA</u>				
East River	5	1	16 900	Feb. 84
Sackville River	3	1	7 100	Feb. 84
<u>Antigonish</u>	<u>2</u>	<u>1</u>	<u>23 300</u>	Nov. 84
3 designations	10	3	47 300	
<u>NEW BRUNSWICK</u>				
Fredericton	10	1	65 000	Feb. 80
Perth/Andover	2	1	1 900	Feb. 80
Oromocto to Lower Jemseg	16	1	15 000	Mar. 81
Lower Fredericton to Lincoln	3	1	3 000	Feb. 82
Sussex	15	1	5 000	Sept. 82
Keswick	5	1	1 100	Mar. 83
Norton	2	1	1 700	May 85
<u>Walker Brook</u>	<u>2</u>	<u>1</u>	<u>1 500</u>	Mar. 86
8 designations	55	8	94 200	
<u>QUEBEC</u>				
Montréal Region	38	22	1 940 000	May 78
Chaudière Basin	19	8	50 000	Mar. 79
Gatineau/Ottawa Rivers	19	15	283 000	Oct. 79
Upper Richelieu River	19	11	80 000	Apr. 80
du Gouffre	4	2	9 000	Apr. 80
Lower Richelieu River	23	10	125 000	Nov. 81
Rivière Assomption	12	4	94 000	May 82
Rivière Saint-François	14	6	170 000	Oct. 82
Rivière Yamaska	22	12	64 000	June 83
Rivière Bécancour	4	2	14 000	May 84
Rivière Nicolet Basin	10	3	73 000	May 84
<u>Trois-Rivières-Ouest</u>	<u>1</u>	<u>5</u>	<u>13 000</u>	Aug. 84
12 designations	185	100	2 915 000	

Table 3 (cont'd)

<u>LOCATION</u>	<u>NUMBER OF COMMUNITIES MAPPED</u>	<u>NUMBER OF PUBLIC INFO. MAPS</u>	<u>POPULATION<sup>1</sup></u>	<u>DATE OF DESIGNATION</u>
<u>ONTARIO</u>				
White River	1	1	1 000	Aug. 82
Toronto	24	8	3 000 000	Dec. 82
Sturgeon River/Lake Nipissing/ French River	9	5	63 000	Mar. 83
Kaministiquia River	2	1	39 000	Aug. 83
Nipigon	1	1	2 400	Mar. 86
Atikokan	1	1	4 400	Mar. 86
6 designations	38	17	3 109 800	
<u>MANITOBA</u>				
Melita	1	1	1 200	Dec. 79
Wawanesa	1	1	500	Dec. 79
Winnipeg	1	1	565 000	Feb. 80
Souris	1	1	1 750	Oct. 80
Elie	1	1	450	Nov. 80
Brandon	1	1	36 250	Mar. 82
La Salle - Sanford - Starbuck	3	1	975	Nov. 82
Swan River	1	1	3 800	May 83
Dauphin	1	1	9 000	Feb. 84
Carman	1	1	2 400	June 84
Lorette	1	1	1 100	Sept. 84
13 designations	13	11	622 425	
<u>SASKATCHEWAN</u>				
Estevan	1	1	9 200	Aug. 80
Oxbow	1	1	1 200	Aug. 80
Roche Percée	1	1	150	Aug. 80
Moose Jaw	1	1	34 000	Oct. 81
4 designations	4	4	44 550	
<u>NORTHWEST TERRITORIES</u>				
Hay River	2	1	2 900	May 84
Fort Simpson	1	1	980	June 85
Aklavik	1	1	720	June 85
Fort McPherson	1	1	630	June 85
Fort Good Hope	1	1	460	June 85
5 designations	6	5	5 690	
56 designations	319	153	6 852 485	

1. Figures are approximate and based on 1981 Census data.

PARTICIPANTS AND FUNDING: Canada and the provinces share the costs (see Table 4).

RELATED AGREEMENTS: Several ongoing studies and implementation agreements dealing with flood prone areas in Canada were in force when the Flood Damage Reduction Program was launched. Only one such agreement remains as described elsewhere in this report under the title: Lower Fraser Valley Flood Control Program.

#### REPORT ON PROGRESS

##### Newfoundland

The Steady Brook area was designated March 22, 1985, and an associated public information meeting was held in May. As a follow-up a remedial measures study has been initiated and is scheduled to be completed early in 1986-87.

Combined hydrotechnical and remedial measures studies were completed for both Placentia and Badger, and a hydrotechnical study was completed for Rushy Pond. Placentia was designated March 11th and Badger and Rushy Pond were designated March 13th. Public information meetings are scheduled for mid-May 1986 at Placentia, and a draft implementation agreement and a draft forecasting agreement are being developed.

Base maps for Deer Lake, Stephenville Crossing/Black Duck and Waterford have been completed.

Work under way includes a combined hydrotechnical and remedial measures study for Rushoon; selecting a consultant for the Deer Lake hydrotechnical study; and initiating the Stephenville Crossing/Black Duck hydrotechnical study.

##### Nova Scotia

Action was taken to correct problems encountered with the field work on the Truro Hydrotechnical Study; modelling is under way and the final report is being drafted. Work on updating topographic maps for the Truro area was initiated.

Topographic maps of the Kentville area, the last area on Schedule A, were completed and terms of reference for a hydrotechnical study were prepared.

Work is ongoing on a hydrotechnical study of the Little Sackville River, for completion in 1986-87.

Increased emphasis was placed on public information activities in the province.



Table 4 - FEDERAL-PROVINCIAL FLOOD DAMAGE REDUCTION AGREEMENTS  
TO March 31, 1986

	<u>Duration (years)</u>	<u>Total Cost* (dollars)</u>	<u>Expiry Date</u>
<u>NEWFOUNDLAND</u>			
Amending Agreement	-	-	-
General Agreement	12	-	1993
Flood Risk Mapping Agreement	7	1 470 000	1988
Studies Agreement	5	480 000	1988
<u>NOVA SCOTIA</u>			
Amending Agreement	-	-	-
General Agreement	16	-	1994
Flood Risk Mapping Agreement	11	1 030 000	1989
Studies Agreement	11	670 000	1989
<u>NEW BRUNSWICK</u>			
Amending Agreement	-	-	-
General Agreement	15	-	1991
Flood Risk Mapping Agreement	10	2 000 000	1986
Studies Agreement	10	200 000	1986
Flood Forecasting Agreement - Saint John River Basin	10	1 400 000	1987
Flood Damage Reduction - Marsh Creek	6.5	2 010 000(a)	1984
Petitcodiac Sea Dykes Agreement	3 months	160 000	1979
<u>QUEBEC</u>			
Amending Agreement	-	-	-
Combined General and Flood Risk Mapping Agreement	16	6 000 000	1992
(mapping 11)	11	-	1987
Dykes and Flow Regulation Works - Montreal Region	5.5	11 556 000(b)	1982
Studies and Implementation of Dykes and Flow	2	4 500 000(b)	1984
Regulation Works - Montreal Region	2	833 000(b)	1985
Quebec City Flood Prevention Agreement	2	13 100 000(b)	1987
Mille Iles River Agreement	3.5	4 350 000(b)	1987
Saint Francois River Agreement - Town of Richmond	3	-	-
<u>ONTARIO</u>			
Amending Agreement	-	-	-
All Inclusive Flood Damage Reduction Agreement	17	-	1995
(mapping 12)	12	15 400 000	1990
(other 14)	14	2 200 000	1992
<u>MANITOBA</u>			
Amending Agreement	-	-	-
General Agreement	17	-	1994
Flood Risk Mapping Agreement	11	2 350 000	1988
Studies Agreement	12	310 000	1989
Flood Forecasting	5	600 000	1986
Construction of Flood Protection Projects Agreement	7	6 100 000(b)	1989
<u>SASKATCHEWAN</u>			
General Agreement	10	-	1987
Flood Hazard Mapping and Studies Agreement	(mapping 5)	1 300 000	1982
(studies 5)	5	480 000	1982
<u>NORTHWEST TERRITORIES</u>			
Memorandum of Understanding	2	225 000(c)	1978
Memorandum of Understanding	10	400 000(c)	1989
(mapping 5)	5	-	1984
General Agreement	10	-	1989

\* These costs are to be shared equally by the federal and provincial governments except for

(a) 33-1/3% federal, 66-2/3% provincial/local

(b) 45% federal, 55% provincial/local

(c) costs shared equally by Environment Canada and the Department of Indian and Northern Affairs

### New Brunswick

As a result of provincial government restraint, funding in 1985-86 for flood studies and flood risk mapping was at a low level, similar to that in 1984-85, while funding for flood forecasting remained at a level similar to that for the past several years. Continuing emphasis is being placed on public information.

The Norton and Walker Brook areas were designated by the Ministers on May 14, 1985 and March 25, 1986 respectively, bringing the number of designations in New Brunswick to eight.

Operational flood forecasting for the Saint John River basin by the Saint John River Forecast Centre during the 1985 spring freshet commenced March 18, 1985 and ended on May 3, 1985. River stages did not exceed the flooding threshold at any time, despite normal to above-normal snow pack conditions in the watershed during the winter months. Major refinements were made to the models used in the forecast operation. A current priority is to investigate simplifying the operation of the Forecast Centre through technological initiatives. Forecasting for the 1986 spring runoff began on March 17, with snow pack conditions below normal and ice thickness at near record proportions. Several ice jams occurred during March resulting in highway closures.

The development of a low-cost flash flood warning system for the Kennebecasis River Valley continued to receive high priority. All data collection facilities were put in place, volunteer observers and a local coordinator were recruited, and arrangements were made with emergency measures officials to develop a communications and emergency response action plan. Preliminary forecasting nomographs were developed and will be revised as appropriate hydrometeorological data are collected.

The emphasis on public information activities continued with presentations to community groups, interviews with the media, and through use of the FDR Program display at fairs, exhibitions, etc. Brochures are being prepared on the FDR Program in New Brunswick and on flood forecasting.

Provincial officials have requested an extension to the Mapping, Studies, and Flood Forecasting Agreements. Technical discussions were held to identify time and resource parameters. The Mapping and Studies Agreements expired on March 31, 1986; the Flood Forecasting Agreement expires on March 31, 1987.

The national meeting of the streamflow forecasters was hosted by the River Forecast Centre in Montreal, June 3 and 4, 1985.

## Quebec

Work under the Canada-Quebec Agreement respecting flood damage reduction on the Saint-François River within the limits of the Town of Richmond was completed in November 1985. A project to protect the section north of the town has been proposed. These works, however, were not forecast in the original agreement and, because of budget uncertainties, Environment Canada was unable to agree to proceed with additional works.

Under the Agreement respecting flood damage reduction on the Mille Îles River, construction of the flood control structure was completed in December 1985. The structure is operational but work on the automated control system is ongoing. The Ministers agreed through an exchange of letters concluded on August 15, 1985 to reallocate funds contained in the Agreement to increase funding for studies from \$30 000 to \$230 000; these studies are now under way.

Joint preliminary economic, technical, and environmental studies are under way to determine whether flood damage reduction projects at Sainte-Marie on the Chaudière River and at Baie-Saint-Paul on the du Gouffre River qualify for implementation under the FDR Program.

An amendment to An Agreement Respecting Flood Risk Mapping Applied to Flood Damage Reduction (Mapping Agreement) was negotiated to establish a procedure for derogation in exceptional cases (among others, certain requests related to municipal works, and third party requests). Treasury Board and Order in Council authorization have been received for the amendment; however, signing of the Agreement has been delayed due to the change in provincial government.

Negotiations to amend the Mapping Agreement began in 1985. The proposed amendments would allow the mapping portion of the Agreement to continue until March 31, 1991 with additional funding of \$5 million, and the termination date of the Agreement in terms of policies would be March 31, 1997. The number of communities to be mapped, listed in Annexe 'A', is expected to be increased considerably.

To date twelve designations have occurred under the agreement, affecting 185 municipalities.

## Ontario

The Canada-Ontario Flood Damage Reduction Program Amending Agreement No. 1 was signed by the Ministers on November 14, 1985. The Amending Agreement allows for a time extension to 1990 for mapping and to 1995 for policies. The program is further expanded by a sum of \$8.4 million. Of this allocation, \$7.4 million is for mapping and \$1.0 million for other measures.

Revised criteria for flood plain management released by the province in October 1984 call for a more flexible approach towards defining a regulatory flood. The Amending Agreement accommodates all of the provincial revisions and still maintains the federal criteria. With the release of the policy and the signing of the Agreement, work resumed on a number of projects and designations.

The Nipigon and Atikokan flood risk areas were designated by the Ministers in March 1986, raising to six the number of designations in Ontario.

Work on the public information flood risk map was initiated for McNab and Petawawa. Open houses were held in February to inform the public of the designation process.

Six northern designations are presently before the Steering Committee: Espanola (Spanish River and Darkie Creek), Thessalon (Thessalon River), McNab (Ottawa River), Petawawa (Ottawa River), James (Hornepayne River) and Elk Lake (Montreal River).

Public information flood risk maps are also being developed for the shoreline mapping of Lake Huron for the Maitland Valley Conservation Authority. Procedures were initiated for the designation of flood risk areas in Lower Trent Region Conservation Authority. This Authority-wide recommendation to designate follows an evaluation of work done prior to and outside of the federal-provincial program. All work done prior to 1979 will not meet the Agreement requirements and the area will therefore be designated on an interim basis.

To date, 61 streams and 85 communities have been mapped under the Canada-Ontario FDR Program. Currently, work is in progress for 13 conservation authorities and 8 municipalities where no conservation authority exists.

The Steering Committee addressed the recommendations of the Muskoka River Study. These were discussed with the public Advisory Group before forwarding to the Ministers.

The Depth Damage Curve Development Project was completed and the draft final report was received by the Steering Committee. The intent of the study is to establish a data base of potential flood damages to a representative sample of homes in Ontario and to develop depth of flooding versus damage curves based on this information.

The analysis for the Regional Flood Frequency Analysis Study was completed. All three phases of the project have been documented in a three volume report. Volume I addressing the Index Flood

Method has been printed and distributed. A summary of Volume I was forwarded to the province for inclusion in the Floodplain Management Technical Guidelines. The study is scheduled for completion in 1986.

Studies were initiated to evaluate flood damage reduction measures on a number of streams in the Niagara Peninsula Conservation Authority. A project to improve reservoir operations in Halton Region Conservation Authority with a view to reducing the flood risk in downstream communities is also under way. The Steering Committee commissioned studies to define floodway/flood fringe and to conduct a comprehensive hydrology study of the Nottawasaga Valley Conservation Authority.

### Manitoba

The General, Mapping, and Studies Agreements were amended by an exchange of ministerial correspondence concluded on September 6, 1985 to extend the Agreements in time (4 years) and new funding of \$160 000 for additional mapping.

Designation packages are being prepared for the communities of Arborg, Riverton, and Fisher Branch.

The Red River Ring Dyke Upgrading Agreement was amended on May 22, 1985 to include projects at Ste. Rose du Lac and Souris with additional funding of \$1.6 million. As the communities of Ste. Rose du Lac and Souris are not located in the Red River Valley, the Amended Agreement is now referred to as the "Canada-Manitoba Flood Protection Projects Agreement". The earthwork and permanent pumping facilities have been completed at Brunkild, Rosenort, Letellier, St. Jean, and Morris. The existing dyke at St. Adolphe has been upgraded but a new section to complete the north segment of the project has been delayed. A draft of an agreement between Manitoba and the U.S. Corps of Engineers to construct the international segment of a dyke to protect Emerson, Manitoba and Noyes, Minnesota is under review. The construction is planned for 1986-87 providing the agreement can be finalized before the construction season.

In November 1985, Manitoba requested an amendment to the Canada-Manitoba Flood Forecasting Agreement to extend the time frame by 3.5 years with additional funding of \$400 000. The aim of the proposed amendment is to streamline the forecasting by shifting emphasis from model simulation to more practical activities such as the retrieval of real time data. Provincial Treasury Board authorization was received in February 1986, and a submission has been prepared to seek federal Treasury Board approval.

#### Saskatchewan

In 1985-86, negotiations continued between Environment Canada and the Saskatchewan Water Corporation for renewal of Agreements that had expired. The text of the three Agreements has been finalized by the Steering Committee. The agreements are: 1) to amend the existing General Agreement, 2) a new Mapping and Studies Agreement, and 3) a Community Floodplain Management Measures Agreement. The flood mitigation project for Weyburn was deleted from the Floodplain Management Measures Agreement because the economic analysis indicated an unfavorable benefit/cost ratio using federal guidelines. This deletion has resulted in the province delaying the agreement negotiations until the possibility of obtaining additional funding for the Weyburn project under an existing ERDA agreement has been investigated.

The hydraulic report for Weyburn that incorporates the proposed flood mitigation works was approved by the Technical Working Group. Hydrotechnical studies for Buffalo Narrows and Ile-à-la-Crosse have been initiated.

#### Alberta

The province is giving consideration to joining the FDR program in the form of a designation agreement, a public information agreement, and a cost-shared mitigation agreement based on existing provincial flood plain maps.

#### British Columbia

British Columbia has expressed interest in a flood plain mapping agreement at a shared cost of \$5.0 million over five years. A draft Agreement has been negotiated and has undergone federal legal review. The Government of British Columbia will be submitting the draft agreement and federal comments for a legal review early in 1986-87.

#### Northwest Territories

The designation process and associated community information meetings were completed for Aklavik, Fort McPherson, Fort Good Hope and Fort Simpson in the early summer. A major flood at Hay River settlement during the first week in May exceeded the floodlines previously designated for the community. Since the original designation was based on a historic flood rather than a statistical event, consideration is being given to re-opening the designation process. Floods in Hay River are caused by complex hydrologic inputs from high flow interactions with Great Slave Lakes ice regimes. To gain understanding, proposals were solicited from the research community for a study design to examine these relationships.

Preliminary results from the Tuktoyaktuk Driftwood Study were received from the contractor. A decision was made to map flood-lines based on driftwood data rather than a wave model developed previously.

The five-year Flood Risk Mapping Agreement with the Northwest Territories expired on May 2, 1984. A Treasury Board submission to add the communities of Fort Liard and Nahanni Butte to Schedule "A" of the agreement and to extend the expiry date of the agreement to March 31, 1987 is being coordinated by the two departments. Additional funds will not be required to complete this expanded program.

#### Yukon

A draft agreement prepared by the Yukon Territorial Government was reviewed by federal officials. Subsequently, one negotiation meeting was held between Environment Canada and the Yukon Government. A revised draft agreement was under review by Environment Canada, Indian and Northern Affairs Canada (DINA) and Yukon.

#### Indian Lands

A short enabling Memorandum of Understanding between the Departments of the Environment, and DINA was signed in May 1985 to allow interested Indian bands, with the support of regional offices of DINA to take part in the flood risk mapping program. The work has a funding ceiling of \$300 000 per annum shared equally by the two federal departments. The program expires on March 31, 1990. Designation, which is intended to restrict development in flood risk areas, is not required. Four projects, two each in Ontario and Manitoba, were initiated in 1985-86. Similar projects are under consideration in other provinces.

#### Guidelines on FDR Program

A document, "Federal Guidelines for the National Flood Damage Reduction Program", was prepared in 1984-85. The English text was distributed in 1985-86; translation of the document is nearing completion. The guidelines are intended as the main reference for federal managers of the FDR Program and are based on the originally stated aims of the program, the experience gained and precedents established over the years. To the extent possible, the guidelines attempt to anticipate the program's foreseeable future needs.

## Water Research Under the Canada Water Act

Research is carried out in the Inland Waters Directorate in support of operational Branches and departmental objectives. The in-house research programs are undertaken by the National Water Research Institute and the National Hydrology Research Institute. Support of related research in Universities takes place through a subventions program. Undertakings are summarized below:

### 1. The National Water Research Institute (NWRI)

NWRI carries out water research under the Canada Water Act to address chemical, physical and biological environmental problems of lakes, rivers and reservoirs and also urban and coastal regimes. Field and laboratory studies are undertaken by five research divisions in Burlington, Ontario, and two regional groups in western Canada to advance knowledge of and find solutions to problems in aquatic ecology, environmental contaminants, analytical methods and aquatic physics, and hydraulics research. Some studies are undertaken in response to problems in specific geographical locations while others are national in scope.

- (a) Aquatic Ecology: The Aquatic Ecology research was carried out by specialists in the fields of limnology and paleolimnology, microbiology, geochemistry, algal and invertebrate ecology, statistics and plant physiology. It addressed departmental issues related to environmental degradation and ecosystem health, particularly in the area of nutrient and contaminants control, lake restoration, acidification, management of aquatic weeds and water quality monitoring (both chemical and biological).

Lake acidification project staff conducted research in the following areas: long-range transport of atmospheric pollutants (LRTAP) with emphasis on geochemical aspects of lake acidification, peatland development and its impact on water quality, paleolimnology, and statistical methodology for water quality interpretation. The LRTAP related studies dealt with the use of sulphur isotopes as tracers, metal profiles in sediment cores and the release of metals from sediment upon acidification, the characterization of natural acidity, and the use of diatoms as paleolimnological indicators of pH and of Sphagnum moss as a bioindicator of atmospheric deposition of metals. The emphasis of the peatland study was the ecological impact of the mining of peatlands on the receiving waters. One paleolimnological study concentrated on the use of proxy climatic data.

The Great Lakes Rehabilitation group continued work on research projects related to the Canada-U.S. Agreement on Great Lakes Water Quality. Projects included work on internal nutrient loading of lakes, availability of non-point phosphorus loads, oxygen



in Lake Erie, trends in Lake Erie water quality, nutrient and contaminant movement in the St. Lawrence River and Lake St. Clair and the ecology and potential control of nuisance macrophytes.

The Nutrient Pathways group continued research on the problems related to lake restoration, taste and odour problems in municipal water supplies, effect of toxic substances and nutrients on biological processes (i.e., algal and bacterial productivity and metabolic activities), and the functional roles of selected organic substances found in lake waters.

One of the highlights in this field was organizing the International Symposium for Aquatic Microbial Ecology held at the Canada Centre for Inland Waters on May 13-15, 1985. Thirty-five speakers from nine countries presented their current research interests.

- (b) Environmental Contaminants: Research on environmental contaminants includes organics, inorganics and radionuclides and has been in three categories.

The first, associated with the study of actual pathways at contaminated sites, involves chemicals of public concern such as PCBs, chlorophenols, arsenic, and plutonium. The major study sites in 1985 were the Detroit River-St Clair River, and the Niagara River-Lake Ontario in Ontario; the Fraser River in British Columbia; and the St. Lawrence River in Quebec. The Tobin Lake reservoir in Saskatchewan is the site of an inter-agency study of response of benthic organisms to contaminant stress in the North Saskatchewan River system. Mercury cycling in aquatic foodwebs and its implications for human health in northern Manitoba reservoirs and the Qu'Appelle River Lakes continue to receive special attention in western Canada. Contaminant transport mechanisms are being investigated in the Mackenzie River.

The second category encompasses experimental sites where investigation of processes controlling environmental fate and effects are studied by additions of contaminants. These are primarily regulated to the fate and effects of pesticides applied in agricultural watersheds. Studies were conducted in PEI.

The third category included laboratory determinations and theoretical physical-chemical calculations. The laboratory work includes tests of microbial and fungal biodegradation, photodegradation, hydrolysis, water lipid partitioning, contaminant sorption, volatility, and bioaccumulation. The theoretical calculations included structure-activity correlations to predict environmental hazards, electron orbital calculations to predict degradation products, and assessment of computer models for contaminant fate in aquatic ecosystems. Laboratory tests are also made of contaminant flow in fractured bedrock and other media so as to predict fate in ground water at sites such as the Niagara and St. Clair River areas.

- (c) Analytical Methods: Analytical methods research has concentrated on the use of techniques such as high pressure liquid chromatography, gas chromatography, gas chromatography-mass spectrometry, atomic spectroscopy, electrochemical techniques and flows injection analysis. Projects recently completed include methodologies for polynuclear aromatic hydrocarbons, carbamates, trace metals, total organics, 2,3,7,8-Tetrachlorodibenzo-p-dioxin and other dioxin isomers, acid and neutral herbicides, toxaphene and numerous inorganic parameters. These methods have been transferred to the Water Quality National laboratory for routine use. A radioimmuno assay screening technique for dioxins is nearing completion.

Research work was also carried out in the area of identification and confirmation of trace organics in samples from the Great Lakes using high resolution gas chromatography-mass spectrometry. A special clean and hazardous chemicals laboratory, completed in 1981, is being used primarily for methods development research and preparation of standards involving hazardous compounds such as dioxins, or when working with ultra-trace contaminants requiring a special ultra-clean working environment.

Regional, national and international interlaboratory quality assurance programs are conducted to ensure that data generated by different laboratories are comparable. Special programs are undertaken for the Great Lakes Water Quality Program, Long Range Transport of Air Pollution, the Prairie Provinces Water Board and federal/provincial water quality agreements.

A battery of microbiological toxicity testing procedures has been assessed and a yeast test for mutagens was improved to eliminate weaknesses that became apparent in testing. Bacteriological surveys of Lake Ontario have been undertaken and microbiological studies of lakes stressed by acid rain indicated that several microbial species were adversely affected.

- (d) Aquatic Physics: An extensive field program designed to obtain information on the physical processes governing sediment transport and bottom resuspension in the Lake St. Clair region has been undertaken. Data from this venture are currently being incorporated into model development. Water quality and aquatic ecosystems models were developed to simulate the temporal and spatial distributions of dissolved and suspended materials in the nearshore and off-shore regions of inland lakes. Based on a general modelling framework, pertinent data in the physical, chemical and biological sciences can be combined into an overall model capable of simulating the effects of contaminants in the aquatic ecosystem. A comprehensive model to simulate the temporal behaviour of the thermal and dynamic regimes comprising northwest Lake Ontario was completed, as was a comprehensive atlas of Great Lakes optical measurements undertaken by NWRI.

Investigation of the physical factors influencing contaminant transport in the Niagara River plume, and modelling of sediment transport through the Upper Great Lakes Connection Channels is nearing completion.

In western Canada, field and theoretical studies were focussed on physical dynamics of prairie lakes in order to improve understanding of the eutrophication processes. Instrumentation was developed for measuring baroclinic mass exchange under ice in northern Manitoba lakes. Measurements of the mass exchange under the ice of Yukon lakes have been undertaken with the objective of modelling such processes.

Two scales of models have been developed to relate surface water acidification to the deposition of acidifying substances by atmospheric transport. A small basin-scale model simulates short episodic event acidification while a general regional-scale model relates sulphate deposition to the regional cation yield to estimate the regional loading consistent with acceptable levels of surface water acidity. Both models are being applied to the concept of a target loading and the associated extent of aquatic resources at risk.

- (e) Hydraulic Research: Research on river processes is geared towards predicting the effects of human activities on the physical environment. The river model MOBED was improved so that effects of different sediment sizes can be included. This model was applied to the Qu'Appelle River in Alberta to investigate the effects of straightening the river. The model RIVMIX was extended so that it can be used to predict the mixing of effluents which undergo decay. Laboratory experiments were conducted to gain knowledge of the frictional resistance of alluvial channels under different bed conditions. Experiments were also conducted to investigate the flow resistance in the Pitt River, a tributary of the Fraser, when the water flows backwards over the sandwaves due to tidal conditions. Studies of the behaviour of the toxic material in the bottom of the St. Clair River were made. Sources of toxic contaminants in the urban runoff in the Sarnia area were investigated.

Problems of ice jams and flooding were studied in the laboratory and through field observation. Development of a material for modelling ice sheets was carried out and a new material has been produced and tested. A mathematical model of ice jams was improved to make it applicable to non-prismatic channels. The distribution of frazil ice in natural rivers was studied using data obtained from the Lachine Rapids at Montreal.

Urban water resources research has emphasized the development and verification of models for urban runoff quality and quantity and the effects of urbanization on urban drainage. A simulation model was applied to a catchment in the Waterford River basin with good success. Experiments on flow in sewer networks has been completed.

Air-water interaction research produces new knowledge of fundamental importance for all research into the physics and biology of lakes and oceans. The circulation, heat budget, dilution of pollutants and production of biota are all controlled by the processes at the air-water interface. New data on wind waves in shallow water were collected for use in developing shallow water wave forecasting techniques. Field studies of turbulence under white-capping waves has resulted in an important new data set currently being analyzed for better understanding of the dispersion of pollutants in the surface layers. Radar backscatter techniques have been developed which will lead to better measurement of oceanic winds and hence, weather forecasting.

Wave interactions with the shore and with man-made structures also have been studied. Basic relationships between waves and longshore sediment transport and resulting shoreline recession and accretion have been examined. Numerical methods to model shoreline evolution are sought so as to provide shore management tools. Also, resuspension of sediment by waves, because of the importance of sediment in the movement of pollutants, was examined in a shallow lake, supplemented with laboratory tests. Interactions of structures (such as wave agitation in harbours) also were examined, and economic and environmentally benign breakwaters and shore facilities, developed. Studies are under way to evaluate environmental risks associated with submarine pipelines.

Problems related to shorelines are being examined from a geological and geotechnical viewpoint. A data base of the nearshore sedimentology has been developed for the Canadian shorelines of the lower Great Lakes (Erie and Ontario). The sediments of Lac St-Louis were surveyed and the information is being incorporated in the data base. Post glacial evolution of some of the Great Lakes shores has been examined to put into context some of the recent severe erosion problems. Geotechnical factors affecting bluff recession and subaqueous erosion also are being examined.

Work has also been done on techniques for control and recovery of oil in ice-covered waters. Urban water resources research has emphasized the development and verification of models for urban runoff quantity and quality and the effect of urbanization on urban drainage in order to improve management and design of stormwater systems.

## 2. The National Hydrology Research Institute (NHRI)

NHRI, with headquarters in the Ottawa-Hull Region, specializes in research related to the flow and quality of both surface and ground water, and to snow and ice. The

construction of a permanent home for the institute at Saskatoon is scheduled for April 1986 and occupation of this new facility is expected three months later.

The consolidation of a broad range of water research activities in a single research facility makes possible for the first time a planned approach to integrated multi-disciplinary investigations focusing on western and northern water resource problems. This research thrust at the Centre will be reinforced beginning in 1986-87 by the addition of a hydrometeorological research group from the Atmospheric Environment Service (AES). Also based at the National Hydrology Research Centre will be the regional water quality laboratory of IWD's Water Quality Branch and the AES Saskatoon Inspection Services.

Snow and Ice Research, previously dealt with separately, is now incorporated in other sections.

- (a) Ground Water Research: Ground water contamination from many sources, for example, landfills, pesticides used in agriculture, mining developments and acid rain, is becoming of increasing concern. A number of investigations are being conducted to study the natural processes involved in the movement of contaminants in the subsurface and to solve the problems they present. They include a major investigation near Niagara Falls where subsurface migration of toxic contaminants from chemical dumps is a serious hazard, and a major intensive study of toxic chemical migration at Gloucester, Ontario, where the emphasis is on the development of remedial technologies. Solute exchanges between water and aquifer are being investigated. Pesticides can also present ground water contamination problems. New field sites have been established to study the fate of pesticides in ground water in British Columbia (Abbotsford), Saskatchewan and Prince Edward Island, and a study continues near Osoyoos, British Columbia, where it is suspected that surface waters are becoming contaminated by pesticide-bearing ground waters. Research sponsored by Atomic Energy of Canada Ltd. has examined ground water aspects of the underground disposal of nuclear wastes in crystalline rocks. Data from boreholes up to 1000 metres deep were subjected to various analytical and numerical analysis techniques to determine hydraulic parameters. The effect of the ground water-aquifer system in mitigating the adverse effects of acid rain is under investigation, principally at a field site near Sault Ste. Marie.

In the North, research is directed towards ground water discharge and recharge under permafrost conditions and the effect on the ground water regime of engineering structures and developments such as pipelines and roads.

Modelling is a fundamental part of ground water studies and the models developed are used to solve both quality and quantity programs. An increasing amount of assistance was being provided to various Environment Canada agencies pertaining to the ground water aspects of the environmental impacts of various developments, particularly in southern Ontario.

- (b) Surface Water Research: Surface water research emphasizes the investigation of watershed processes, particularly those that characterize elements of the hydrologic cycle other than the ground water. Hydrologic processes in permafrost, alpine and prairie environments are of particular interest. This array of studies includes the interactions between Arctic streams and permafrost, lake dynamics and flooding in the Mackenzie Delta, fluvial processes in the Mackenzie Delta, and the processes controlling the impact of land drainage on the streamflow characteristics of watersheds. Modelling activities are concentrated on the development and testing of precipitation-runoff models including the design of statistical streamflow forecasting models with and without climatic forecasting ability, a model of snowmelt in the Mannes - Domain drains of southern Manitoba and its partitioning into soil moisture, ground water, surface ponding, evaporation and runoff, and the sensitivity analysis of a passive microwave snow cover model to a range of snow cover and soil moisture conditions.

The agricultural land drainage project is progressing with continuation of data collection in the long-term study area of the Mannes-Domain drains. Land drainage is of concern to the Prairie Provinces Water Board, provincial government agencies and the primary producer. Such studies have a direct influence on management and reclamation practices for primary producers and water resource managers.

Research activities have continued in the Mackenzie Basin related to the effects of possible future regulation of Liard-Mackenzie flow, and to potential oil and gas developments in the Mackenzie-Beaufort region. A study of the processes and patterns of channel change in the Mackenzie Delta was broadened to include an analysis of historical channel shifting, through airphoto interpretation. Field studies continued into the relative magnitudes of the major water balance components of a "closed" delta lake. Data collection of the natural variations in water levels of a variety of delta lakes was completed while the Inuvik-Tuktoyaktuk Highway-related hydrologic studies were phased out with a concluding summary report to follow.

Glacier studies are an important element in the snow and ice research program. Glaciers can provide proxy climate data and contribute significantly to water supply. Studies of climate change over the last 250 years are being carried out in conjunction with an ice coring project on Mount Logan. Cores from this area and the Seward Glacier are being analyzed for evidence of long-range transport of atmospheric pollution.

Further analysis of changes in glacier water storage for the Glacier National Park section of the Columbia River system has been assessed. An inventory of the glaciers in the headwaters of the Fraser River has been initiated. Assessment of annual mass changes in the glaciers of the Cordillera has been terminated on the Iskut, Homathko and Bridge River basins, but continues on Sentinel, Place, Helm and Peyto Glaciers. Mass balances on all the glaciers were strongly negative. In collaboration with other agencies, investigations on Peyto Glacier include the study of water chemistry, meltwater flow paths, ice depth determination, and temporal variations in suspended and solute concentrations.

Snow structure and its metamorphism influence melt rates and runoff characteristics. By the photomicrographic analysis of section planes, a variety of stereological and topological parameters have been found which contribute to an understanding of changing snow structure.

River ice research is concentrated on the Liard and Mackenzie rivers. Photogrammetric interpretation of aerial photographs of breakup is used to derive quantitative information about specific ice jam characteristics.

At the basin scale, a synoptic classification of the air masses which prevail during the breakup period has being made and at the smaller scale, a micrometeorological study is being conducted to quantify the relative importance of atmospheric and river heat to the ablation of snow and ice, and to the decrease of ice strength prior to breakup. A number of hydrologic characteristics of river breakup fronts and ice jams are being measured. To carry out such measurements, special equipment, such as a 35 mm airborne camera system, has been developed. A final draft of the "Guidelines for River ice Data Collection Programs" has been distributed. At the confluence of the Liard and Mackenzie rivers the convective heat flux from the river to the overlying ice has been examined and its importance in the removal of ice from the river is assessed in a recently completed report.

A resistivity probe designed to measure ice thickness was successfully tested in the Mackenzie Delta in 1984-85 and used again over the 1985-86 winter season.

- (c) Limnological Research: This division was formed by the amalgamation of the two western branch offices of the National Water Research Institute. Current expertise of the division encompasses ecotoxicology, palaeolimnology, physical limnology, nutrient dynamics, river ecology, and the biogeochemistry of mercury and other heavy metals.

In the field of ecotoxicology, interest has been focussed on the development of a biological screening tool for contaminants in aquatic ecosystems based on morphological deformities in chironomid larvae.

Work on palaeolimnology has been directed towards the development of techniques to determine lake/watershed histories from fossil remains in sediments which may be used to study climatic changes or land use impacts such as toxic contamination or trophic changes.

Physical limnology expertise includes aspects of environmental fluid dynamics and lake circulation, air-sea interaction, mixed layer dynamics and entrainment, turbulence and Langmuir circulation, sediment transport and resuspension, under-ice circulation and physical-biological interactions. Methods of physical dynamics have also been applied to study nutrient dynamics in lake systems.

Experimental river research has developed expertise on nutrient pathways in riverine systems and, in particular, the bioavailability of different forms of phosphorus and nitrogen in water and sediments. Related topics of interest are the effects of nutrients on algal and bacterial growth, the physical processes controlling biological and chemical kinetics in aquatic systems, the development and improvement of the methodology for measuring biological productivity in aquatic systems, nutrient and pollution transport (spiralling) in rivers, and the role of plants and bacteria on invertebrate and fish production.

Expertise has also been developed on nutrient-toxicant interactions in riverine systems including both the effect of microbial activity on the transport, transformation and longevity of toxic organics in aquatic systems and the influence of different organic toxicants on microbial ecology in rivers.

Metal pathways, speciation (especially mercury methylation and demethylation), bio-availability and bio-accumulation, and the binding and release of metals by sediments have been under investigation in natural rivers, lakes and reservoirs under different site-related and seasonally varying environmental conditions. Laboratory experiments have been undertaken on microbial methylation and demethylation of mercury as affected by different environmental variables such as clay minerals, hydrated oxides and humic matter. Expertise and methods have also been developed for assessing bio-availability and the ecological impact of other heavy metals such as copper, cadmium and zinc from experimental and field data.

### **3. Water Resources Research Subvention Program**

In 1985-86, 15 universities across Canada received a total of \$250 000 in grants to carry out research as an adjunct to the Inland Waters Directorate in-house research programs. The 21 water-related environmental research projects supported were focussed on regional and national water research topics associated with acid rain, toxic substances, land drainage, sediment transport, flood damage reduction and innovative water resources research. The aims of the program are to stimulate development of water



resources research across Canada, to encourage development of innovative ideas by non-governmental scientists, and to foster closer contact between those scientists and their counterparts in Environment Canada.

#### Other Water Management Activities

Not to be overlooked in the review of operations under the Canada Water Act are various activities which provide indispensable information for effective water planning and management.

Socio-Economic Studies: The framework of the Canada Water Act allows for the development of socio-economic methods and techniques, used in various studies and as policy and technical inputs to Canadian water management. During the year, studies of a socio-economic nature were completed in both Headquarters and Regional offices. Among the more important Headquarters studies were (a) a set of water use forecasts, commissioned by the Inquiry on Federal Water Policy, covering the 1981-2011 period; (b) publication of a report on Canadian industrial water uses for 1981, and compilation of a computerized municipal water use database. In the Regions, major studies included (a) an analysis of the costs of industrial water use in British Columbia and (b) the application of the Directorate's water use analysis model for river basins in New Brunswick.

Continued development occurred in analyzing the nature of water supply constraints to energy development, primarily in Western Canada. Improvements made to the water use analysis model, which was built during the 1982 - 1984 period, included a more detailed analytical routine for municipal and industrial water uses, the addition of a reservoir simulation component, and the analysis, on an experimental basis, of a number of water use scenarios for the Saskatchewan-Nelson drainage basin. The water use model built under this project is currently being adapted for use in all regions for examining trends in water use in various river basins and comparing the projected future use to available water supplies.

Work began on a socio-economic program associated with water conservation. Water use analysis on a nationally consistent basis is proposed as an essential component of such a program. As part of the program, a National Water Use Analysis component was established to coordinate Headquarters and regional water use activities.

The Inquiry on Federal Water Policy reported during 1985 with some 55 recommendations relating to the improvement and realignment of federal water management. Socio-economic advice and input was provided to assist in formulating federal responses and positions on these recommendations.

Internationally, three papers were prepared for presentation to workshops and seminars, including the Economic Commission for Europe, the Organization for Economic Cooperation and Development and the International Water Resources Association. Topics of these presentations included hydroelectric development, water resource engineering and water pricing. In addition to

international studies, a number of other reports and papers were written on various socio-economic aspects of water resources management, including irrigation water use, the evolution of Canadian water policy, the impact of structural change on industrial water use, water use for power generation in Canadian river basins, and the water use impacts of potential climatic change.

Socio-economic policy advice was provided during the year on wide-ranging topics including: Canadian progress in implementing the World Conservation Strategy, the federal Flood Damage Reduction program, water availability to Canadian agriculture, the effects of climatic change on municipal and industrial water use and various departmental information programs and workshops.

Public Consultation: In November 1985, during a two-day national meeting on the environment, a number of citizens and members of various non-governmental organizations participated in a full-day session to discuss the Inquiry on Federal Water Policy. As a result of this workshop, comments were invited from all public groups who participated in the hearings or who indicated an interest in the report. These meetings and further consultations with representatives from other federal departments, industries and universities, are providing a sounding board for the many ideas and recommendations influencing government policy.

Water Data: Programs for the systematic collection and compilation of data on streamflow, water levels, sediment transport, ground water, water quality, and related information on glaciers, snow and ice predated the Canada Water Act but have continued to operate in support of water management basin studies and implementation programs. A newer innovation is the collection of background data on water use by municipal and industrial users in Canada.

At the National Water Research Institute in Burlington, Ontario, water data activities in support of water data collection include programs of quality assurance and analytical methods adaptation for the water quality program and current meter calibration for the water quantity program.

Data Management Systems: Data and information reference systems continue to be operated in support of water resource activities. WATDOC, the water resource document reference centre, gives direct access nationwide by computer terminal to an inventory listing of published water-related papers and reports through a publicly available on-line interactive storage and retrieval system. This reference system was recently broadened to cover environmental baseline data in general. NAQUADAT, the national water quality monitoring program's data bank, was designed to store and retrieve chemical, physical, bacteriological, biological and hydrometric data relevant to water quality for surface waters, ground waters, wastewaters and sediments. STAR, a data storage and retrieval system, was developed to handle limnological data from Great Lakes monitoring cruises. WATENIS, the water effluent national information system, provides an inventory of industrial and

municipal water pollution sources including data on physical, chemical, and toxicological characteristics of effluents and information on water effluent regulations and guidelines. MUNDAT, a data-base covering municipal waterworks and wastewater systems from coast to coast, including data on federal facilities, was developed in close cooperation with the provincial governments and the Federation of Associations on the Canadian Environment (FACE). HYDAT, the national surface water data bank has been developed to store and retrieve streamflow, water levels, and sediment transport information collected under the Federal-Provincial Water Quantity Agreements; it also includes water quantity data contributed by other organizations that meet national standards in data collection procedures and accuracy. A Glacier Data and Information System has been designed to contain a compilation of physical dimensions of Canadian glaciers and a bibliography of Canadian glacier documents. CHOMS is a database which provides an inventory and summary description of selected operational techniques and procedures used to collect, process and manipulate hydrologic data in water resources studies. The CHOMS database was developed as the Canadian contribution to the HOMS project of the World Meteorological Organization (WMO) for the organized transfer of hydrological technology operationally used in water resources investigations by member countries of WMO.

#### PART II: Water Quality Management

No water quality management areas, as defined under Part II of the Canada Water Act, have been set up. However, there are a number of federal-provincial implementation agreements under which water quality management programs have been or are being implemented. These include programs in the Great Lakes basin and in the Okanagan and Qu'Appelle basins. While these agreements do not provide for the establishment of water quality management agencies under Part II of the Act, they nevertheless have the same objectives of maintaining and improving water quality and are managed by joint federal-provincial Boards. The federal government, in concert with provincial governments, has completed the development of water quality management strategies for the St. Lawrence River (Quebec), the Souris River (Manitoba-Saskatchewan) and the Shubenacadie-Stewiacke Rivers (Nova Scotia) and the Fraser River Estuary in British Columbia. Also, a Canada-Ontario-Quebec Coordinating Committee is working to establish a water quality monitoring plan for the Ottawa River, a Canada-Ontario Task Force has recommended actions which the federal and Ontario governments might take to deal with mercury contamination in the English-Wabigoon rivers system, and a Canada-Manitoba Team is undertaking to monitor and study mercury in the Churchill River diversion.

At its fall meeting in 1983, the Canadian Council of Resource and Environment Ministers (CCREM) established a Task force on Water Quality Guidelines to address the problem of the many different water quality guidelines and objectives in use across Canada and to consider the possibility of harmonizing these guidelines. During 1984 this task force had produced the

"Inventory of Water Quality Guidelines and Objectives 1984" and "Canadian Water Quality Issues", which were published by the CCREM in February, 1985. In October 1984 the Task Force recommended, and the CCREM agreed, that harmonized Canadian guidelines should be developed. The Task Force has been preparing "Canadian Water Quality Guidelines" during 1985 and plans to present a final draft to the October 1986 meeting of the CCREM (with publication expected in early 1987). In order to meet the tight deadline imposed by the CCREM, this document will be based on existing guidelines. The Task Force will also produce a report on research needs identified during the preparation of the Guidelines. This report will help orient future research so that it will be useful in the preparation of new and revised guidelines.

### PART III: Regulating Nutrient Inputs

The federal government launched its phosphorus concentration control program in the late 1960s. Regulations limiting the maximum phosphorus content of laundry detergents to 8.7% elemental phosphorus (P) by weight, or 20% phosphorus pentoxide ( $P_2O_5$ ), were established in 1970. At that time, an inspection program was introduced under which product samples were collected from manufacturers and importers for government analysis. It is estimated that these first regulations resulted in a 22% reduction in the amount of phosphate discharged from all detergent sources (from 26 000 000 kilograms to 20 000 000 kilograms per annum).

On January 1, 1973, the maximum permissible phosphorus content for laundry detergents was reduced to a maximum of 2.2% elemental phosphorus by weight (or 5%  $P_2O_5$ ). In 1973, a national network of regionally based inspectors was formed. Since that time samples of laundry detergents and other products have been collected and analyzed on an annual basis. In the 1985-86 fiscal year, 158 random samples of commercially available laundry detergents were collected as well as 6 samples of dishwashing compounds. Fourteen of these were analysed before the end of the fiscal year; of these, none was found to contain phosphorus in excess of the regulated limit.

Concern over the adequacy of the standard method of analysis for phosphates (ASTM) referenced in the Phosphorus Concentration Control Regulations (1973) led to the development of a regulation amendment. The ASTM method specified by regulation tended to give slightly high results; the automated colorimetric procedure was found to be more accurate. The revised regulation allows for the determination of phosphorus in laundry detergents by either a modified version of the ASTM method or an automated colorimetric procedure. This amendment was approved by the Privy Council Office and came into effect on April 9, 1985.

### PART IV: Public Information Program

A broad range of water management activities were announced during final year 1985-86.

On April 10, 1985, a report entitled "Hearing about Water" was released, providing a synthesis of comments on matters related to supply, quality and management of Canada's water resource received by the Inquiry on Federal Water Policy during its hearings. The Inquiry's final report was released on September 30.

An announcement on June 11, 1985, accompanied the start up of the Granular Activated Carbon Water Treatment System for Regina and Moose Jaw, in Saskatchewan. The Government of Canada contributed about one third of the \$15 million cost.

Several Canada-British Columbia agreements were announced on October 10, 1985. One dealt with the extension of the Fraser River Flood Control Program in 1995 with increased funding of \$41 million to be shared equally by the two governments. Another announced a water quality agreement in which the two governments will share equally the \$140 000 annual cost of maintaining 74 water quality stations that cover the major river basins in the province. The third was a \$1.25 million, five year Fraser River Estuary Management Program Agreement under which Environment Canada, the B.C. Ministry of Environment, the Fraser and North Fraser Harbour Commissions and the Department of Fisheries and Oceans will guide economic development in the Fraser River Estuary while protecting its environment.

On January 23, 1986, an agreement to extend the Canada-Ontario Flood Damage Reduction Program to 1995 was announced. The amended agreement will provide an additional \$8.4 million for flood risk mapping and related studies.

The Canada-Ontario Great Lakes Water Quality Agreement was renewed on March 6, 1986. The renewal extends the agreement to 1990 and provides additional funds for surveillance, upgraded sewage treatment and phosphorus control programs.

An announcement was made on March 26, 1986, with the release of the final report of the Yukon River Basin Study.

On March 27, 1986, the opening of the Great Lakes Water Level Communication Centre was announced to provide rapid and informative responses to events affecting the current high water conditions on the Great Lakes.

TABLE 5 - CURRENT AND PROJECTED RELEASE DATES OF FINAL REPORTS  
ARISING FROM CANADA WATER ACT STUDIES

<u>Report</u>	<u>1985-86</u>
Yukon River Basin Study Report	early 1986

Available upon request from: Director, Water Planning and Management Branch, Inland Waters Directorate, Department of the Environment, Ottawa, Ontario, K1A 0E7.

## PRINCIPAL FEDERAL-PROVINCIAL COOPERATIVE ARRANGEMENTS UNDER THE CANADA WATER ACT

### REGULATION, APPORTIONMENT, MONITORING AND SURVEY PROGRAMS

1.	Water Quantity Survey Agreements.....	40
2.	Water Quality Monitoring Agreements.....	41
3.	Prairie Provinces Water Board.....	41
4.	Ottawa River Regulation Planning Board.....	43
5.	Ottawa River Water Quality Coordination Committee.....	44
6.	Mackenzie River Basin Committee.....	44
7.	Lake of the Woods Control Board.....	45

### WATER MANAGEMENT PROGRAMS

1.	Winter River Basin.....	46
2.	Fraser River Estuary Management Program.....	47
3.	Waterford River Urban Hydrology Study.....	47
4.	Qu'Appelle Conveyance.....	48
5.	Lower Fraser Valley Flood Control.....	48
6.	Canada-Ontario Agreement on Great Lakes Water Quality.....	49

### FLOOD DAMAGE REDUCTION PROGRAM

1.	Flood Damage Reduction in the Town of Richmond (Quebec).....	51
2.	Canada-Manitoba Flood Protection Projects.....	52
3.	Mille Iles Flood Control Structure.....	52

### COOPERATIVE ARRANGEMENTS FUNDED FROM SOURCES OTHER THAN THE CANADA WATER ACT

1.	Regina-Moose Jaw Water Treatment Plant.....	53
2.	Channel-Port aux Basques Water Treatment.....	53
3.	Mercury in the Churchill River Diversion System.....	54

## REGULATION, APPORTIONMENT, MONITORING AND SURVEY PROGRAMS

### 1. WATER QUANTITY SURVEY AGREEMENTS

Objective: To maintain a viable and efficient national water quantity survey network and to give recognition to joint federal and provincial responsibilities in this activity.

Duration of Agreements: Agreements between Canada and each province were signed in 1975 and letters were exchanged between the Department of Environment (DOE) and the Department of Indian and Northern Affairs (DINA) agreeing to joint survey operations in the territories. The programs are continuous but there is a provision in each agreement for termination on 18 months written notice.

Participants: CANADA.....Department of the Environment, and the Department of Indian and Northern Affairs representing the Yukon and Northwest Territories.  
ALL PROVINCES

Arrangements: Data are gathered, analyzed and interpreted to meet client's needs in the hydrologic community. This is a shared-cost program, with the federal government carrying out field and office procedures and invoicing the provinces quarterly. An exception is Quebec which operates the program in that province and invoices the federal government quarterly except for international and navigable waters, and waters crossing federal land in Quebec, which are surveyed by the federal government. DINA transfers funds annually to DOE for the territories' share of costs.

Funding: 1985-86 (provisional costs)

Total Program Cost	\$23 284 800
Total Recovered from Provinces	5 077 800
Total Paid to Quebec by Canada	642 300

Total Program Costs are the expenditures required to conduct the National Water Management Data Program.

The Total Recovered from Provinces is the amount reimbursed by the provinces, except Quebec, to Canada. These costs are determined according to schedules specified in the Agreements.

The Total Paid to Quebec by Canada is the amount paid by Canada to the Province of Quebec for operating stations of federal interest in that province. These costs are also determined according to schedules specified in that Agreement.

Status: Coordinating Committees, established for each province, convene at least annually but normally more frequently to review the water quantity survey networks and to determine annual cost sharing. National meetings of all Coordinating Committees are convened periodically to ensure common practices are followed in administering the Agreements.

Water quantity surveys now include technologically advanced techniques such as satellite communication telemetry systems and a nationally distributed electronic data processing system.

## 2. WATER QUALITY MONITORING AGREEMENTS

**Objective:** To establish a nationwide water quality monitoring network that will make it possible to assess water quality on a national basis and at the same time meet the needs of the provinces.

**Duration of Agreement:**

To March 31, 1985, Agreements have been signed with Quebec and British Columbia. These Agreements contain no termination date, but there is provision for termination by either party within a specified period of time after written notice. Agreements with other provinces will contain similar provisions.

**Participants:** CANADA.....Dept. of the Environment  
ALL PROVINCES

**Arrangements:** In designing the Agreements to meet the needs of both the federal and provincial governments, the party(s) who will conduct the work are identified, and the costs of the program are shared in accordance with the value of the information to each party.

**Funding:** Costs will be determined according to the schedules appended to each Agreement. Federal stations will be funded 100% by Canada; provincial stations will be funded 100% by the province; federal-provincial stations will be funded equally by each party. Treasury Board provided \$2 139 000 for the Agreements in 1984-85.

**Status:** The Agreements with Quebec and British Columbia became effective in 1983 and 1985, respectively. Agreements have been negotiated with Alberta and Newfoundland but have not yet been signed; negotiations for Agreements with Manitoba, Ontario and New Brunswick are progressing. Plans call for negotiations to begin in 1986-87 with remaining provinces and territories.

## 3. PRAIRIE PROVINCES WATER BOARD

**Objective:** The equitable apportionment of interprovincial prairie waters flowing eastward. The agreement ensures that one half the natural eastward flow of waters arising in or flowing through Alberta is reserved for Saskatchewan, and that one half the eastward flow arising in or flowing through Saskatchewan is reserved for Manitoba.

**Duration of Agreement:** Continuous since October 30, 1969.

**Participants and Funding:** CANADA  
ALBERTA  
MANITOBA  
SASKATCHEWAN

(Funding to be borne one-half by Canada and one-sixth by each of the provinces.)



Arrangement:

Schedule C of the Agreement provides for the reconstitution of the Prairie Provinces Water Board whose responsibility is to oversee and report on apportionment of waters flowing from one province into another province; to take under consideration comprehensive planning, water quality management and other management problems referred to it by the entities concerned; to recommend appropriate action to investigate such matters; and to submit recommendations for resolution of the problems.

Status:

The Agreement is administered through the Prairie Provinces Water Board, its five Committees, and its Secretariat.

The Board's Committee on Hydrology has recommended procedures for the determination of natural flow and streamflow forecasting for five major interprovincial basins in the area. Natural flows are calculated on an annual basis for five drainage basins. Similar natural flow reports have been prepared for twelve other smaller drainage basins crossing provincial boundaries. The Board has approved the Committee's report that describes the mechanisms required to administer the 1969 Apportionment Agreement, and a report on the apportionment implications of westward flowing streams, and is now dealing with a report on westward flowing tributaries of eastward flowing streams. It is now developing a workable strategy to deal with interprovincial drainage problems. Article 6 of Schedule A of the Master Agreement on Apportionment has been amended to apportion the flow of Battle, Lodge and Middle Creeks at the Alberta-Saskatchewan boundary, and the Committee on Hydrology monitored apportionment of those three creeks in 1985-86.

At the request of the Board, the Water Quality Branch of Environment Canada reports monthly on water quality at eleven monitoring sites. These stations are part of the basic long-term network proposed by the Board to monitor water quality in the prairie provinces. The Board's Committee on Water Quality is now preparing water quality indicators for each of these eleven stations. It will present to the Board site-specific indicators for all eleven sites in the fall of 1986. This Committee, under the direction of the Board, also has established a task force on analytical methodology to provide a means of coordinating water quality laboratory results for the prairie provinces and has submitted to the Board a draft report suggesting administrative procedures that could be used in defining, monitoring and administering interprovincial water quality requirements.

The report entitled "Water Demand Study - Historical and Current Water Uses in the Saskatchewan-Nelson Basin" was released to the public on February 10, 1983. The water use information in that report is updated annually and both the study results and the updated information are being stored in a computerized format for retrieval by interested agencies and individuals.

The Board's Committee on Interjurisdictional Agreements Administration has proposed an interim method of administering the interprovincial waters of Boxelder Creek basin. The Board accepted the Committee's recommendations in January 1984 and the Board's Secretariat implemented those recommendations in 1984 and 1985.

The Board's Committee on Groundwater has prepared a report showing a cross-section, or profile, of ground water conditions along the Alberta-Saskatchewan boundary. That report was published in the spring of 1985 and the Committee is preparing a similar report, to be published in 1986, on ground water conditions along the Saskatchewan-Manitoba boundary. The Committee is also coordinating the tabulation of a bibliography of ground water reports and data related to interprovincial ground water evaluations.

The Board also evaluates the effects that proposed projects might have on streamflow in downstream provinces. The results of each such evaluation are reported to the respective ministers of the Board.

#### 4. OTTAWA RIVER REGULATION PLANNING BOARD

Objective: To plan and recommend criteria for regulating the Ottawa River, taking into account hydro-power production, flood protection, navigation, low water problems, water quality needs and recreation.

Duration of Agreement: Continuous since March 1983

Participants: CANADA (3 members)  
ONTARIO (2 members)  
QUEBEC (2 members)

Canada assumes initial responsibility for financing the cost of the Agreement with Ontario and Quebec each contributing 25%.

Prior Action: As a result of recommendations made following a study of flooding in the Montreal region in 1976, a Canada-Ontario-Quebec Ottawa River Regulation Planning Committee was established in 1977 by an exchange of letters between the federal minister of the Environment, the Quebec minister of the Environment and the Ontario minister of Natural Resources. The final report of the Planning Committee was submitted in December 1980 recommending that a tripartite regulation agreement be negotiated. Negotiations then followed, culminating in the signing on March 2, 1983 of a Canada-Ontario-Quebec Agreement Respecting Ottawa River Basin Regulation.

Arrangement: The Ottawa River Regulation Planning Board administers the agreement. It also formulates and reviews regulation policies and criteria concerning integrated management of the principal reservoirs in the basin.

A regulating committee, composed of operators of the principal reservoirs, is responsible for ongoing operation of the reservoirs, within the guidelines established by the Board.

Status: A secretariat has been established within Environment Canada to act as the executive arm of the Board.

During the spring flood period (March 1 - May 30), forecasts on a real-time basis are provided daily for the principal reservoirs in the Ottawa River basin and at selected points where flooding takes place.

The mathematical regulation model is operated on a real-time basis during the spring flood period to serve as a guide to reservoir operations. In 1986, flood reserves were implemented in three reservoirs, on a trial basis to facilitate the operation of the Mille Iles dam.

Subcommittees have been established to study the use of flood reserves in some reservoirs, to develop risk management methodology for the Ottawa River basin and to develop bylaws and procedures for the Board.

5. OTTAWA RIVER WATER QUALITY COORDINATING COMMITTEE

Objective: To review and modify the proposed monitoring plan and oversee its implementation; to undertake or recommend special studies as needed; and to recommend water quality objectives for the river.

Duration of Agreement: Continuous from 1983

Participants: CANADA  
QUEBEC  
ONTARIO

Prior Action: A Technical Work Group on Water Quality in the Ottawa River was formed in 1980 to study problems related to bacteria and toxic substances in the Ottawa River basin; to identify quantities and sources of nutrients, and to evaluate the importance of agriculture and other diffuse sources of phosphorus. It was hindered from carrying out its mandate by gaps in the data available and, in its report of October 1981, recommended the establishment of a committee to coordinate monitoring, and proposed a monitoring plan to obtain the data needed.

Status: The Coordinating Committee is preparing its first annual report to the three governments. This report will contain a description of water quality and problems areas based on an analysis of monitoring data from the past several years. It also contains proposed water quality objectives and recommendations for improved monitoring. A technical Supplement, also in preparation, will give details of monitoring activities and of the analysis of the monitoring data.

6. MACKENZIE RIVER BASIN COMMITTEE

Objective: To exchange information on potential water-related developments in the basin and to formulate a program of studies to gather data on the basin's water and related resources.

Duration of Agreement: Continuous since 1973.

Participants: CANADA.....Department of the Environment, Ministry of  
Transport, Department of Indian and Northern Affairs, Yukon  
Territory, and Northwest Territories.  
ALBERTA  
BRITISH COLUMBIA  
SASKATCHEWAN

Prior Action:

The Mackenzie Basin Intergovernmental Liaison Committee was established in 1973 and reconstituted as the Mackenzie River Basin Committee in a Memorandum of Understanding between the participating governments in May 1977. In May 1978, a \$1 600 000 program to study the water and related resources of the basin was endorsed.

The study has been completed and the final report was released by the Ministers on February 26, 1982. The main recommendations call for early negotiations toward a transboundary water management agreement, an expanded network of water data stations, follow-up field studies on ice breakup and a major study of the Mackenzie Delta.

Status:

The Mackenzie River Basin Committee continued to meet during 1985-86 to fulfill its liaison responsibilities and to consider study designs, budgets and agreements associated with future implementation of Recommendations 2 and 5 as well as a general agreement which would grant member status to the governments of the Northwest Territories and Yukon Territory. Implementation of Recommendation 1, an agreement through which transboundary water management issues can be addressed, is being pursued outside of the Mackenzie River Basin Committee. Seven bilateral subagreements between the various jurisdictions will precede the development of a master agreement under the Canada Water Act. Bilateral discussions between Alberta/Northwest Territories and Alberta/Saskatchewan have been initiated. Discussions between B.C./Alberta, B.C./Yukon, and B.C./Northwest Territories are on hold at the request of British Columbia. Saskatchewan/Northwest Territories discussions will be initiated in the near future.

7. LAKE OF THE WOODS CONTROL BOARD

Objective:

To control and regulate certain major waterways in the Winnipeg River Drainage basin so as to achieve water flow and level conditions that are reasonably acceptable to the various interests.

Duration of Agreement: Continuous. The Board was formed in 1919 under a Dominion Order-in-Council, and was confirmed by federal legislation in 1921 and by Ontario legislation in 1922. At that time, jurisdiction of the natural resources of the four western provinces was vested in Canada, and therefore the member for Canada acted on behalf of Manitoba. Manitoba gained active membership in 1958.

The Board was established under the Lake of the Woods Control Board Act and is included here only because of its association with other water management programs.

Participants and Funding:

Canada - one member  
Ontario - two members  
Manitoba - one member

Canada pays one-third of the Board's annual operating costs in the interest of navigation. The remaining two-thirds is paid by Manitoba and Ontario in the proportion of developed hydropower head in the basin in each province.

Arrangements:

The Board fulfills its responsibilities by directing what the outflows of Lake of the Woods and Lac Seul (and at times the flows diverted from Lake St. Joseph) should be.

To assist it in making its decisions, the Board has traditionally maintained a full-time engineering support group in Ottawa within the Inland Waters Directorate of Environment Canada. This group was formally established as the Board's Secretariat with the signing of a Memorandum of Understanding in 1981.

To ensure two-way communications with interests within the basin, the Board has recognized a number of specific interest groups, each of which has appointed an observer to the Board. Groups represented include hydropower utilities, pulp and paper industries, native people, cottage owners and tourist outfitters.

The Board holds public meetings each year in the basin to provide detailed information to the public and to obtain feedback on the effects of levels and flows. Also, the Board maintains a phone-in information service to ensure that the public has ready access to information on current conditions in the basin.

Since the Lake of the Woods is an international boundary water, the federal member of the Board serves as Member for Canada on the International Control Boards for Rainy Lake and Lake of the Woods, to ensure coordination with the United States.

Status:

Basin conditions during 1985 were extremely wet with inflows ranking as the second highest since records began in the early 1900s. Much time was spent managing these flows and keeping the public advised of high water levels and hazardous conditions. Apart from direct regulation activities, the Board is continuing to improve its data collection and analysis procedures and has plans to introduce mathematical modelling to assist it in its deliberations.

WATER MANAGEMENT PROGRAMS

1. WINTER RIVER BASIN

Objective:

To carry out preliminary data acquisition and assessment of the aquifer hydraulics of the basin. This work will form the basis of subsequent studies to determine the reliability and sensitivity of the existing water supply system for Charlottetown.

Duration of Agreement:

April 1984 to March 1987.

Participants:

CANADA  
PRINCE EDWARD ISLAND  
CITY OF CHARLOTTETOWN

Status:

Preplanning studies have been completed and a planning study approved by an exchange of letters. Funding sought from Canada Water Act and MSERD sources was not approved, and the study is being completed under a work-shared arrangement.

## 2. FRASER RIVER ESTUARY MANAGEMENT PROGRAM

Objective: To guide economic development while protecting the environment of the Fraser River Estuary.

Duration of Agreement: October 1985 to December 31, 1990.

Participants and Funding: ENVIRONMENT CANADA  
FISHERIES AND OCEANS CANADA  
MINISTRY OF THE ENVIRONMENT (B.C.)  
THE FRASER RIVER HARBOUR COMMISSION  
THE NORTH FRASER HARBOUR COMMISSION

The agreed total cost is \$1 250 000; annual costs to be shared equally by the five parties are not to exceed \$250 000.

Prior Action: The Fraser River Estuary Management Program is based on a study conducted between 1977 and 1982. The Fraser River Estuary Study examined means to accommodate population and growth while protecting valuable environmental assets of the estuary.

Status: The Fraser River Estuary Management Program Agreement was signed on October 10, 1985. The Agreement provides for a review of development projects in the estuary and a public information and consultation program.

The management committee, representing the federal and provincial governments, municipalities, regional districts, port authorities and Indian Bands located in the Estuary, focussed on the coordinated Project Review Process, Activity programs, Water Quality Plan, Area designation and Public Consultation.

Terms of Reference for a Standing Committee on Water Quality to support the terms of the Fraser River Estuary Agreement have been establishment and members nominated. This committee will prepare a Water Quality Plan for the Estuary in the coming year. Key components of the plan will be water quality monitoring and the establishment of water quality objectives.

A coordinated interagency referral process is now in formal operation as well as an Environmental Review Committee. Coordination of project review will be supported by a computerized central project registry.

The development of a Terms of Reference for Activity Programs commenced.

## 3. WATERFORD RIVER URBAN HYDROLOGY STUDY

Objective: To examine the effects of urbanization on the water resources of the basin, and to develop criteria for urban development which minimize impacts.

Duration of Agreement: 1980-1985

Participants: CANADA  
NEWFOUNDLAND

Status: The federal input was essentially completed with the preparation of six technical reports dealing with land use, urban runoff, watershed modelling, flood studies, water quality and data collection. A ground water and a biological report were still under preparation by the province.

#### 4. QU'APPELLE CONVEYANCE AGREEMENT

Objective: To complete the conveyance works begun under the Qu'Appelle Implementation Agreement (1974-1984).

Duration of Agreement: April 1, 1984 to March 31, 1989.

Participants and Funding: CANADA.....\$2 375 000  
SASKATCHEWAN.....\$2 375 000

Status: During the second year of the Agreement, 1985-86, Canada spent \$240 000, which includes \$174 500 as Canada's share of the right-of-way agreement signed with Piapot Indian Band on February 14, 1986. An additional \$33 000 was spent by Canada on private land right-of-way agreements during 1985-86.

#### 5. LOWER FRASER VALLEY FLOOD CONTROL

Objectives: To provide protection from flooding of land in the lower reaches of the Fraser River Valley and other areas upstream by rehabilitating existing dykes, constructing new dykes, increasing river bank protection, and improving internal drainage facilities.

Duration of Agreement: 1968 to March 31, 1995 (extended).

Participants and Funding: CANADA.....50%  
BRITISH COLUMBIA.....50%

(Local authorities are responsible for providing construction and access right-of-way.)

In 1974, the federal government increased its contribution to the Flood Control Program and Storage Studies from \$18 000 000 to \$30 500 000 and British Columbia agreed to increase its share by the same amount. In fiscal year 1976-77, both parties agreed to increase the funding to \$60 000 000 for each party, and to extend the Agreement to March 31, 1984. In fiscal year 1983-84, the Agreement was extended to December 31, 1986 with no increase in funds. In fiscal year 1985-86 the Agreement was extended to March 1995 and funding was increased by \$41 million.

Status: Construction has been completed at Kent, Matsqui, Surrey (Serpentine-Nicomekl Dams), New Westminster, Coquitlam, Abbotsford, Kamloops (Oak Hills), Surrey-South Westminster (Bridgeview), Richmond and Pitt Meadows; Surrey-South Westminster (West Sector) and Delta, and the Vedder River are nearly complete. Construction is well advanced for the Duncan-Bateson Flood Box and bank protection at Kent. Estimated expenditures under the program to March 31, 1986 are \$119 000 000. The current annual funding rate is \$2 500 000 for each government.

## 6. CANADA-ONTARIO AGREEMENT ON GREAT LAKES WATER QUALITY

Objectives: To renew and strengthen cooperation between Canada and Ontario in meeting the obligations under the revised 1978 Canada-U.S. Agreement and to provide for cost-sharing and work sharing of specific programs which the province will undertake with the federal government in meeting these obligations.

Duration of Agreement: April 1971 to March 31, 1990; agreement renewed in 1976, 1982 and 1986.

An initial agreement from August 1971 to December 31, 1975 authorized \$3 million for feasibility studies and joint sewage treatment technology and urban drainage research. Loans totalling \$250 million for sewage treatment facilities from CMHC and the Ontario Government were also called for in the initial agreement. (Funding for municipal sewage treatment between 1976 and the signing of the new agreement in 1982 was the subject of a separate agreement with CMHC under the National Housing Act.)

The agreement was renewed in March 1976, retroactive to 1 January 1976, as a basis for establishing joint water quality objectives, and to serve to coordinate and implement federal and provincial input to Canadian responsibilities under the international agreement, and to conduct research. This agreement expired on March 31, 1980 but, because a revised agreement was then under negotiation, the 1976 agreement was extended to March 31, 1982, through exchanges of letters between ministers. The agreement was renewed again in July 1982, and again on March 6, 1986.

Participants and Funding: CANADA  
ONTARIO

The participants each pay half the cost associated with the research and surveillance programs. For each fiscal year, the total amount payable by Canada shall not exceed an amount to be agreed upon between Canada and Ontario, taking into account:

- (a) the recommendations made by the International Joint Commission relevant to the Great Lakes International Surveillance Plan as developed under the revised Canada-U.S. Agreement;
- (b) the decisions taken, as a result of such recommendations, by the parties to the Canada-U.S. Agreement with respect to such surveillance;
- (c) the recommendations of the Board of Review.

The renewed agreement provides \$82.1 million for surveillance, upgraded sewage treatment and phosphorous control programs. Each of the governments will contribute \$9.6 million for surveillance to determine concentrations of pollutants in the Great Lakes. In addition, each will give \$1.4 million to a new program to control phosphorus. Special funding in the amount of \$65 million was made available to Ontario for the period 1982-1985 to assist in the completion of municipal sewage facilities



construction to meet the requirements of the Canada-U.S. Agreement. This extra funding was formalized under the 1982 Canada-Ontario Agreement. Some \$9.7 million of the original federal funds were not expended and this amount has been committed over the next two years. Ontario and area municipalities will contribute an additional \$50.4 million to upgrade present sewage treatment facilities or build new ones.

Status:

In February 1981, a joint Canada-U.S. team of scientists began a comprehensive investigation of toxic chemicals in the Niagara River. This joint investigation will make recommendations as to what should be done to reduce or remove the contamination and to monitor the effectiveness of clean-up programs. The final report on this investigation, released in November 1984, contained 24 recommendations pertaining to point source and non-point source control, further investigations and monitoring. A detailed long-term water quality monitoring program was included. A seven point Canada/U.S. proposal, based on this report, is now under consideration.

Because, as already noted, the Canada-Ontario Agreement is being undertaken to provide a basis for implementing the Canada-U.S. Agreement on Great Lakes Water Quality, a brief outline of activities under the latter agreement is also provided.

**CANADA-U.S. AGREEMENT ON GREAT LAKES WATER QUALITY**

Objectives:

To improve the quality of the water in the areas of the Great Lakes now suffering from pollution; to ensure that Great Lakes water quality will be protected in the future; and to restore and maintain the chemical, physical and biological integrity of the waters of the Great Lakes Basin Ecosystem.

Duration of Agreement:

Continuous since April 1972; revised Agreement signed November 22, 1978.

Participants:

CANADA  
UNITED STATES

Commitment:

The concept of the Great Lakes basin and its human resources as an ecosystem is explicitly recognized in the new Agreement. Numerical water quality objectives for some 40 compounds have been specified. Approximately 99 percent of the sewered population on the Canadian side of the basin is now served by adequate municipal wastewater treatment facilities. Programs to control and prevent pollution from industrial sources entering the Great Lakes System have been designed and are being implemented. A commitment has been made to eliminate the discharge of toxic substances into the Great Lakes. New interim phosphorus loading targets, defined for each lake, are designed to achieve desirable levels of water quality. Binational negotiations to ratify the loading targets and reach agreement on Canadian and U.S. programs to meet these targets were partially completed in 1983.

Arrangement: The International Joint Commission was given primary responsibility for overseeing implementation of this international water quality Agreement. The Commission has established a number of Boards and Committees to carry out the various provisions of the Agreement. Activities are carried out under four programs: Objectives Development, Controls, Assessment, and Special Projects (including toxics, eutrophication, health hazards, etc.).

Status: Canada and Ontario have agreed to proceed with the implementation of a Phosphorus Control Supplement as recommended under Annex III of the 1978 Agreement. The Control Supplement agreed to on October 16, 1983 includes measures to both protect the upper Great Lakes and further reduce phosphorus discharges to the lower Great Lakes. The Agreement ratifies the phosphorus loading targets and allocates the residual load reductions to Lake Erie between the United States and Canada. Negotiations continue to similarly allocate the load reductions to Lake Ontario.

The 1978 Agreement is to be reviewed following receipt and examination of the IJC's third biennial report. This report is expected to be presented to the governments of Canada and the U.S. in the fall of 1986. The review of the Agreement by the two federal governments will be undertaken, as in the past, in full consultation with the Provinces of Ontario and Quebec and the eight Great Lakes States. During the latter part of 1985, the Royal Society of Canada and the U.S. National Academy of Science jointly reviewed the progress by the jurisdictions in implementing the 1978 Agreement. This joint report will be most helpful in the forthcoming review by the governments.

#### FLOOD DAMAGE REDUCTION PROGRAM

##### 1. FLOOD DAMAGE REDUCTION IN THE TOWN OF RICHMOND (QUEBEC)

Objective: To reduce the damages caused by flooding of the Saint François within the Town of Richmond, Quebec.

Duration of Agreement: May 1984 to March 1987

Participants and Funding:

CANADA.....	\$1 956 500
QUEBEC.....	\$1 403 500

Prior Action: Joint studies conducted in 1983-84 demonstrated the feasibility of corrective measures.

Status: The Canada-Quebec Agreement was signed on May 14, 1984. During the year, construction of a pumping station was initiated and a dyke was erected.

##### 2. CANADA-MANITOBA FLOOD PROTECTION PROJECTS

Objective: To increase the level of protection afforded by ring dykes in the Red River Valley communities of Rosenort, Morris, St. Adolphe, Dominion City, Emerson, St. Jean Baptiste, Letellier and Brunkild and to provide protection to the community of Ste. Rose du Lac and the water treatment facility at Souris.

Duration of Agreement March 10, 1983 to March 31, 1989.

Participants and Funding:

CANADA.....\$2 745 000  
QUEBEC.....\$3 355 000

Prior Action:

Between 1967 and 1971 Canada and Manitoba cooperated in the construction of dykes around seven Red River basin towns that had suffered damages during the 1950 flood and again in 1966. Subsequent experience demonstrated, most recently in 1979, that the dykes constructed under the 1967 agreement did not provide a sufficient margin of safety, nor did they meet the standards of the Canada-Manitoba Flood Damage Reduction Agreement signed in 1976. Thus, a new agreement was signed to upgrade the seven ring dykes which were jointly built earlier, as well as an eighth dyke, around Brunkild, which had been built and fully paid for by Manitoba.

Status:

The agreement was signed on March 10, 1983, and a committee was formed to administer it. The agreement was amended in May 1985 to include the construction of a dyke at Ste. Rose du Lac and the upgrading of the dyke at the water treatment plant at Souris with additional funding of \$1 600 000. The earthwork and permanent pumping facilities have been completed at Brunkild, Rosemont, Letellier, St. Jean Baptiste and Morris. Some upgrading has been completed at Emerson and St. Adolphe.

3. MILLE ILES FLOOD CONTROL STRUCTURE

Objective:

To reduce the level of flood damage along the Rivière des Mille Iles in Montreal Region.

Duration:

December 1983 to March 1987.

Participants and Funding:

CANADA.....\$5.9 million  
QUEBEC.....\$7.2 million

Prior Action:

Studies to determine the feasibility of a flood control structure on the Rivière des Mille Iles were conducted under the Agreement Respecting Dykes and Flow Regulation Works - Montreal Region.

Status:

The Canada-Quebec Agreement was signed on December 10, 1983. During 1984-85, about 60% of the construction of the regulation dam was completed and by December 1985 the dam was operational.

The Ministers agreed in August 1985 to reallocate funds already in the agreement so as to increase funding for studies from \$30 000 to \$230 000; these studies are continuing.

COOPERATIVE ARRANGEMENTS FUNDED FROM SOURCES OTHER THAN THE CANADA WATER ACT

1. REGINA-MOOSE JAW WATER TREATMENT FACILITY

Objective:

To improve the water supply available to Regina and Moose Jaw by the construction of a granular activated carbon water filtration plant at Buffalo Pound Lake in Saskatchewan.

Participants and Funding:

CANADA  
SASKATCHEWAN

Canada will pay 33 1/3% of the total cost up to a maximum federal contribution of \$5 million under an ERDA Subsidiary Agreement.

Status: Major contracts were awarded in July 1984. Construction was completed on schedule and the treatment plant was opened officially in June 1985. The associated carbon regeneration furnace commenced operation in November 1985 and the waste disposal lagoon is expected to be completed during the summer of 1986.

## 2. PORT AUX BASQUES WATER TREATMENT

Objectives: To improve the water supply available to the Town of Channel-Port aux Basques.

<u>Participants and funding:</u>	Canada	\$6 500 000
	Newfoundland	\$ 722 000

Canada will pay 90% of the total cost up to a maximum federal contribution of \$6.5 million under an ERDA subsidiary agreement.

Status: The treatment process has been selected and engineering and construction supervision services associated with the water treatment plant provided. Chemical precipitation has been selected as the treatment process, and construction of the plant is scheduled to begin during the summer of 1986.

Feasibility studies were conducted on a backup water supply, and at year end, contract documents were finalized and put out to tender. A gravity diversion scheme was adopted.

Engineering and construction supervision services were provided for a solid waste incinerator/landfill site. At year end, contract documents were prepared and put out to tender.

Engineering and construction supervision was provided to replace the asbestos-cement transmission main. During the year, a portion of the main was constructed and preliminary engineering was completed on the remaining portion, which is scheduled for completion during FY 1986-87.

An inventory and hydraulic analysis of the distribution system was conducted and, at year end, a draft report was under consideration.

## 3. MERCURY IN THE CHURCHILL RIVER DIVERSION SYSTEM

Objectives: To determine the degree to which mercury is present in the Churchill River Diversion system and to identify sources; to study pathways and mechanisms by which mercury moves from water to fish and wildlife through the food chain; to monitor the concentration of mercury in aquatic plants and fish and compare it with available data on the presence of mercury in people living in this area and; where possible, suggest remedies to local mercury problems and means of predicting future occurrences of mercury contamination.

Duration of Agreement:

March 1983 to December 1986

Participants and Funding:

CANADA	\$380 000
MANITOBA	\$380 000

Background:

This study arose from concern over increased levels of mercury in fish along the diversion route. Area soils and mineral deposits contain background levels of inorganic mercury which may have been released when the area was flooded. This problem was first addressed under the Northern Flood Agreement that the Department of Indian and Northern Affairs negotiated on behalf of Canada in 1977-78 between Canada, the Province, Manitoba Hydro and the Northern Flood committee (a collectivity of various Indian Bands). An arbitrator, appointed in March 1980 under the terms of the Northern Flood Agreement, to arbitrate claims from any of the four parties concerned, identified the mercury agreement as a priority federal-provincial responsibility.

The Canada-Manitoba Agreement on the Study and Monitoring of Mercury in the Churchill River Diversion was signed on March 10, 1983. The Agreement allows for cost-sharing of expenditures made by Canada and Manitoba retroactive to April 1, 1982. The four year Agreement is scientific in nature and has five broad objectives aimed at improving the knowledge and the ability to respond to mercury problems in northern Manitoba.

Status:

Work under this Agreement has progressed well to date with all of the possible 14 projects completed. A four-person Steering Committee and an eight-person Technical Advisory Committee were appointed with an equal number of federal and provincial members. A Study Coordinator provides the necessary management support, coordinates the projects and information, and develops the public awareness component of the Agreement. Annual reports for fiscal year 1983-84 and 1984-85 have been prepared and distributed widely to government and public agencies.