Environment and Climate Change Canada
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Canada Water Act

Annual Report

for April 2014 to March 2015

Canada

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Foreword

The *Canada Water Act*, proclaimed on September 30, 1970, provides the framework for cooperation with the provinces and territories in the conservation, development and use of Canada's water resources. Section 38 of the Act requires that a report on operations under the Act be laid before Parliament after the end of each fiscal year. This annual report covers progress on these activities from April 1, 2014, to March 31, 2015.

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

The names of several federal government departments have changed since the October 2015 election. However, for this annual report, the names used during the 2014–2015 reporting period have been retained.

Provisions of the *Canada Water Act*

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

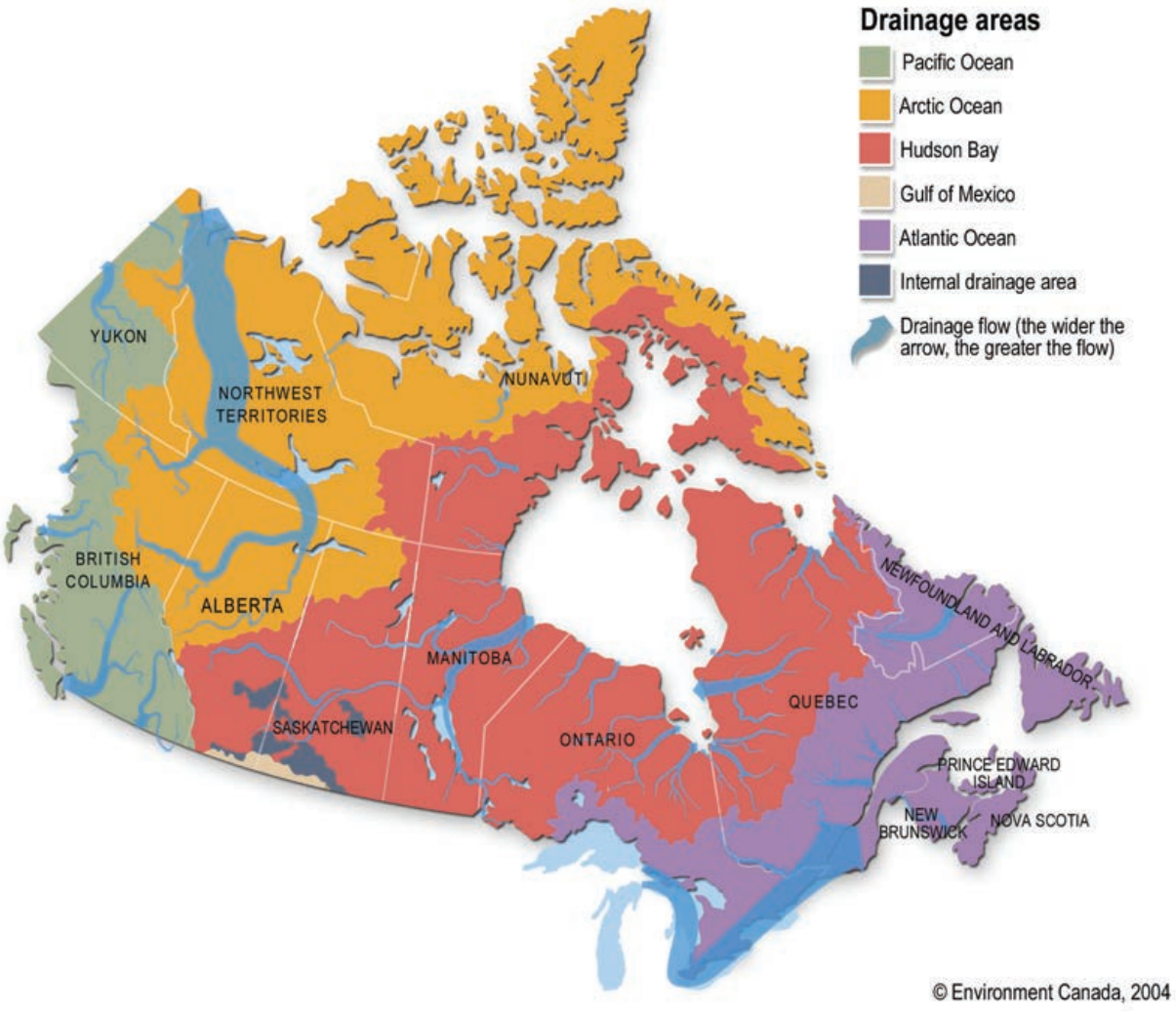
Part I, section 4, provides for the establishment of federal-provincial/territorial arrangements for water resource matters. **Sections 5, 6 and 8** provide the vehicle for cooperative agreements with the provinces to develop and implement plans for the management of water resources. **Section 7** enables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

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

Part III, which provided for regulating the concentration of nutrients in cleaning agents and water conditioners, was repealed. It was incorporated into the *Canadian Environmental Protection Act* in 1988 and later into sections 116–119 (Part VII, Division I) of the *Canadian Environmental Protection Act, 1999*, which came into force on March 31, 2000. (See the *Canadian Environmental Protection Act, 1999* annual reports to Parliament, available at www.ec.gc.ca/lcpe-cepa/default.asp?lang=En&n=64AAFDF1-1.)

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

Figure 1: Major drainage areas and drainage flows in Canada



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Executive summary

The *Canada Water Act* provides an enabling framework for collaboration among the federal and provincial/territorial governments in matters relating to water resources. This annual report highlights Environment Canada's (EC) activities under the Act from April 1, 2014, to March 31, 2015.

During 2014–2015, the National Hydrometric Program (NHP) continued to provide critical water level and flow information to Canadians through a federal, provincial and territorial cost-shared network of approximately 2750 hydrometric stations. EC's Water Survey of Canada, the federal partner in the NHP, continued to operate approximately 2200 stations, about 1000 of which are fully or partially federally funded. Work also continued on outreach, technology development and maintaining the program's International Organization for Standardization certification.

The freshwater quality indicator provides an overview of water quality in Canadian waters, as reported under the Canadian Environmental Sustainability Indicators program. This report includes a synopsis of these data. As well, analysts from all levels of government used measurements from numerous water quality monitoring stations for groundwater, inland freshwater and transboundary waters to assess and report on water quality status and trends, and to evaluate the progress of protection and remediation programs. The water quantity indicator reports on the state of, and changes in, surface water flows in Canada and is updated on a two-year basis, with the next update coming in 2016.

Work under the Joint Canada–Alberta Implementation Plan for Oil Sands Monitoring continued throughout 2014–2015, and the governments of Canada and Alberta began negotiations to renew the Plan, which ended on March 31, 2015.

Four inter-jurisdictional water boards (the Ottawa River Regulation Planning Board, the Prairie Provinces Water Board, the Mackenzie River Basin Board and the Lake of the Woods Control Board) addressed issues such as the integrated management of reservoirs, flood protection, transboundary apportionment, water quality, relations among adjoining jurisdictions and development activities.

Work continued under three partnership-based ecosystem approaches (Great Lakes Ecosystem Initiative, St. Lawrence Action Plan and Atlantic Ecosystem Initiatives) to ensure that Canadians have access to clean, safe and healthy water, and that the country's water resources are used wisely, both economically and ecologically.

A new Canada–Ontario Agreement on Great Lakes Water Quality and Ecosystem Health was negotiated, and it entered into force on December 18, 2014. The Agreement outlines how the governments of Canada and Ontario will cooperate and coordinate their efforts to restore, protect and conserve the Great Lakes basin ecosystem.

Implementation of the Canada–Quebec Agreement on the St. Lawrence (2011–2026) continued, delivering 48 projects from its joint action program, along with activities under the Monitoring the State of the St. Lawrence River Program and the Numerical Environmental Prediction Program for the St. Lawrence.

In 2014–2015, the Atlantic Ecosystem Initiatives Funding Program included 26 projects relating to water quality, biodiversity and climate change. These included the enhancement and improvement of water quality and watersheds through activities such as identification and assessment of threats to water resources, water quality monitoring and research, and development of ecosystem management tools and management plans.

EC continued work under the Lake Winnipeg Basin Initiative to address excess nutrients in Lake Winnipeg and its basin.

In 2014–2015, EC engineers and scientists carried out research projects on various current and emerging issues that support the various partnership-based ecosystem initiatives. Important areas of research included improving the understanding of nutrient loads and harmful algal blooms outbreaks, measuring the status and trends of priority pollutants in sediment and water, quantifying and predicting local, regional and national sensitivities of aquatic ecosystems to climate variability and change, and conducting hydro-meteorological modelling and prediction.

EC continued to provide water-related data and information to the public through its Water website (www.ec.gc.ca/eau-water). In 2014, the availability of hydrometric data was increased by adding EC's Water Survey of Canada levels and flows to EC's Datamart (http://dd.meteo.gc.ca/about_dd_apropos.txt) for partners to directly upload data into their own software systems.

Comprehensive Water Resource Management (Part I of the *Canada Water Act*)

The *Canada Water Act* provides an enabling framework for collaboration among the federal, provincial and territorial governments in matters relating to water resources. Each level of government has different roles related to the management of water resources. Joint projects involve the regulation, apportionment, monitoring or surveying of water resources, and the planning and implementation of programs relating to the conservation, development and utilization of water resources. As well, there are many areas of shared jurisdiction.

Canadian provinces, Yukon and Northwest Territories have the primary jurisdiction over most areas of water management and protection. Most of these governments delegate some authority to municipalities, in particular drinking water treatment and distribution, and waste-water treatment operations in urban areas. In certain cases, local authorities responsible for a particular area or river basin take on some water resource management functions when requested by government.

The federal government has responsibilities for managing water on federal lands (e.g., national parks), federal facilities (e.g., office buildings, laboratories, penitentiaries, military bases), First Nations reserves, and in Nunavut.

Bow River at Banff National Park

Photo: © Environment and Climate Change Canada

Agreements for specific water programs require participating governments to contribute funding, information and expertise in agreed ratios. For ongoing activities such as the hydrometric agreements with each province, cost-sharing is in accordance with each party's need for the data. For study and planning agreements, generally the federal government and the specific provincial government each assume half of the costs. The planning studies encompass interprovincial, international or other water basins where federal interests are important. Implementation of planning recommendations also occurs on a federal, provincial and federal-provincial basis. Cost-sharing for infrastructure often includes a contribution from local governments.

The following *Canada Water Act* agreements were ongoing during 2014–2015.

Agreements related to apportionment and monitoring programs

- Renewed hydrometric agreements with nine provinces, Yukon and Northwest Territories, and with Aboriginal Affairs and Northern Development Canada for Nunavut
- Master Agreement on Apportionment in the Prairie Provinces (Prairie Provinces Water Board)
- Water quality monitoring agreements with British Columbia, Newfoundland and Labrador, New Brunswick, Manitoba, and Quebec
- Canada–Prince Edward Island Memorandum of Agreement on Water
- Agreement Respecting Ottawa River Basin Regulation

Agreements related to water management programs

- Mackenzie River Basin Transboundary Waters Master Agreement
- Canada–Manitoba Memorandum of Understanding Respecting Lake Winnipeg and the Lake Winnipeg Basin

Two other related agreements also address apportionment and/or monitoring programs:

- The Canada–Ontario Agreement on Great Lakes Water Quality and Ecosystem Health, which was made pursuant to the *Canadian Environmental Protection Act, 1999*
- The Canada–Quebec Agreement on the St. Lawrence (2011–2026), which was made pursuant to the *Department of the Environment Act* and the *Department of Fisheries and Oceans Act*

The sections below describe federal, provincial and territorial collaboration in the following areas:

1. data collection and use;
2. inter-jurisdictional water boards; and
3. partnership-based ecosystem approaches.

1 Data collection and use

1.1 The National Hydrometric Program

The National Hydrometric Program (NHP) is responsible for providing critical hydrometric data, information, and knowledge that Canadian jurisdictions need to make informed water management decisions. This data is made available on Environment Canada's (EC) Wateroffice website at www.wateroffice.ec.gc.ca.

Formal bilateral hydrometric agreements between most provincial/territorial governments and the federal government provide for the collection, analysis, interpretation and dissemination of water quantity data. These agreements have been administered cooperatively since 1975.

ECCC hydrometric technician

Photo: © Environment and Climate Change Canada

Under the Partnership Renewal Process initiative, government partners have been reviewing, updating and revising the 1975 bilateral agreements. In 2014, both parties signed the renewed Canada–Nova Scotia agreement, while negotiations continued for renewed agreements with Newfoundland and Labrador, New Brunswick, and Saskatchewan.

In March 2015, the Government of Canada and the Northwest Territories announced a new hydrometric agreement following the devolution of land and water resource management to the territory. The new agreement allows for the continued collection, processing, publication and distribution of water quantity data in the Northwest Territories, with similar terms to the other agreements across the country.

Governance

The NHP is co-managed by the National Administrators Table and the National Hydrometric Program Coordinators' Committee, both consisting of members responsible for the administration of the hydrometric agreements in each jurisdiction, and one national administrator designated by Canada. Both groups met regularly throughout 2014–2015 to discuss program issues. The work of these two groups resulted in, among other things, the sharing of hydrometric data on EC's new Datamart system, allowing provincial and territorial agencies to upload data directly into their own software systems.

The Network

During 2014–2015, the national monitoring network of the NHP consisted of 2724 hydrometric monitoring stations (see Figure 2 and Table 1). During 2014–2015, EC's Water Survey of Canada (WSC), the federal partner in the NHP, operated 2162 of these hydrometric stations. Out of the WSC-operated stations, 1152 were fully or partially federally funded, and the remaining were operated by WSC on behalf of the provincial and territorial partners or a third-party interest, and cost-shared according to specific needs and requirements (see Table 1). In Quebec, the ministère du Développement durable, de l'Environnement, et de la Lutte contre les changements climatiques operated 231 stations, some funded in whole or in part by the Government of Canada.

Figure 2: National Hydrometric Monitoring Network

WSC disseminates the Quebec-collected data, along with data from another 331 stations operated by parties other than WSC across Canada.

In 2014–2015, there were no significant changes to the size of the national hydrometric network, although the network did undergo some adjustments, including the following.

Yukon

- Twenty-one hydrometric stations were upgraded to include satellite telemetry to transmit data to the Wateroffice website in near real-time.
- Five hydrometric stations were re-established at former WSC sites that had been decommissioned in the 1990s, and preparation was completed for a sixth site.
- Funding from the Government of Yukon increased in response to the release of its Yukon Water Strategy.
- Preparatory work began at eight more sites to continue the network expansion in 2015–2016.

Northwest Territories

- A new memorandum of agreement was negotiated and signed between EC and the Government of the Northwest Territories after implementation of the devolution agreement. There were no changes to the hydrometric network operations.

British Columbia

- One federally funded and five provincially funded stations were closed and removed from the network.
- For one station, a new funding contribution from a commercial partner was added to the existing federal-provincial funding arrangement.

Alberta

- Five stations had operations re-established and four contributed stations were revised to have seasonal operational periods (April to October).
- Temporary gauge installations began being utilized to monitor the flow at stations that were destroyed by a flooding event in June 2013,

although one such station is still not operational. Cableways damaged during the 2013 flood have not yet been repaired.

- Recently identified deficiencies with Alberta's staffed cableways have resulted in 89 of 91 being suspended from operation pending an operational review and engineering inspection.
- Eleven stations in Alberta (eight federal, one provincial and two federal-provincial) in the Peace-Athabasca Delta, which were previously operated by Alberta Environment, are now both operated and funded by EC's WSC.
- Sediment collection at the three remaining sediment stations in Alberta has been discontinued.

Manitoba and Saskatchewan

- Monitoring is moving towards safer alternatives, reduced infrastructure and operational efficiencies by continuing to invest in bank-operated cableways, remote control boats and tilting mast stations.
- In 2014–2015, the operation of one provincial station in Manitoba was suspended while alternative locations and technologies are investigated. The plan is to have the station operational in fall of 2015–2016.
- One federal-provincial station (Red River above floodway control structure) was upgraded to include satellite telemetry to transmit data to the Wateroffice website in near real-time.

Ontario

- To support the new Ontario Ministry of the Environment study of small basins and contaminants (Pollution from Land Use Activities Reference Group), four new stations were installed and instrumented in 2014–2015 in southern Ontario.
- Large alterations to an outflow channel of Lake Nipissing (to accommodate a new hydro-electric facility) resulted in the requirement for reinstallation of one gauging station as an Index Velocity Station in October 2014.
- The jointly funded Turkey Creek at Windsor gauge has been re-established following the construction of the new Windsor-Essex Parkway (leading to the proposed Gordie Howe International Bridge). Due to major modifications in the design of Turkey Creek, a new location for the gauge is being proposed further upstream.
- One station in the Lake of the Woods watershed near Kenora, Ontario, was relocated from private land onto a Crown land island due to landowner request.
- A provincial effort, supported by the Minister of Natural Resources and Forestry, increased the number of stations using satellite telemetry to transmit real-time data; increased the number of stations using solar power; and converted at least 87 stations to updated loggers.

Quebec

- The provincial network was reduced by 2 stations, bringing the total to 247.

Atlantic Region

- Decisions made by provincial partners decreased the station count by four stations in New Brunswick and one station in Newfoundland and Labrador, and increased the station count by two stations in Prince Edward Island.

Table 1: Stations within the National Hydrometric Monitoring Network

	WSC-operated (by cost arrangement)					
Province/ Territory*	Federal	Cost-shared**	Province/ Territory	Third party	Non-WSC-operated (various cost arrangements)	Total by province or territory
Alta.	80	158	161	1	55	455
B.C.	48	179	211	1	7	446
Man.	24	86	108	2	95	315
N.B.	15	20	20	2	0	57
N.L.	17	32	68	0	0	117
N.S.	10	6	8	4	0	28
N.W.T.	40	24	9	19	0	92
Nun.	16	6	4	8	0	34
Ont.	127	67	333	9	45	581
P.E.I.	0	5	0	4	0	9
Que.	16	0	0	0	231	247
Sask.	93	51	13	0	129	286
Y.T.	9	23	24	1	0	57
Total	**495**	**657**	**959**	**51**	**562**	**2724**

* Hydrometric monitoring stations located within the boundaries of each province, no matter which office operates them.

** Cost-shared stations are those that are partially funded by the federal and the provincial/territorial governments. The cost-share ratio varies by station.

Note: The network also includes a small number of designated International Gauging Stations located in the United States that are not included here as they support International Joint Commission activities not covered under the *Canada Water Act*.

Outreach

In addition to its contribution to the Canadian Environmental Sustainability Indicators program (see section 1.3), the NHP has integrated the water quantity indicator calculator into its HYDAT interface application, the Environment Canada Data Explorer (ECDE), thereby making it publicly available in both official languages. The new version of ECDE was validated in 2014–2015 and is expected to be published in 2015–2016.

Technology

Software and hardware for the national Hydrometric Work Station were updated in 2014–2015. The Work Station, a computer system for managing the NHP's entire data production process, was originally implemented in 2012–2013 and aims to provide water level and flow data in near real-time.

The NHP continued its investment in new field technologies (particularly hydroacoustic equipment) and the development of new methods to improve the measurement and estimation of streamflow for open water and under-ice conditions for all regions across Canada.

Data dissemination

EC completed the redesign of the national Wateroffice website (www.wateroffice.gc.ca) to improve its accessibility and usability. The transformation, as well as conversion of archived Web content, provides one integrated website for users to access both real-time and archived hydrometric information. Further, the creation of a hydrometric folder on EC's Datamart now allows partners and the public to easily access near real-time data for upload directly into their software systems.

Through a joint effort, the NHP and the U.S. Geological Survey (USGS) produced the North American Water Watch (NAWW) Web page at http://watermonitor.gov/naww/en/index.php, which displays

streamflow conditions throughout much of North America. These Web pages provide a fast, easy to use, cartographic and centralized Web interface for users to access real-time streamflow conditions for both Canada and the United States. The publishing of the NAWW website marks another milestone achieved through the cooperation between USGS and NHP.

International Organization for Standardization certification and audits

The NHP continued to maintain its International Organization for Standardization (ISO) certification during 2014–2015, and two internal and two external audits were performed at various WSC offices throughout Canada as required under the ISO process. The results of the audits were positive and resulted in very few calls for corrective actions and/or opportunities for improvement within the program.

1.2 Water quality monitoring

1.2.1 Freshwater Quality Monitoring Program

Freshwater quality monitoring has been a core program function of EC since the Department's inception in the early 1970s. The Department's monitoring and surveillance activities are critical for assessing and reporting on water quality status and trends, and for fulfilling many federal domestic and international commitments and legislative obligations. Much of the Department's monitoring is carried out through federal-provincial/territorial agreements, ensuring cost-effective and non-duplicative program delivery.

The objectives of the federal-provincial/territorial water quality monitoring agreements are to achieve a long-term commitment for the acquisition of water quality data; to obtain comparable, scientifically sound water quality data that are reliable for the purposes of water resource management; and to disseminate timely information on water quality to the public, government agencies, industry and the scientific community. Data are used to support the freshwater quality indicator in the Canadian Environmental Sustainability Indicators (see section 1.3). Six federal-provincial water quality monitoring agreements are active. Other ongoing arrangements include the ecosystem-based Canada–U.S. Great Lakes Water Quality Agreement, involving Ontario, and the St. Lawrence Action Plan, involving Quebec.

The long-term freshwater quality monitoring network consists of federal, federal-provincial and federal-territorial sampling sites across Canada (see Figure 3). Water quality samples are collected routinely at these sites for physical and chemical water quality parameters such as temperature, pH, alkalinity, turbidity, major ions, nutrients and metals. Pesticides and additional parameters of concern are also monitored where site-specific water quality issues exist.

The Freshwater Quality Monitoring (FWQM) Program is aligned with Canada's major watersheds (Pacific, Arctic, Hudson Bay and Atlantic). This organization promotes robust water resource management across Canada.

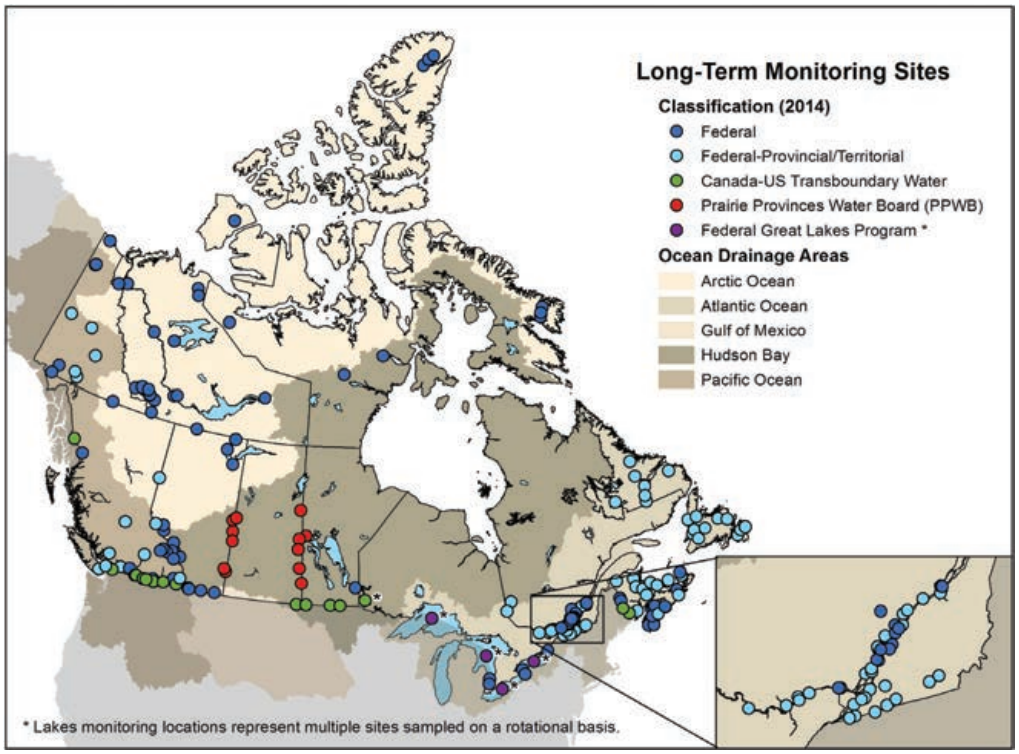
The FWQM Program continued refining the Risk-Based Basin Analysis (RBBA), a geospatial approach to identifying relative risks and priorities in basins (sub-drainage areas) across Canada. Key stressor variables were identified, stressor intensities calculated, and compilation of relevant geospatial layers continued. The RBBA is being used in conjunction with statistical power analytical tools to optimize the national monitoring networks such that sampling locations and frequencies are aligned with risks of water quality impairment in Canadian watersheds.

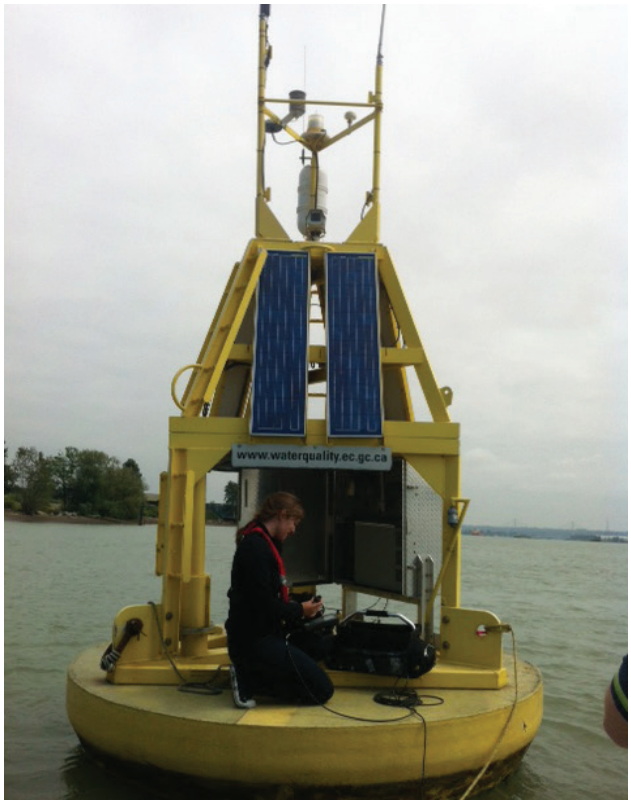
In addition, work is under way to categorize sampling locations by type of water body in order to facilitate the reporting of environmental information across the country.

Pacific Ocean Watershed

In the Pacific Ocean Watershed (which includes parts of British Columbia and Yukon), monitoring is conducted under the Canada–British Columbia (BC) Water Quality Monitoring Agreement and under operational schedules agreed to with the Yukon government. In British Columbia, under the Canada-BC agreement, originally signed in 1985, EC conducts joint monitoring with the provincial Ministry of Environment at 38 river sites (including 3 automated sites). In the Yukon, 8 sites (including 1 automated site) were monitored on rivers in collaboration with Environment Yukon.

Figure 3: Long-term water quality monitoring sites





Water quality testing near Vancouver
Photo: © Environment and Climate Change Canada

One of the Canada–British Columbia monitoring sites located in the Fraser River Estuary is a monitoring buoy platform. This automated site provides real-time water quality, flow and meteorological data, accessible to the public on EC's Fresh Water Quality Monitoring and Surveillance website. In 2014, upgrades to buoy design included improvements to an automated sampler that can be triggered remotely to collect water quality samples, ensuring year-round sampling. The data generated will be used to identify important trends and emerging water quality issues from the effects of urban, agricultural and industrial activities on the lower Fraser River.

On August 4, 2014, a tailings pond breach occurred at the Mount Polly Mine in south-central British Columbia. Approximately 17 million cubic metres of water and 8 million cubic metres of tailings/materials discharged into Polly Lake and Quesnel Lake. EC, with enhanced monitoring operations, provided support to the British Columbia Ministry of Environment following the breach to identify water quality impacts and emerging issues that may arise.

In 2014–2015, EC operated six long-term water quality monitoring sites in four national parks, in

partnership with the Parks Canada Agency (Glacier, Yoho and Kootenay National Parks in British Columbia and Kluane National Park in Yukon). The sites are relatively pristine and provide important reference information for comparison with sites influenced by human activities. Many of these sites are also located in key areas for assessing climate change.

Hudson Bay Watershed

In the Hudson Bay Watershed, EC conducts water quality monitoring at key interprovincial and international transboundary sites as well as in certain national parks.

In support of the Prairie Provinces Water Board Master Agreement on Apportionment, EC monitors 11 sites along the main rivers crossing between the Alberta, Saskatchewan and Manitoba provincial boundaries, as well as Cold River at the outlet of Cold Lake in Alberta. This work supports annual reporting on water quality objectives for nutrient, metal, major ion and pesticide parameters established by Canada, Alberta, Saskatchewan and Manitoba. The water quality data and information obtained is also used to support the Lake Winnipeg Basin Initiative. Water quality data are routinely shared with partners involved in the Lake Winnipeg Research Consortium, including the Province of Manitoba, federal departments, universities and institutes working on Lake Winnipeg.

EC continued to work with Manitoba Conservation and Water Stewardship under the Lake Winnipeg and Lake Winnipeg Basin Science Subsidiary Arrangement. The agreement, signed in 2012, supports the development of science-related data, indicators and nutrient targets.

Other key transboundary monitoring sites are located on the Red, Pembina, Winnipeg and Souris rivers and on the Milk River–St. Mary River system. The Red and Souris rivers, in particular, have encountered many water quality issues over time (nutrients, metals, pesticides, salinity). Water quality and water quantity issues on these rivers are addressed formally through the International Red River Board and International Souris River Board under the International Joint Commission (IJC). Regular monitoring updates were provided to these boards and to a number of institutional partners in 2014–2015.

All of the transboundary rivers in the watershed are monitored regularly (8 to 12 times per year). During the 2014–2015 open water season, the Red River was monitored more intensively (biweekly to weekly) to address concerns related to increased water releases from Devils Lake (North Dakota) crossing the Canadian border, and to improve the nutrient loading estimates for Lake Winnipeg. Additionally, EC operates an automated station on the Red River at Emerson, Manitoba, as an alert system in the context of transboundary flooding and water quality monitoring. Real-time data were used to assess water quality changes due to increased Devils Lake water releases.

In 2014–2015, the South Saskatchewan River near the Alberta and Saskatchewan border and the Assiniboine River near the Saskatchewan and Manitoba border in the Prairies were monitored for a suite of current use pesticides, including neonicotinoids, carbamates (fungicide) and sulfonyl urea (herbicide).

As an international and interprovincial transboundary waterway, Lake of the Woods is relatively unique in the number of jurisdictions and international organizations, such as the IJC, that have a role to play for successful environmental management. Local and national concerns with noxious and potentially toxic cyanobacteria (blue-green algae) blooms and declining water quality in Lake of the Woods prompted the formation of EC's Lake of the Woods Science Initiative as part of a larger program to assess and remediate deteriorating water quality in Lake Winnipeg. As part of the international effort, EC conducted two monitoring cruises on the lake. This effort is unique because it provides a whole-lake snapshot bi-annually, allowing scientists to assess the spatial inter-lake water quality relationships, an important part of tracking changes in the hydrological system. In addition, the Rainy River, an international boundary river and the major tributary to the lake, was monitored regularly for nutrients and trace metals.

Atlantic Ocean Watershed

In the Atlantic Ocean Watershed, federal-provincial water quality monitoring is supported through the Great Lakes Water Quality Agreement, Canada–Quebec Water Quality Agreement, Canada–New Brunswick Water Quality Monitoring Agreement, Canada–Prince Edward Island Memorandum of Agreement on Water, and the Canada–Newfoundland and Labrador Water Quality Monitoring Agreement.

In 2014–2015, a broad range of monitoring activities was undertaken in the Great Lakes targeting water, sediment and fish. The impacts of the 1978 Great Lakes Water Quality Agreement phosphorus controls and the introduction and explosive spread of non-native mussels are evident in the long-term monitoring record for the Great Lakes. Monitoring results demonstrated which waters have phosphorus concentrations below established targets and which areas may require further nutrient action or controls.

Other work in the Great Lakes included monitoring a number of chemical pollutants, as well as the first basin-wide monitoring of flame retardants.

EC conducted water and sediment monitoring in Randal Reef to establish a baseline condition that will be used to measure the effectiveness of remediation activities scheduled to begin in 2015. The Department also collaborated in a joint study with the Ontario Ministry of the Environment that documented the declines in pesticide concentrations in Ontario urban streams following the Government of Ontario's cosmetic pesticides ban (April 2009) was implemented.

The Canada–Quebec Water Quality Monitoring Agreement signed at the end of 2012–2013 comprises 39 sites in the transboundary St. Lawrence River and its tributaries. In addition to the sites covered by this agreement, EC operated 10 additional federal sites (including 6 automated) in the St. Lawrence River Basin. The sites were sampled monthly in 2014–2015 for physicals, nutrients, metals, pesticides and polybrominated diphenyl ethers (PBDEs).

The Canada–New Brunswick Water Quality Agreement was signed in 1988 and updated in 1995. During 2014–2015, 10 federal-provincial sites were monitored under the Agreement. The sites are located on international and interprovincial transboundary rivers or their tributaries in the Saint John River and Restigouche River watersheds. In addition, 2 real-time (automated) sites were maintained by EC at the borders of the transboundary Big Presque Isle Stream and Meduxnekeag River.

The International St. Croix River Watershed Board, under the IJC, plays an important role in managing water levels, water quality and fisheries between Maine and New Brunswick. The Board works collaboratively with stakeholders within the watershed by preventing and resolving disputes. EC monitored water levels at seven stations in the watershed and real-time (automated) water quality at two stations and provided input to the Board's 2014 Annual Report to the IJC.

The Canada–Prince Edward Island Memorandum of Agreement on Water was originally signed in 1989 and renewed in 2001. Eleven sites were monitored under the agreement in 2014–2015. One real-time (automated) site was operated on the Wilmot River. The sites are distributed across the province, with data available on the Government of Prince Edward Island's website.

EC managed 13 federal sites (including 2 automated sites) in Nova Scotia in support of the Canadian Environmental Sustainability Indicators in 2014–2015. Nova Scotia Environment provided support on data collection. The sites are located across the province and cover major watersheds within the Maritime Major Drainage Area, including those flowing into the Bay of Fundy.

Pesticide monitoring during rain events was added to the routine monitoring at three sites in Atlantic Canada based on the ongoing risk-based assessment of monitoring sites. The pesticide sampling was added at higher-risk agricultural sites in Nova Scotia (Cornwallis River), New Brunswick (Big Presque Isle Stream) and Prince Edward Island (Wilmot River) to assess potential impacts from surface runoff during rain events.

In Newfoundland and Labrador, 79 sites across the major drainage areas were sampled 4–8 times during the year. Data and station information from the sites is available on the Department's website at www.ec.gc.ca/eaudouce-freshwater/default.asp?lang=En&n=EFDA57C6-1, as well as on the Newfoundland and Labrador Water Resources website.

Arctic Ocean Watershed

EC undertakes monitoring at 48 sites within the Arctic Ocean Watershed and across the North: 24 in Northwest Territories, 10 in Nunavut, 2 in Yukon and 12 in northern Alberta. A majority of these sites are operated in cooperation with Parks Canada, with

sites often co-located with WSC gauge stations in 8 national parks (Auyittuq, Quttinirpaaq, Ukkusiksalik, Aulavik, Ivvavik, Tuktut Nogait, Nahanni and Wood Buffalo National Parks). In 2014–2015, a total of 113 sampling trips were completed.

Many of the High Arctic sites are considered relatively pristine and, over time, provide an important baseline and reference for comparison with respect to long-range transport of atmospheric pollutants to high-latitude areas, as well as for any potential future influences from human activities in the North. EC also operates water quality sites on major rivers in the North, some of which are associated with transboundary basins (e.g., Mackenzie River, Slave River, Liard River) or are significant northern watersheds (e.g., Coppermine River, Thelon River, Great Bear Lake/River). Additional northern rivers are also monitored in Yukon (see Pacific Ocean Watershed section, above).

For more information, please consult the EC Fresh Water Quality Monitoring and Surveillance website at www.ec.gc.ca/eaudouce-freshwater/Default.asp?lang=En&n=6F77A064-1.

Aquatic Ecosystem Health

In addition to the physical-chemical water quality monitoring detailed above, EC also undertakes biological monitoring using benthic macroinvertebrates to assess the health of aquatic ecosystems.

The Canadian Aquatic Biomonitoring Network (CABIN) is a component of the Freshwater Quality Monitoring (FWQM) program for assessing the biological condition of freshwater ecosystems in Canada using standardized data collection and analysis methods (www.ec.gc.ca/rcba-cabin). This component, based on decades of research and development in many countries, has been adopted by multiple agencies and organizations across Canada. The success of CABIN results from interagency collaboration and data sharing. It is led by EC's National CABIN Team, which provides online data management, assessment tools and models, field and laboratory analysis protocols, certification and training, and ecological research and development. Network partners share their observations within the national database. CABIN partners include federal, provincial and territorial government departments, industry, academia, First Nations, and non-governmental organizations such as community watershed groups. A CABIN Science Team, consisting of EC and external scientists with expertise in large-scale ecological monitoring, provides science advice and recommendations for the CABIN component of the FWQM program.

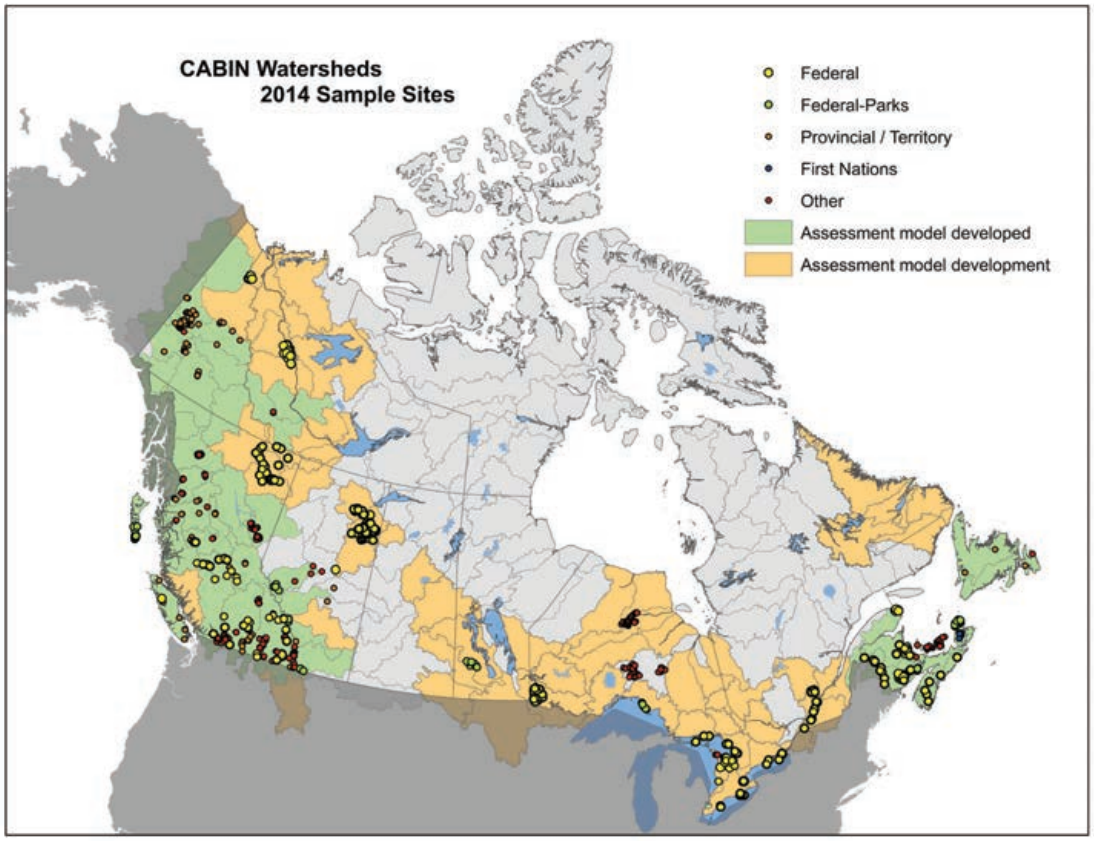
Currently, there are 11 reference models available to assess the biological health of freshwater bodies in Yukon, British Columbia, Nahanni National Park, Rocky Mountains national parks, the Atlantic provinces and the Great Lakes. Reference models in the Boreal ecoregion of Central Canada and the St. Lawrence River are being finalized, while additional reference models are in development for streams in northeastern British Columbia and northern Ontario. Laboratory methods for processing, taxonomy and quality control were published in 2014.

Since the early development of the CABIN monitoring strategy in the 1980s, data have been collected in over 8070 locations across the country. In 2014–2015, data were collected at 878 sites in several sub-basins across the country by EC and its partners (Figure 4). The development of a national training program in 2008, in partnership with the Canadian Rivers Institute of the University of New Brunswick, provided a means of promoting the use of national protocols, and expanding data collection and knowledge of biological conditions across the country. In 2014, participation in the online modules included 156 participants. As the number of CABIN-trained participants increases, the ability to generate new data across the country and assess water quality improves for EC and all network partners.

Pacific Ocean Watershed

In British Columbia, CABIN monitoring is jointly conducted under the Canada–British Columbia Water Quality Monitoring Agreement. Under this agreement, EC and the provincial Ministry of Environment collaborate on data collection for reference model maintenance and development and site assessment. Nine reference models are available to all CABIN users to conduct biological assessments in watersheds in British Columbia and Yukon that were developed collaboratively by federal, provincial and territorial agencies (i.e., Department of Fisheries, Oceans and the Canadian

Figure 4: CABIN monitoring sites



Coast Guard, Parks Canada, BC Ministry of Environment, and Government of Yukon). Models are available for the Yukon River Basin, Fraser River/Georgia Basin, Skagit River Basin, Columbia/Okanagan Basin, B.C. Coastal, Skeena Region and Rocky Mountains national parks models. In 2014, EC collected CABIN data from 56 stream and river sites: 40 sites for reference model maintenance and development, and 16 sites for assessment of biological condition co-located at long-term physical-chemical monitoring sites. The Fraser River/Georgia Basin and Yukon Territory reference condition bioassessment models were revised and made available through the CABIN website.

Arctic Ocean Watershed

CABIN activity in the Arctic Ocean Watershed has been focused in the Athabasca Basin. Under the Joint Canada–Alberta Implementation Plan for the Oil Sands, CABIN protocols have been applied in the tributaries of the Athabasca River as per recommendations in Phase 2 of the Integrated Monitoring Plan, with a total of 60 sites visited in 2014. The program also included biomonitoring sampling in the mainstem of the Athabasca River, with 11 monitoring reaches along the Athabasca River and multiple stations within each reach representing 110 sampling sites. The sampling sites range from sites extending from within the active oil sands development region to sites outside of the development area as well as beyond any natural exposures of the bituminous geologic formations in the region. Further details can be found below (see section 1.2.2) and on the Canada–Alberta Oil Sands Environmental Information Portal (www.jointoilsandsmonitoring.ca/pages/home.aspx?lang=en).

Hudson Bay Watershed

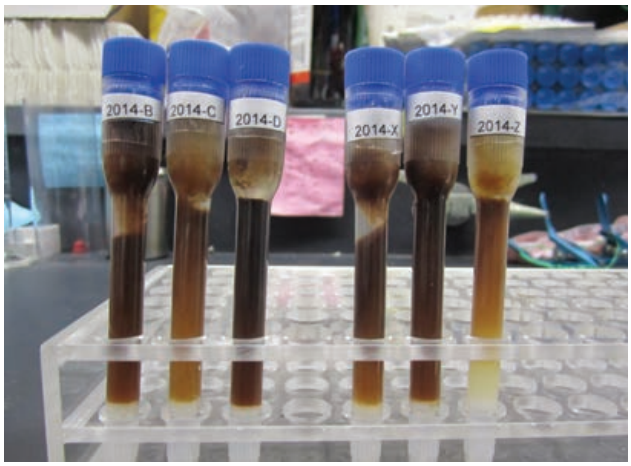
CABIN sampling has been focused on the Lake of the Woods, conducted as part of the Lake of the Woods Science Initiative. A preliminary reference model for the lake has been developed and will continue to be revised and updated as additional sites are sampled. Located at the corner of Ontario, Manitoba and Minnesota, Lake of the Woods is the largest lake in the drainage basin upstream of Lake Winnipeg, contributing approximately 6% of the total phosphorus load to Lake Winnipeg via the Winnipeg River.

Atlantic Ocean Watershed

In the Atlantic Ocean Watershed, 135 stream and river sites were monitored in 2014 (90 in the Atlantic provinces, 40 in Quebec and 5 in Ontario), using CABIN protocols by EC and partners. This work supported federal-provincial water quality monitoring agreements with Newfoundland and Labrador and Prince Edward Island, Canadian Environmental Sustainability Indicators. The monitoring allowed partners to conduct assessments in transboundary watersheds (Saint John River, St. Lawrence River) and federal lands (i.e., national parks, First Nations, and the Meaford and Gagetown Canadian Forces Bases). CABIN sampling using lake protocols was also conducted in the Great Lakes.

1.2.2 Oil sands monitoring

In February 2012, the governments of Canada and Alberta announced the Joint Canada–Alberta Implementation Plan for Oil Sands Monitoring. The monitoring work done under this plan is designed to track the cumulative effects of oil sands development in air, water, wildlife and biodiversity, which in turn can help inform governments and industry decision-making processes. Through the plan, the geographic coverage of environmental monitoring has increased, and data is now being collected from more monitoring sites, more frequently, and for a greater variety of chemical substances.



Oil sand snow samples from near Fort McMurray

Photo: X. Wang © Environment and Climate Change Canada

Canada and Alberta advanced the approach established in the co-management agreement signed in May 2013 by reviewing all component work plans and making decisions with respect to the delivery and implementation of the Joint Plan. In 2014–2015, the National Hydrometric Program received support to run hydrometric stations as part of the Joint Plan.

In the Joint Plan, the two governments committed to ensuring that data will be transparent, supported by the necessary quality assurance, and will be made publicly available to allow independent scientific assessments and evaluations. Towards this, the Canada–Alberta Oil Sands Environmental Monitoring Information Portal at www.jointoilsandsmonitoring.ca/default.asp?lang=En&n=5F73C7C9-1 provides information related to the joint plan, including maps of the monitoring region, details of the monitoring sites, the most up-to-date data collected by scientists, annual reports and scientific analysis and interpretation of the data and results.

In 2013, the Government of Alberta created the Alberta Environmental Monitoring, Evaluation and Reporting Agency (AEMERA), which has taken over the responsibility for oil sands monitoring on behalf of the Government of Alberta. AEMERA and the Government of Canada released the Joint Canada/Alberta Implementation Plan for Oil Sands Monitoring Second Annual Report (2013–2014) in two parts: a Business Report was published in October 2014, and a Monitoring Results Report in December 2014 (www.jointoilsandsmonitoring.ca/default.asp?lang=En&n=FA292E4D-1).

1.2.3 Agricultural and industrial runoff

Research efforts between EC and Agriculture and Agri-Food Canada, in collaboration with academic research partners from the University of Calgary and University of Waterloo, continued throughout 2014–2015.

The main focus is collaborative research towards the mitigation of agricultural impacts on groundwater quality in the transboundary Abbotsford-Sumas aquifer (the study area is located on the Canadian side of the aquifer, in British Columbia's Lower Fraser Valley). The Abbotsford-Sumas aquifer straddles the Canada–U.S. border (approximately 40% in Canada) and is a valuable source of fresh water for communities on both sides of the border. EC manages a network of monitoring wells on the Canadian side of the aquifer, focused on the agricultural area where high nitrate levels have been

observed in groundwater. Continuous groundwater monitoring in this portion of the aquifer has shown 71% exceedance of the Canadian Drinking Water Quality Guidelines for nitrate since 1992 (10 mg/L Nitrate-N). The average nitrate concentration in the area of study is about 14.5 mg/L Nitrate-N (from 1990 through 2014). In 2014–2015, nitrate values ranged as high as 54.3 mg/L Nitrate-N in December 2014. The high average nitrate concentration, above the drinking water guideline levels, represents a concern for groundwater users on both sides of the international border.

A second component of this research effort is taking place on Prince Edward Island, where researchers from EC and Agriculture and Agri-Food Canada collaborate with academic research partners (University of Calgary, University of Guelph, University of New Brunswick and University of Prince Edward Island) to study the effects of intensive agriculture practices on the quantity and quality of groundwater, and consequently on aquatic ecosystems. On Prince Edward Island, the unconfined aquifer set in fractured sandstone constitutes a valuable resource as it is the only source of drinking water for the province. Over the last several decades, nitrate concentrations in both streams and groundwater show an upward trend, resulting in more frequent algal blooms and anoxic events experienced by several estuaries in the recent past. The research effort is concentrated on understanding the nutrient cycling in the soil zone, transport of fertilizers through the shallow geological strata, as well as testing the effects of novel crop production systems on the quality of the receiving waters.

1.3 Canadian Environmental Sustainability Indicators

The Canadian Environmental Sustainability Indicators program reports on the status and trends of key environmental issues at www.ec.gc.ca/indicateurs-indicators/default.asp. Indicators cover air quality, greenhouse gas emissions, water quality and quantity, and protecting nature.

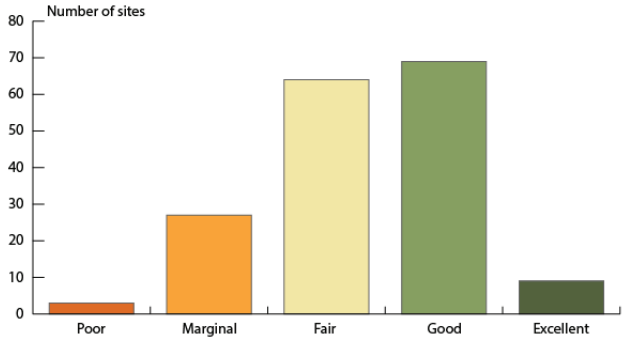
The water quantity in Canadian rivers indicator summarizes annual trends in the hydrometric data at the national scale. The most recent water quantity in Canadian rivers indicator was released in January 2014 and uses 2011 data. It will next be updated in early 2016.

The program's freshwater quality indicator provides an overall measure of the ability of freshwater bodies to support aquatic life (plants, invertebrates and fish) at selected monitoring sites across Canada. The freshwater quality indicator is calculated using the Water Quality Index, endorsed by the Canadian Council of Ministers of the Environment, to summarize the status of surface freshwater quality in Canada. This indicator reflects the extent to which water quality guidelines for the protection of aquatic life are being met at selected river monitoring sites throughout Canada. Water quality at a monitoring station is considered excellent when ambient water quality does not exceed guidelines at any time for any selected parameter. When water quality is rated poor, water quality measurements usually exceed the guideline, and the exceedances may be large.

The latest freshwater quality indicator results are based on data collected from 2010–2012 at 336 water quality stations across Canada, reflecting the diversity of watersheds in the country. The data were assembled from 23 federal, provincial, territorial and joint water quality monitoring programs. The national water quality indicator was calculated using a core national network of 172 river sites, selected to be representative of surface freshwater quality across Canada and the human pressure exerted on it (Figure 5).

Freshwater quality measured at these 172 river sites across Canada was rated excellent for the protection of aquatic life at 9 stations, good at 69 stations, fair at 64 stations, marginal at 27 stations and poor at 3 stations. Overall, there has been little change in the national freshwater quality indicator between 2003–2005 and 2010–2012 at the 100 stations for which there are data for that entire period. During this period, no change was detected in the freshwater quality indicator rankings for 85 stations, while the ranking has improved for 11 stations and declined for 4 stations (Figure 6).

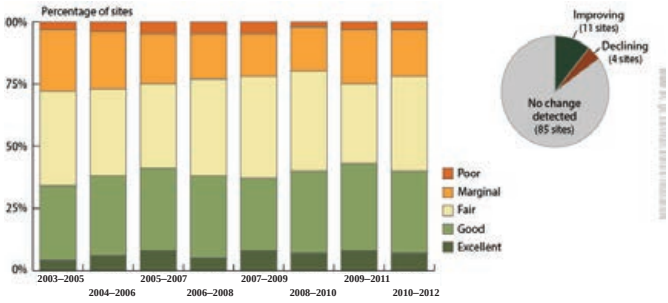
Figure 5: National freshwater quality indicator for 2010–2012, Canada



Note: Freshwater quality was assessed at 172 stations throughout Canada's 16 drainage regions where human activity is most intensive, using the Canadian Council of Ministers of the Environment Water Quality Index.

Source: Data assembled by EC from federal, provincial, territorial and joint water quality monitoring programs.

Figure 6: National freshwater quality indicator change between 2003–2005 and 2010–2012, Canada



Note: Change in the indicator between the 2003–2005 and 2010–2012 periods was assessed at 100 stations in 16 drainage regions across Canada where historical data were available. For each station, change in the indicator was assessed using a consistent set of water quality guidelines and parameters through time.

Source: Data assembled by EC from federal, provincial, territorial and joint water quality monitoring programs.

More information and future releases of the water indicators can be found online at www.ec.gc.ca/indicateurs-indicators.

1.4 Hydro-meteorological modelling and prediction

For several years, researchers and scientists at EC and many partner organizations have used atmospheric and weather data as input for day-to-day operational forecasting models, and hydrologic data collected under the hydrometric agreements as input for hydrologic models. These models demonstrate how regional hydro-meteorological modelling can help improve water resources management.

EC also invested in further development and automation of the Green Kenue, an application for hydrologic modellers and the engineering community. Further development of the Green Kenue built-in tools now allows users to easily process meteorological forecast and hindcast information from EC's Datamart.

EC continued to contribute internationally through its leadership as the Canadian hydrological advisor to the World Meteorological Organization's Commission for Hydrology. This entails providing input and advice to the commission on all matters related to hydrometric monitoring and hydro-meteorology. Specifically, the Department contributed expertise toward the development of techniques for uncertainty analysis in hydrometric measurements and on basic systems. The Department continues to lead the Arctic Hydrological Cycle Observing System initiative, which focuses on freshwater assessment into the Arctic Ocean. In 2014–2015, EC organized and chaired the first steering committee meeting held in March 2015 with representatives from hydrological services in the eight Arctic Council nations. The completed year-one deliverables were discussed, and next year's work plan drafted towards the goal of ensuring data on freshwater fluxes to the Arctic Ocean are made available in a timely fashion.

EC continued to play an active role working with universities on water-quality-related research through support of the Natural Sciences and Engineering Research Council research initiative, including the Canadian Cold Regions Network led by the University of Saskatchewan, and the FloodNet Canadian Strategic Network led by McMaster University.

Great Lakes

In 2014–2015, EC continued to improve methods for coupled hydro-meteorological modelling and prediction under an expanded environmental prediction framework. The model enables an improved understanding of interactions between the atmosphere and land surface, and supports improved water management in the region. EC is partnering with the U.S. Army Corps of Engineers, the National Oceanographic and Atmospheric Administration in the U.S., and the U.S. Geological Survey to operationalize various modelling systems for historical analysis of the water balance in the upper Great Lakes. Products developed in this

modelling system are being analyzed and used to assist in understanding recent and future changes in water levels in the Great Lakes.

Hydrological and modelling experts in EC's Meteorological Service of Canada and the Science and Technology Branch worked on models to estimate possible scenarios of river flow up to 10 days out through ensemble flow forecasting. This capability is of particular use to the provincial flood forecasting agencies. Initial testing of the model in the Great Lakes was initiated in 2014–2015 and is ongoing.

St. Lawrence River

Activities under the St. Lawrence Action Plan's numerical environmental predictions working group progressed well in 2014–2015. The main activities of the group are:

- modelling and assimilation of surface data covering the watersheds of St. Lawrence River tributaries;
- hydrological modelling and routing of waters entering via the watersheds of St. Lawrence tributaries;
- 2D hydrodynamic modelling of the St. Lawrence River, Lac des Deux-Montagnes, Lac Saint-Louis, the LaPrairie Basin, Rivière des Mille-Îles, Rivière des Prairies, and the Sainte-Anne and Vaudreuil channels;
- modelling of the dynamics of the major St. Lawrence River ecosystems; and
- modelling of ocean ice in the St. Lawrence Estuary and the Gulf of St. Lawrence.

These activities are done through the collaboration of federal and provincial partners under the St. Lawrence Action Plan, and they support the main priorities of the plan (biodiversity, water quality and uses).

The hydrodynamic model of the St. Lawrence River between the Port of Montréal and Trois-Rivières has been operating in "experimental mode" at the Canadian Meteorological Centre for more than a year. At present, one simulation per day (nowcasting) is produced automatically. The results are made available online (http://collaboration.cmc.ec.gc.ca/cmc/cmoi/SHOP) and will eventually be published on EC's Wateroffice website. The performance of the system has been assessed, and work is under way to extend the modelling domain upstream in the Montréal archipelago and downstream for the sector from Trois-Rivières to Baie Saint-Paul, downstream of Québec.

Lake of the Woods

In 2014–2015 the Winnipeg River basin hydrological forecasting model was further developed to include ensemble weather forecasts. The model's value was demonstrated during a flood event in spring 2014 when it allowed the Lake of the Woods Secretariat to provide forecasts of expected water level increases.

Prairies

Ongoing studies have focused on improved understanding of water availability in Canada through the development of new methods for modelling the hydrological cycle at a variety of scales, from small basins to large rivers. Research collaboration continued on the development of models for large-scale simulation of the Saskatchewan River and Mackenzie River basins with the Global Institute for Water Security at the University of Saskatchewan. Recent progress includes testing new algorithms developed in previous years and detailed sensitivity analysis of some of the outcomes. Updates in coupled model technology and applications have been made.

Other activities

EC also provided support to many IJC water boards, committees and special studies in 2014–2015. This support includes establishing plans for special studies and development, testing and implementation of hydrologic and ecosystem models. IJC work is not covered under the *Canada Water Act*; EC's progress towards work plans is reported internally under the EC–IJC Memorandum of Understanding.

2 Research on the impacts of climate change on aquatic systems

An ECCC research scientist collects water samples from Lake Erie
Photo: © Environment and Climate Change Canada

In 2014–2015, EC undertook a number of activities to quantify and predict local, regional and national sensitivities of hydrological regimes and aquatic ecosystems to climate change, including:

- Cataloguing freshwater biodiversity water sources across Canada's North;
- A study of the effects of permafrost thaw on tundra lakes, particularly the water chemistry response, and subsequent impacts on benthic invertebrate communities;
- Establishing the impact of warming air temperatures, wetter precipitation regimes and thawing permafrost on predominant hydrological and ecological processes and regimes in Canada's permafrost regions;
- A project to quantify the impacts on river and lake ice phenology[1] in northern regions;
- Continued research evaluating changes in peak runoff events to the Arctic Ocean;
- Ongoing research at the Baker Creek Research Catchment in order to obtain information on how baseline runoff and water chemistry regimes are changing so as to properly evaluate responsible resource development in the subarctic Canadian Shield;
- One of the first studies to quantify and assess Canadian Prairie drought occurrence over three distinct time periods including 1500 to 1900 (from tree rings), 1900 to 2010 (the instrumental record), and 2010 to 2100 (projected temperature and precipitation from several Global Climate Models);
- Assessment of climate variability and change on prairie wetlands and hydrology;
- In collaboration with international and national academic partners, research on the vulnerability of those regions of western Canada reliant on water from mountain headwaters to increasing drought risk and diminishing snowpacks;
- The establishment of the Great Lakes Evaporation Network that manages observation platforms to evaluate ice-lake temperature-evaporation-water level feedbacks and improve analytical tools to understand and predict the impacts, risks to, and vulnerabilities of the quality of the waters of the Great Lakes from anticipated climate change impacts; and
- The development of a methodology to quantify the cumulative effects of climate and regulation on the frequency of ice-jam flooding in rivers that are harnessed for hydro-power generation. Its general applicability represents a significant advancement in our understanding of climate-hydrology interactions in regulated rivers.

3 Inter-jurisdictional water boards

Inter-jurisdictional water boards have been established to focus on specific water issues that have implications for more than one province or territory.

1 Phenology: the study of cyclic and seasonal natural phenomena, especially in relation to climate and plant and animal life.

3.1 Ottawa River Regulation Planning Board

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

In March 2014, snow cover was slightly above average, and the initial estimate of the volume of water entering the Ottawa River during spring melt (freshet) was also slightly above normal. By early April, after a harsh winter, there had still been no significant melt. The condition of the snowpack, combined with the very wet months of April and May, resulted in rapid melting that caused high peak flows for tributaries in the southern part of the basin. Fortunately, there was enough time between the peaks in the northern and southern parts of the basin for the freshet in the southern basin to recede before the waters from the north arrived. Given the intact snow cover and heavy precipitation during the melt, freshet volumes were extremely high for a second year in a row, although they did not reach the record-setting levels of 2013. The start of flooding threshold was exceeded in communities from Mattawa to Britannia, and in the Montréal region. Communities in the central portion of the basin were particularly affected (Westmeath, Lake Coulonge, LaPasse).

The Board supported a number of public information initiatives through the Ottawa River Regulation Secretariat. The Secretariat, which is housed at EC, maintains a website and a recorded message on toll-free telephone services in English and French, both of which provide information about water levels and flows at various locations in the basin. In 2014–2015, the Secretariat recorded 87 293 hits on its website during the freshet period (March–June), approximately 20% lower than the previous year. The total number of unique users of the site numbered 13 499.

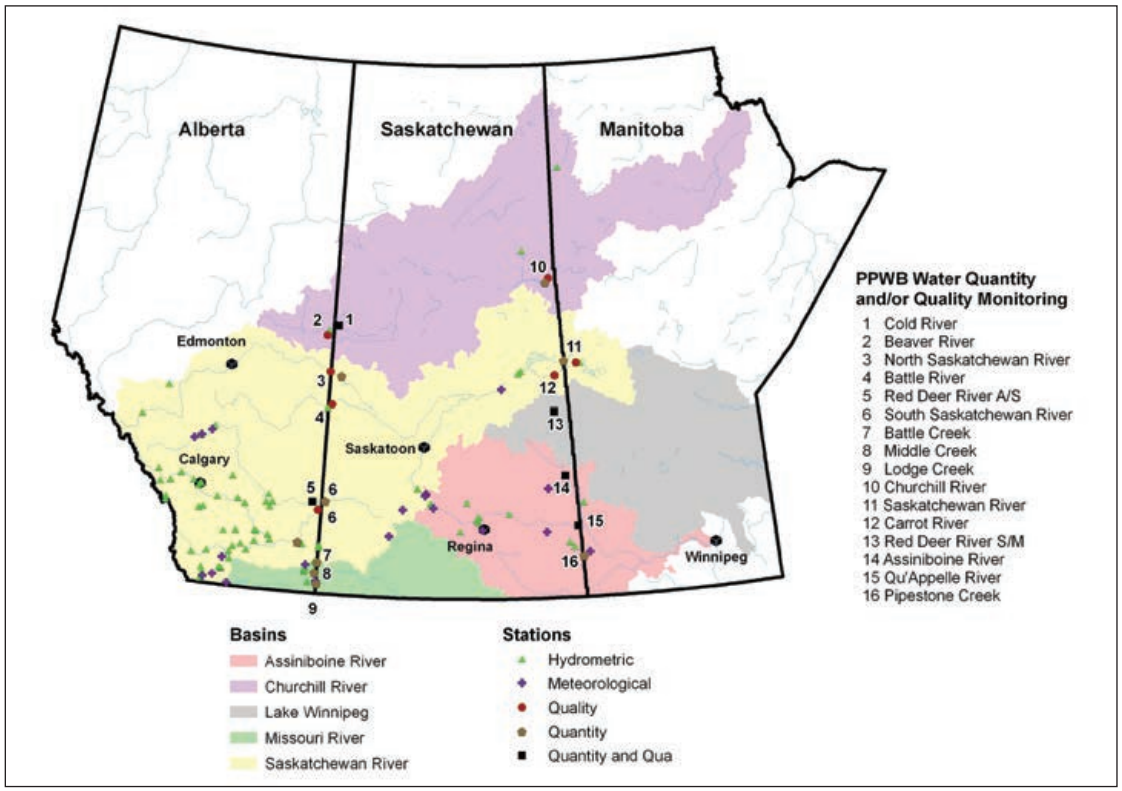
3.2 Prairie Provinces Water Board

Recognizing that water use within one province may impact another province, and because federal and provincial governments have shared responsibility for water, the governments of Canada, Alberta, Saskatchewan and Manitoba signed the Master Agreement on Apportionment (MAA) in October 1969. The purpose of this agreement is to apportion water between the provinces of Alberta, Saskatchewan and Manitoba, and to protect surface water quality and transboundary aquifers. The MAA also provides for cooperation between governments with respect to transboundary water management, and for the establishment of the Prairie Provinces Water Board (PPWB) to administer the MAA (see www.ppwb.ca).

The overarching deliverable for the PPWB is to report on the achievement of the terms of the MAA. The MAA provides for an equitable sharing of available waters for all eastward-flowing streams, including transboundary lakes that cross provincial boundaries. The schedules to the Agreement describe the role of the Board and stipulate the amount and quality of water that shall pass from Alberta to Saskatchewan and from Saskatchewan to Manitoba.

In support of the MAA, EC monitors stream flows, water quality and meteorological conditions on eastward-flowing streams on the provincial borders (see Figure 7). The PPWB computes apportionable flows based on the natural flow on a river if that river had never been affected by the activities of people. Excursions to the MAA water quality objectives are calculated annually.

Figure 7: PPWB water quantity and quality monitoring stations and basins for 2014



Activities and accomplishments in 2014–2015 included the following:

- Apportionment requirements were met in the calendar year of 2013 on all eastward-flowing prairie streams. Interim flows indicated that 2014 apportionment requirements were likely met on the South Saskatchewan River. It is anticipated that there will not be any problems with meeting apportionment for 2014 on any transboundary stream.
- The PPWB approved the hydrometric and meteorological monitoring station list for 2015–2016.
- A project to review apportionment methods is continuing. A contract was issued for the review of apportionment procedures for Cold River at the Alberta and Saskatchewan boundary. A report on the review is expected to be completed in 2015–2016. A review of apportionment methods on the Saskatchewan River basin is in its preliminary phases.
- Work continued on the development of a schedule to the MAA related to transboundary aquifers. A groundwater schedule was drafted and is undergoing review by each of the PPWB member agencies. The objective of the schedule will be to establish a cooperative framework for effective and efficient management and sustainable use of groundwater and aquifer systems by the Parties of the MAA.
- The PPWB approved the 2015 water quality monitoring program and the 2013 Water Quality Excursion Report. The overall adherence to interprovincial water quality objectives was very high, with an average of 95% in 2013, such that water quality continues to be protected. A comprehensive review of interprovincial water quality objectives was completed in 2013–2014, and in 2014–2015, each member organization completed an internal review of the recommended changes. The updated interprovincial water quality objectives will come into effect once approved by all Ministers.
- The PPWB is in early stages of creating a new committee to investigate, oversee, review, report and improve the accuracy of flow forecasting at the interprovincial boundaries. The Committee

on Flow Forecasting will also provide recommendations on matters pertaining to streamflow forecasting of interprovincial basins. The Committee on Flow Forecasting will be a long-standing committee that will report directly to the Board.

- The Committee on Water Quality began setting priorities for the 12 transboundary river reaches and determined that nutrient pollution is the number one priority for further investigation. Work is under way to review nutrients across transboundary river reaches.
- The PPWB continued to exchange information on issues of common interest, including water quality issues related to Lake Winnipeg, Saskatchewan–Manitoba drainage issues, Carrot River sediment issues and invasive species.

3.3 Mackenzie River Basin Board

The governments of Canada, British Columbia, Alberta, Saskatchewan, the Northwest Territories and Yukon signed the Mackenzie River Basin Transboundary Waters Master Agreement in July 1997. The Master Agreement endorses the principle of managing water resources for future generations such that the ecological integrity of the aquatic ecosystem is maintained. It provides for early and effective consultation on potential developments and activities in the basin that could affect the integrity of the aquatic ecosystem. It also contains provisions for seven sets of bilateral agreements between adjacent jurisdictions in the basin.

The 13-member Mackenzie River Basin Board (MRBB), which represents all parties to the Master Agreement, administers the provisions of the agreement. Federal members include representatives from EC and Aboriginal Affairs and Northern Development Canada. Health Canada participates as an observer providing support and expertise on human health issues. The 3 provinces and 2 territories in the basin are represented by 10 members, including an appointee from provincial and territorial government water management agencies, and an Aboriginal board member nominated by Aboriginal organizations.

Under the Master Agreement, EC is responsible for managing the expenditures of the MRBB, which are cost-shared equally by the parties. Shareable costs include the staffing and operation of the secretariat office in Yellowknife, Northwest Territories, to provide working-level support for the board. The secretariat consists of the executive director, who is hired by EC and is responsible for planning, directing and managing board operations.

MRBB members met twice in 2014–2015, and key activities and accomplishments included:

- The governments of Alberta and the Northwest Territories signed a bilateral water management agreement on March 18, 2015, to establish and implement a framework for cooperating to achieve the principles of the Master Agreement.
- The MRBB tracked the progress of bilateral water management negotiations between British Columbia and Alberta; Alberta and Saskatchewan; British Columbia and Yukon; and British Columbia and the Northwest Territories. Negotiations are ongoing.
- Board members discussed the MRBB's potential ongoing role in the implementation of the bilateral water management agreements.
- The MRBB published the *Mackenzie River Basin Board Report to Ministers 2013–2014*. The report describes the activities of the board during this period and is available on the MRBB website (www.mrbb.ca).
- Member jurisdictions continued to exchange information through agency reports.
- The Traditional Knowledge and Strengthening Partnerships Steering Committee partnered with the University of Alberta and the Government of the Northwest Territories to develop a proposal to gather and communicate water-related Traditional Knowledge from around the Mackenzie River Basin.

3.4 Lake of the Woods Control Board

The Lake of the Woods Control Board (LWCB) does not fall under the *Canada Water Act*, but it is included in this report to provide a more complete picture of federal-provincial water management in Canada. The LWCB is a board consisting of four members, each with an alternate, who represent Canada (one member), Ontario (two members) and Manitoba (one member). Appointments are made by orders in council of the appropriate government, and each appointee must be a professional engineer.

The LWCB, established in 1919, is responsible for the regulation of levels in Lake of the Woods and Lac Seul and flows in the Winnipeg and English rivers, downstream from these lakes to their junction. In addition, when the level of Lac Seul exceeds certain specified levels, the LWCB controls the diversion of water from Lake St. Joseph (Albany system) into Lac Seul.

The LWCB's authority is defined by concurrent Canada–Ontario–Manitoba legislation (*Lake of the Woods Control Board Act*; 1921, 1922, 1958) and is further mandated by a Canada–U.S. treaty (Convention and Protocol for Regulating the Level of the Lake of the Woods, 1925), since Lake of the Woods is an international boundary body of water. This treaty also created a second board, the International Lake of the Woods Control Board (ILWCB). Although Lake of the Woods is normally regulated solely by the LWCB, the outflow from the lake is subject to the approval of the ILWCB whenever the level of the lake rises above or falls below certain levels specified in the treaty.

The LWCB maintains a full-time secretariat that monitors conditions in the basin, provides information and analysis, and recommends regulating strategies or specific outflows. It also implements the LWCB's operating strategy, conducts studies and maintains communications with basin users.

In 2014, the LWCB held three regulation meetings with resource advisors and special interest group representatives in Kenora, Ontario. These meetings resulted in the adoption of seasonal operating strategies employed by the LWCB Secretariat in daily operations.

In June and July 2014, extremely high inflows developed across the Winnipeg River basin, in some areas setting new records. The LWCB expanded its information services to provide twice-daily updates on conditions and water level forecasts seven days a week, and its Secretariat provided daily briefings on forecasts to Emergency Management Ontario calls, which were attended by First Nations, municipalities and other government agencies also responding to the extreme conditions. During this period, the LWCB also convened several emergency regulation calls to review conditions and make decisions on flow management. Decisions on outflow from Lake of the Woods were made with approval from the ILWCB from mid-June to late-August, as required under the Canada–United States Treaty when water levels are above the 323.4 metre threshold. Despite efforts to maximize outflow from the lake, the water levels of both Lake of the Woods and the Winnipeg River in Ontario reached the highest level since 1950, while the Winnipeg River flows in Manitoba were unprecedented in the historical record.

Due to the extreme conditions, the LWCB expanded its normal summer engagement activities, visiting a wide range of locations in both the English River and Winnipeg River watersheds to meet with stakeholders and document local conditions. In June, the LWCB held a well-attended public open house in Kenora, Ontario, to provide the latest forecast information and to advise of the forthcoming high water conditions. In August, the LWCB, Secretariat staff and the ILWCB held public meetings in Kenora and in Warroad, Minnesota, to review the high water event as well as tour the south end of the watershed to observe damage. The LWCB later published a review of the 2014 high water event.

4 Ecosystem initiatives and ecosystem-based approaches

Federal and provincial governments have jointly developed and implemented basin-wide action plans in collaboration with communities and other stakeholders. These action plans are designed to help resolve complex environmental issues, particularly deteriorating water quality that threatens human and ecosystem health.

This section describes a number of key partnership-based ecosystem approaches through which EC works to ensure that Canadians have access to clean, safe and healthy water, and that the country's water resources are used wisely, both economically and ecologically.

EC's Ecosystem Initiatives are cooperative, place-based programs designed to deliver environmental results in targeted ecosystems. The objective of the

Ecosystem Initiatives is to enhance or maintain ecosystem sustainability by addressing a range of local or regional environmental challenges through partnership-based work. Local activities are coordinated by EC and undertaken in collaboration with a range of local partners and stakeholders that may include other federal departments, provinces and territories, regional, municipal and local governments, Aboriginal peoples, federal and state governments in the United States, businesses, non-governmental and community organizations, and colleges and universities.

Ecosystem Initiatives achieve their objectives by relying on measurable environmental results, aligned and coordinated efforts, collaborative governance mechanisms, integrated science and monitoring, community and stakeholder involvement, sharing of information and experiences, and informed decision making.

4.1 Great Lakes Ecosystem Initiative

The Great Lakes Ecosystem Initiative is a partnership of federal departments (Agriculture and Agri-Food Canada, EC, Fisheries and Oceans, Health Canada, Natural Resources Canada, Public Works and Government Services Canada, Transport Canada, and Infrastructure Canada) and one federal agency (the Parks Canada Agency) (www.ec.gc.ca/grandslacs-greatlakes).

The Great Lakes Ecosystem Initiative coordinates actions towards meeting Canada's commitments under the 2012 Canada–U.S. Great Lakes Water Quality Agreement (GLWQA), and the 2014 Canada–Ontario Agreement on Great Lakes Water Quality and Ecosystem Health (COA). The GLWQA establishes broad, long-term objectives for Canada and the United States for restoring and protecting the Great Lakes, while the COA provides a short-term (five-year) plan for achieving Canada's GLWQA commitments.

Areas of Concern

Areas of Concern (AOCs) are specific locations, such as harbours and embayments, where water quality and ecosystem health have been severely degraded by human activity at the local level. In 1987, Canada and the United States together designated 43 AOCs, 12 of which are in Canada, and 5 that are shared between Canada and the United States. In 2014–2015, coordination of Remedial Action Plan (RAP) activities in Great Lakes AOCs continued, including assessing and reporting on the success of past actions and on the status of remaining actions. Some examples of these activities are as follows:

- The decision on whether to delist the St. Lawrence River (Cornwall) AOC or to recognize it as an Area of Concern in Recovery is pending. In the meantime, the St. Lawrence River Institute for Environmental Studies undertook a study to assess shoreline sediment mercury concentrations. For the three known contaminated sediment zones along the Cornwall waterfront, sediments within 1 m to 5 m from shore were found to have low mercury concentrations.
- The Bay of Quinte AOC RAP completed an assessment of the status of the "Beach Closings" beneficial use impairment (BUI) and confirmed that the redesignation criteria are continuously being met. Phosphorus modelling has been completed for the bay, which is the first step in developing a Phosphorus Management Strategy for the AOC that will address the bay's eutrophication issues.
- A review of actions taken and the status of environmental recovery, undertaken by the Toronto and Region RAP team, showed substantial progress had been made and significant environmental recovery has occurred. A work plan has been prepared that will guide implementation of the RAP to its completion, which could be accomplished within a six- to eight-year period.
- For the Niagara River AOC, re-designation reports were drafted to support changing the status of the "Eutrophication and Undesirable Algae" and the "Degradation of Benthos" beneficial uses to "not impaired."
- For the St. Clair River AOC, an assessment report recommending the re-designation of "Degradation of Aesthetics" to "not impaired" was completed.
- In the Detroit River AOC, there are two beneficial use assessment reports recommending that re-designation status become not impaired: the "Degradation of Aesthetics" and "Beach Closings."

- Post-monitoring after the removal of contaminated PCB soil in Turkey Creek shows that the concentration of PCBs in sediments, water and forage fish have decreased. Science and monitoring projects were conducted by EC, the Fisheries, Oceans and the Canadian Coast Guard Canada, and other stakeholders to address the assessment of four BUIs ("Fish and Wildlife Consumption"; "Loss of Fish and Wildlife Habitat"; "Fish Tumors or Other Deformities"; and "Degradation of Benthos").
- The Nipigon Bay AOC RAP drafted a report demonstrating that all restoration targets had been met and recommending that the AOC be removed from the list of Great Lakes AOCs.
- In the Jackfish Bay AOC in Recovery, an ecological risk assessment was undertaken to help understand the natural recovery in the ecosystem and determine whether existing levels of contaminants pose a threat to fish and wildlife. The results of the assessment will help guide future management decisions in the AOC in Recovery.
- In the Spanish Harbour AOC in Recovery, a workshop was held where environmental monitoring experts confirmed ongoing recovery of the ecosystem, including improved sediment condition and lower-than-expected contaminant levels in fish and wildlife.
- In the St. Mary's River AOC, it was previously unknown whether there was an increased incidence of bird deformities or reproductive problems. Bird community and toxicology monitoring confirmed that the "Bird or Animal Deformities of Reproductive Problems" BUI is "not impaired."

Examples of outcomes

As a testament to the environmental restoration work that has taken place at Royal Botanical Gardens and Hamilton Harbour, Bald Eagles chose a third nest site in 2014 and are incubating eggs atop a tall pine tree in the Hopkin's Woods Special Protection Area along Spencer Creek. This 75-hectare zone surrounds the nest site, which is protected by Ontario's *Endangered Species Act, 2007*. On March 22 and 23, 2013, the first eaglets in over 50 years hatched in Cootes Paradise on the Canadian shoreline of Lake Ontario.

The Fighting Island (Canada–U.S.) binational fish habitat reef project (expanded to 0.89 hectare in 2013) to restore the populations of the threatened species, lake sturgeon, continues to show success with now-annual spawning of lake sturgeon and other species, like lake whitefish, that have not been present in the Detroit River system for many years.

In 2014–2015, EC continued to fund multi-stakeholder projects to clean up and restore the Great Lakes AOCs through the Great Lakes Sustainability Fund, which is part of the Great Lakes Action Plan.

In partnership with local and provincial stakeholders, the Great Lakes Sustainability Fund provides funds for projects in three key areas: (1) improving point source and non-point-source water quality; (2) rehabilitating and protecting fish habitat and wildlife habitat; and (3) characterizing contaminated sediment and developing contaminated sediment management plans in AOCs.

The fund continued to support work to improve point source and non-point-source water quality, in the Bay of Quinte, Niagara River, Hamilton Harbour, Toronto and Region, Thunder Bay, Nipigon Bay, St. Mary's River, and Detroit River AOCs, to develop and implement stewardship initiatives and deliver programs that reduce nutrient inputs to watercourses from urban and rural non-point sources. Initiatives included outreach and education programs to encourage rural farming and non-farming landowners to adopt best management practices, and studies leading to improved water quality through improved management of municipal waste water.

In 2014–2015, the fund supported a number of projects to restore fish and wildlife habitat in AOCs, including projects to implement habitat management plans in the Bay of Quinte AOC; habitat restoration projects along the Detroit River, in the tributaries of the Niagara River, in George Creek in the Thunder Bay AOC, and six projects in the St. Clair River AOC; projects to monitor and assess fish populations in the Nipigon Bay AOC and wildlife populations in Thunder Bay; and five projects to restore fish and wildlife habitat and populations in the Toronto and Region AOC.

In 2014–2015, work continued to advance the development of plans and strategies to remediate contaminated sediments. This included supporting management plans for mercury-contaminated sediments in the St. Clair River and in Thunder Bay North Harbour, with projects in both AOCs aimed at identifying and evaluating sediment management options and carrying out public, stakeholder and First Nations consultation on the potential options. The fund also supported collaborative EC work to measure harmful blooms and phosphorus release by sediments in the Bay of Quinte and Hamilton Harbour AOCs to support nutrient management modelling and provide input toward setting realistic delisting targets for phosphorus ("Eutrophication or Undesirable Algae" BUI).

Science and monitoring

EC undertakes science and monitoring projects to support decision making in the Great Lakes AOCs in Canada and in binational AOCs. Science-related work undertaken in 2014–2015 included the review and update of the suite of Great Lakes indicators to be used for reporting in 2016; preparation of a draft groundwater science report; and preparation of an analysis on the state of climate change knowledge in the Great Lakes.

Focus in 2014–2015 in the Bay of Quinte AOC was on identifying factors that promote the development of harmful algal blooms and tracking the status of the lower trophic levels to identify changes in growth and mortality.

As part of the Great Lakes Nutrients Initiative, research was conducted on tributaries flowing to Lake Erie to determine relative contributions of nitrogen and phosphorus from municipal sewage versus agricultural lands and the effects of these added nutrients on stream ecosystem health. In addition, work continued in the nearshore of East Basin Lake Erie to characterize the sources of phosphorus fueling the resurgence of the attached macroalgae, *Cladophora*, and the nutrient and hydrodynamic conditions near the bottom above dreissenid mussel beds.

Canada–Ontario and Canada–U.S. cooperation

A new COA was negotiated, and it entered into force on December 18, 2014. The COA outlines how the governments of Canada and Ontario will cooperate and coordinate their efforts to restore, protect and conserve the Great Lakes basin ecosystem.

Commitments by Canada and Ontario include:

- taking action to address algal blooms, including blue-green algae;
- completing actions to clean up historical AOCs including the Niagara River, Nipigon Bay, Peninsula Harbour, the Bay of Quinte and the St. Lawrence River (Cornwall);
- helping to prevent aquatic invasive species, such as zebra mussels, from entering the lakes;
- protecting the lakes from harmful pollutants;
- conserving important fish and wildlife habitats; and
- strengthening collaboration with the Great Lakes community.

In 2014–2015, the Department continued its long-standing collaboration with the U.S. and Ontario to restore and protect the Great Lakes. EC continued to lead implementation of the Canada–U.S. GLWQA, 2012 and through the Great Lakes Executive Committee; the Department contributed in key areas, such as:

- Nutrients – Work was undertaken in 2014–2015 under the Great Lakes Nutrient Initiative to draft new phosphorus targets for Lake Erie through Canada–U.S. and Canada–Ontario discussions; establish a Canada–Ontario interagency steering committee to begin analysis of policy options to achieve phosphorus reduction targets; and draft components of a new nearshore framework, including an approach to baseline assessment;

This work is being coordinated under the Canada–U.S. GLWQA, which requires the identification of new phosphorus targets for Lake Erie by 2016 and domestic action plans by 2018;

- Habitat and Species – Finalized a Canada–U.S. Biodiversity Conservation Strategy for Lake Superior;
- Chemicals – Work towards the identification of the first set of proposed Canada–U.S. Chemicals of Mutual Concern, and monitoring of U.S. activities at a hazardous waste site near the Niagara River;

Also in 2014–2015, in recognition of the commitments related to Harmful Pollutants under the new COA, a draft report was completed summarizing past and current research, monitoring and risk management activities and achievements on chemicals identified as Tier I and Tier II under previous COAs. Results of this report may inform future nominations for Chemicals of Concern under the Harmful Pollutants Annex.

Under the GLWQA, the governments of Canada and the United States are also obligated to protect the physical, biological and chemical integrity of the waters of the Great Lakes. The Lakewide Action and Management Plan (LAMP) is the binational mechanism to establish shared goals, identify threats, take coordinated action and monitor results. The implementation of the LAMP was advanced through Canada–U.S. discussions on governance, Lake Ecosystem Objectives, reporting and outreach. In addition, the 2014 LAMP annual reports were published.

Lake Simcoe/South-eastern Georgian Bay

In 2014–2015, the Government of Canada committed $8.0 million, leveraging $10.7 million, to 32 community-based projects under the renewed and expanded Lake Simcoe/South-eastern Georgian Bay Clean-Up Fund. These projects included activities to reduce phosphorus inputs to the watersheds from urban and rural point and non-point sources, restore and create aquatic habitat, and support innovation and advance research into the water quality issues of Lake Simcoe/South-eastern Georgian Bay.

A researcher obtains a sediment/water interface sample from frozen Georgian Bay

Photo: Jacqui Milne © Environment and Climate Change Canada

Also in 2014–2015, studies started during the previous reporting year continued on sediment characterization; nutrient source tracking; surface water quality and associated harmful algal blooms; and groundwater quality and its role in nutrient loading. In addition, preliminary modelling of phosphorus loads was undertaken and nearshore autonomous underwater vehicle deployments were carried out on the Nottawasaga River to Nottawasaga Bay.

4.2 St. Lawrence Action Plan

The St. Lawrence Action Plan (http://planstlaurent.qc.ca/en/home.html) is a collaborative effort between the Canadian and Quebec governments to protect, conserve and enhance the St. Lawrence ecosystem. This multi-year program, which has been renewed four times since it was first signed in 1988, has helped produce concrete results through the cooperative efforts of the two governments. Their efforts have benefited from participation by the private sector, universities, research centres, Areas of Prime Concern committees (zone

d'intervention prioritaire, known as ZIP committees), non-governmental organizations and riverside communities. The program focuses on all of the St. Lawrence River's ecosystems and on the mouths of its main tributaries, from Lake Saint-François, straddling the border between Quebec and Ontario, to the eastern reaches of the Gulf of St. Lawrence.

The Canada–Quebec Agreement on the St. Lawrence, also known as the St. Lawrence Action Plan 2011–2026, covers a span of 15 years, with 5-year planning cycles.

In 2014–2015, various components of the Action Plan continued, including 48 projects from its joint action program, where a number of research activities, field work and decision support tool development were undertaken, including:

- Biotoxins in the benthic cyanobacteria *Lyngbya wollei* were identified and quantified from algal blooms along the St. Lawrence River;
- Agricultural stream enhancement work in the Lake Saint-Pierre flood plain, with the aim of reducing non-point-source pollution of agricultural origin;
- A study designed to document the presence of pharmaceuticals in municipal effluents in the Montréal area and assess their effects on aquatic wildlife; and
- The development of a decision-making framework for assessment of contaminated sediments and their impact on the water quality and general environment of the St. Lawrence.

Community involvement and awareness

The ZIP Program supports Stratégies Saint-Laurent and its members (the 13 Areas of Prime Concern committees) in their efforts to mobilize and coordinate the various parties involved in issues affecting the St. Lawrence, and to foster their commitment to improving the quality of the environment. In 2014–2015, activities included collaboration with local communities to highlight local environmental issues related to the St. Lawrence River; concertation concerning emerging issues (shipping of hydrocarbons on the river, port development); participation in information activities pertaining to shoreline erosion, the sustainable development of coastal environments and the preservation of uses (swimming, access); as well as habitat conservation and enhancement of natural environments. In addition, the ZIP committees contributed significantly to the St. Lawrence integrated management approach at the local scale, notably through the establishment of and participation in six regional round tables devoted to priority regional issues.

Under the St. Lawrence Action Plan 2011–2026, EC and Quebec's ministère du Développement durable, de l'Environnement et de la Lutte contre les changements climatiques are also implementing the Community Interaction Program (CIP), which supports non-governmental organizations that implement projects that benefit the St. Lawrence. During 2014–2015, EC funded, for a total of $556,000 in contributions, 21 projects under CIP, which were carried out throughout the program area, extending along the south shore of the St. Lawrence, from Cornwall to Gaspé, including the Magdalen Islands, and along the north shore, from Carillon to Blanc-Sablon, including Anticosti and the Saguenay region. These projects involve key players from riverside communities, including municipalities, First Nations, academia, industry, agriculture, local communities, and relevant provincial and federal departments. Projects in 2014–2015 included improving the free movement of Yellow Perch to a spawning ground by carrying out an innovative wildlife habitat enhancement project in Odanak, in the Lake Saint-Pierre area; the voluntary conservation of woodlands of interest, wetlands, and riparian plant and wildlife habitats on the north shore of the Île d'Orléans, in the Québec area; and the improvement of fish access to the flood plain of the Saint-Jacques River, at Brossard near Montréal by creating a connecting channel between two drainage ditches leading to a spawning area. A total of 22 new project proposals were submitted under CIP in 2014–2015 for activities that will be carried out beginning in the spring of 2015.

Finally, the fourth Forum on the St. Lawrence was held in Québec in October 2014, focusing on climate change adaptation. This forum for discussion and concertation among the parties involved in water-related issues affecting the entire St. Lawrence River provided an opportunity to identify strategic goals and objectives and joint actions relating to this important topic.

The State of the St. Lawrence River Monitoring Program

A network of governmental and non-governmental partners and collaborators continued to conduct sampling campaigns required to obtain scientific data through the State of the St. Lawrence River Monitoring Program. EC collected data on water levels and flow rates; water and sediment quality; land cover; benthic communities at Lake Saint-Pierre; seabird populations, the Northern Gannet and the Great Blue Heron; and shellfish water quality.

During 2014–2015, EC published five new fact sheets on environmental indicators online. Each fact sheet contributes to our understanding of the state of the St. Lawrence River. They deal with oceanographic processes in the estuary and Gulf of St. Lawrence; the surface area of freshwater wetlands; contamination of sediments by toxins (butyltins); the Northern Gannet; and seabirds.

The Working Group on the State of the St. Lawrence River completed a draft of the Overview of the State of the St. Lawrence River 2014, which is scheduled for publication at the beginning of 2015–2016.

Numerical Environmental Prediction Program

The Numerical Environmental Prediction Program for the St. Lawrence is a program to aid decision making and water management planning for the St. Lawrence and its watershed. It simulates the evolution of physical, biological or chemical processes in the St. Lawrence and its watershed to predict the state of the corresponding terrestrial and aquatic environment. The program aims in particular to improve our understanding of the St. Lawrence ecosystem as a whole and to provide a tool to support decisions about its integrated management. The program is being carried out by a working group whose activities in 2014–2015 made significant progress, notably through four projects that dealt with the coupling of the hydrological models of the St. Lawrence watershed, the integration of hydrodynamic modelling tools into the Montréal archipelago, and hydrological and hydraulic modelling of the Richelieu River watershed. The group also supported various activities under the St. Lawrence Action Plan's three main issues, which are conservation of biodiversity, sustainability of uses and water quality improvement.

4.3 Atlantic Ecosystem Initiatives

The Atlantic Ecosystem Initiatives (AEI) implements an ecosystem-based approach to environmental management through internal engagement, external engagement with 20 multi-stakeholder community organizations, regional coalitions and research organizations in Atlantic Canada. The work of these partners has a positive impact on the health of watersheds across the region, including the Gulf of Maine and the southern Gulf of St. Lawrence. AEI-funded initiatives support the use of local and regional expertise, and the people who work in their own communities and regions, to help build a better environment for Canadians.

EC contributed funding, technical and scientific expertise, and direct staff support, to four broad categories of projects relevant to the *Canada Water Act*: clean water, pollution sources, toxics and natural habitat.

In 2014–2015, 26 projects (representing 63% of all projects funded by AEI) addressed water issues related to water quality, biodiversity and climate change. EC committed over $810,000 for these projects. The bulk of project activities pursued enhancement and improvement of water quality and watersheds through initiatives such as identification and assessment of threats to water resources, water quality monitoring and research, and development of ecosystem management tools and management plans. The following examples demonstrate the type of projects that were carried out.

- In Prince Edward Island, the Bedeque Bay Environmental Management Association collaborated with Saint Mary's University in Halifax on the second year of the CURA H2O project, a province-wide community water quality monitoring program. The baseline data collected enabled the comprehensive and accurate assessments of trends in water quality. The project helped to address threats and identify potential remediation options, particularly related to agricultural impacts to water resources such as soil erosion, siltation of streams and estuaries, elevated nitrate concentrations, bacterial contamination of shellfish harvesting areas, and the occurrence of pesticide residues in groundwater and surface waters.

- In New Brunswick, completion of the Saint John's Harbour Cleanup initiative during the winter of 2013–2014 brought about the cessation of 400 years of untreated municipal effluent discharge into the Saint John Harbour. This presented an opportunity to restore the recipient nearshore water quality of a major estuary. In 2014–2015, Atlantic Coastal Action Program (ACAP) Saint John Inc. undertook water quality sampling to measure and document the changes and recovery in nearshore water quality and biodiversity following the cessation of untreated municipal waste-water discharges.
- In Newfoundland and Labrador, the Northeast Avalon ACAP, Inc. concluded its final year of a three-year project to develop and implement a water quality monitoring program on rivers throughout the Northeast Avalon region, allowing for in-depth, long-range data collection. The data helped to establish baseline conditions throughout the region and assess impacts from upstream land uses or changes in climatic patterns. The data gathered can now be used to inform appropriate officials if and when action needs to be taken to halt or remediate any adverse effects on the waterways included in the study.
- Other AEI project activities included assessment of threats from sedimentation and nutrient transport, the development of data management and reporting tools for integrated watershed planning, assessing land-based threats to coastal wetlands and important aquatic habitats, and reducing vulnerability of coastal habitats to petroleum contamination.

4.4 Gulf of Maine

EC is working collaboratively with other federal departments, provincial governments, U.S. governments and community groups to help advance efforts that enhance conservation and promote responsible development in the Gulf of Maine transboundary ecosystem, which includes watersheds and coastline in New Brunswick and Nova Scotia.

The focus of the Gulf of Maine Initiative (GMI) is to build knowledge of the ecosystem—watershed and coast—to better understand its current condition and identify stressors and threats to help inform decisions.

In 2014–2015, over $260,000 in grants and contributions were provided for the initial year of seven multi-year projects (87% of GMI projects) that address water quality issues in the Gulf of Maine ecosystem. Some examples of the projects funded include:

- Researchers from Dalhousie University are investigating the threat that ocean acidification imposes on ecosystem health and will integrate their results with U.S. initiatives to generate a comprehensive view of the entire Gulf of Maine ecosystem.
- The World Wildlife Fund Canada is conducting a Freshwater Health Assessment and a Freshwater Threats Assessment throughout the entire Canadian portion of the Gulf of Maine ecosystem to quantify the top threats to the Gulf of Maine and identify the key drivers behind them.

Other GMI project activities included collecting and making accessible information on eutrophication and contaminants, applying the Ocean Health Index to assess the health of the Gulf of Maine, identifying linkages between environmental stressors and upstream land use activities in the Annapolis watershed (Nova Scotia) and the development of a strategic framework to understand, monitor and manage the cumulative effects from multiple stressors in Saint John Harbour (New Brunswick).

4.5 Lake Winnipeg Basin Initiative

The Lake Winnipeg Basin Initiative (LWBI) is the Government of Canada's response to address the water quality issues in Lake Winnipeg. The LWBI aims to engage citizens, scientists, and domestic and international partners in actions to restore the ecological health of Lake Winnipeg, reduce nutrient pollution and improve water quality.

Lake Winnipeg at Gimli

Photo: © Environment and Climate Change Canada

Phase II of the LWBI ($18 million, 2012–2017) increases focus on stakeholder stewardship actions that measurably reduce nutrient loading and improve Lake Winnipeg's water quality. Science efforts during Phase II focus on watershed and in-lake research and monitoring to help identify and measure which actions on the land will best improve water quality in the lake. An enhanced transboundary focus in Phase II will encourage other jurisdictions to consider water quality in Lake Winnipeg as they make water management decisions in their local watersheds.

Some key highlights from 2014–2015 include:

- The Minister of the Environment's approval of 30 Lake Winnipeg Basin Stewardship Fund (LWBSF) projects in funding Rounds 7 and 8;
- Continued engagement of transboundary water management boards supported efforts to develop water quality objectives for nutrients in the Red River and Winnipeg River systems;
- Substantial progress was made towards the renewal of the Canada–Manitoba Memorandum of Understanding (MOU) Respecting Lake Winnipeg and the Lake Winnipeg Basin and delivery of its work plan. The MOU facilitates a cooperative and coordinated approach in efforts to understand and protect the water quality and ecological health of Lake Winnipeg and its basin;
- Following the signing of Manitoba's Lake Friendly Accord by the Minister of the Environment on behalf of the Government of Canada on March 21, 2014, the Lake Friendly Annex was developed and approved, documenting Environment Canada activities to reduce nutrient loading in the Lake Winnipeg Basin;
- The Progress Report on the Lake Winnipeg Basin Initiative 2012–2013 and 2013–2014 was published in January 2015 (www.ec.gc.ca/eau-water/default.asp?lang=En&n=BE1AD165-1);
- The Lake Winnipeg Basin Stewardship Fund Symposium was held in March 2015 and provided an opportunity for information exchange on LWBSF funded projects. Over 60 LWBSF stakeholders attended to hear 21 presentations on nutrient reduction projects conducted in the Lake Winnipeg Basin.

The Government of Canada also continued to provide support for community-based projects through the LWBSF with an increased funding envelope for Phase II. In 2014–2015, EC approved $1,453,891 for 30 LWBSF projects aimed at reducing nutrient loading in the Lake Winnipeg Basin. Since its inception in 2008, the LWBSF has provided over $6.7 million in federal funding for 88 stakeholder-driven projects ranging from wetland restoration to innovative waste-water treatment, and beneficial agricultural practices to cutting-edge scientific research. For every dollar provided by the fund, approximately $2.63 in additional partner funds and in-kind contributions were generated. In total, stakeholder-driven projects valued at over $23 million have benefitted the Lake Winnipeg Basin.

The LWBI continued to provide annual funding support to the Lake Winnipeg Research Consortium, which operates the *MV Namao* and *MV Fylgja*, two research and monitoring vessels. In addition, annual funding support was provided to the University of Manitoba for the Lake Winnipeg Basin Information Network, a web-based information portal for exchange of scientific information generated in the Lake Winnipeg Basin.

The LWBI emphasizes collaborative work with other governments (provincial, state, federal) and organizations within the Lake Winnipeg transboundary watershed. Domestic and international water management boards play a key role in managing nutrients in the Lake Winnipeg Basin. EC participates in a number of water science and water management boards to facilitate coordination of efforts across the watershed and

to help address nutrient loading originating from outside of Manitoba's jurisdiction.

Research and monitoring activities in 2014–2015 included the ongoing implementation of 13 projects in Lake Winnipeg and its watershed focusing on the identification of the sources and impacts of nutrient loadings to Lake Winnipeg. Work is well under way in a number of areas, including water quality monitoring of core transboundary sites and related main rivers.

Projects in 2014–2015 focused on:

- addressing knowledge gaps related to the impacts of human activity (particularly land use) on nutrients in Lake Winnipeg tributaries;
- addressing critical knowledge gaps in lake nutrient dynamics relative to changes in nutrient loads to Lake Winnipeg, by evaluating the spatial and temporal flux of nutrients from the watershed to Lake Winnipeg and evaluating the fate of these nutrients once in the lake, particularly in relation to harmful algal blooms; and
- developing predictive models in support of nutrient management in the Lake Winnipeg Basin.

4.6 Pacific and Yukon Region/ Okanagan Basin Water Board

During 2014–2015, EC committed over $200,000 to support projects across British Columbia and Yukon, including in the Okanagan Basin, Fraser Basin, Salish Sea and Yukon River Basin. These projects advanced the development and implementation of water balance models and ecosystem health indicators to support informed decision making, as well as to protect wetland habitat and biodiversity.

In the Fraser Basin, EC supported a collaborative project to develop a suite of indicators to characterize the state of the Nechako River Watershed. This will form the basis for further assessment of the health of the watershed, to inform actions and decisions of governments, business and individuals that share in the responsibility of improving the health of the watershed and the ecosystems, communities and economies that depend on it.

In the Okanagan Basin, EC completed field data collection under the Okanagan Lake Evaporation Study research project, in collaboration with the Okanagan Basin Water Board. The results of this work include the identification of major drivers of lake evaporation, estimation of evaporation rates, and provision of a mathematical model to forecast future evaporation scenarios. These results have enabled local decision-makers to be better informed about environment impacts.

Public Information Program (Part IV of the *Canada Water Act*)

There are a number of ways in which Environment and Climate Change Canada (ECCC) and its partners engage Canadians to learn more about the country's water resources and provide information on its sustainable use and conservation at a national level. These activities are discussed throughout the annual report, including in the section on ecosystem initiatives.

Environment and Climate Change Canada's websites

ECCC's Water website (www.ec.gc.ca/eau-water) continues to provide general information on a wide range of water-related topics, comprehensive educational materials (such as *A Primer on Fresh Water* and various fact sheets) and the full text of key water publications (such as the *Canada Water Act* Annual Report, the Federal Water Policy, and reports on municipal water use and pricing). In addition, the site provides content on ECCC's water-related activities and program areas.

ECCC's Wateroffice (www.wateroffice.ec.gc.ca) provides public access to real-time and archived hydrometric data collected in Canada. In 2014–2015, the Wateroffice website received over 62 million hits (approximately 1.2 M visits).

Real-time hydrometric data is also now available on ECCC's Datamart (http://dd.meteo.gc.ca/about_dd_apropos.txt), for partners to directly upload data into their own software systems.

Additional information can be obtained at:

Environment and Climate Change Canada
Public Inquiries Centre
7th Floor, Fontaine Building
200 Sacré-Coeur Boulevard
Gatineau QC K1A 0H3
Telephone: 1-800-668-6767 (in Canada only) or 819-997-2800
Email: ec.enviroinfo.ec@canada.ca