4.1 Introduction

The Four Parties have implemented programs and undertaken activities, both regulatory and voluntary, that have resulted in measurable improvements lakewide. Other actions have led to small incremental gains in localized areas. Remedial Action Plan (RAP) projects are reducing pollutants, cleaning up the environment, and restoring habitat in Areas of Concern (AOC). Joint federal/state and federal/provincial programs to reduce sources of pollutants to the lake have been ongoing under the Lake Ontario Toxics Management Plan (LOTMP). There is a renewed commitment, in the 1996 Letter of Intent signed by the Four Parties (see Appendix C) and in this Plan, to those LOTMP programs that have been working to restore the beneficial uses of the lake.

Environmental progress is evident in the reduced levels of contaminants in lake biota and other ecological improvements.

This chapter provides a summary of the progress, both programmatic and environmental, that has been made to date in Lake Ontario. In both the U.S. and Canada, there has been progress in fulfilling commitments that were made in the LOTMP, as well as in initiatives undertaken outside the scope of the LOTMP. Environmental progress is evident in the reduced levels of contaminants in lake biota and other ecological improvements.

4.2 Progress Under The LOTMP

The LOTMP has focused specifically on the reduction of persistent toxic contaminant loadings to the lake. Commitments were made by the Four Parties in 1989, 1991, and 1993, and include both existing and developing programs. Highlights of achievements under these programs are described below. A detailed table specifying LOTMP commitments and their status is provided in Appendix F.

Binational Activities

Niagara River Toxics Management Plan

The Niagara River Toxics Management Plan (NRTMP) was initiated in 1987 as a binational process designed to achieve significant reductions of toxic pollutants in the Niagara River. Eighteen priority toxics were identified and 10 (including Lake Ontario LaMP critical pollutants dioxin, mercury, mirex, and PCBs) were selected for 50 percent reduction because these were deemed to have Niagara River sources. The 1996 NRTMP progress report indicates that the Four Parties have made significant progress towards achieving the commitments made in the 1987 Niagara River Declaration of Intent. Remedial actions at sources have substantially reduced inputs of chemical pollutants to the Niagara River. A Letter of Support was signed by the Four Parties on December 3, 1996, to continue the commitment to the Declaration of Intent and to further actions to reduce loadings of toxic chemicals to the Niagara River.

NRTMP Letter of Support -- The Four Parties reaffirmed their commitment and set a new goal of reducing toxic chemicals in the river in order to achieve water quality that protects human health, aquatic life, and wildlife.

Point Sources — Under the Canadian portion of the NRTMP, the Ontario Ministry of the Environment (MOE) monitored the effectiveness of control actions at 21 Canadian point sources between 1986 and 1995. As of 1995, the number of Ontario point sources directly discharging to the Niagara River had been reduced to 16. The data show that the daily loadings of 18 priority toxics have been reduced by 99 percent over that period of time. None of the 10 chemicals targeted for 50 percent reduction were detected at any of the 15 facilities sampled in 1995.

Under the U.S. plan, the New York State Department of Environmental Conservation (NYSDEC) monitored the 29 most significant U.S. point sources of toxic pollutants to the river. Twenty-six of these dischargers are still operating. Between 1981/1982 and 1985/1986, NYSDEC reported an 80 percent reduction in 121 organic and inorganic priority pollutants from these significant point sources. Between 1985/1986 and 1993/1994, another 25 percent reduction was reported. The NYSDEC monitoring program does not specifically track the 10 chemicals of concern, although most of them are included in the suite of the United States Environmental Protection Agency (USEPA) priority pollutants reported.

Based on information available in 1987, the U.S. identified the Falls Street Tunnel as the largest of any of its point sources of toxic pollutants. The Tunnel was once a major unlined industrial sewer cut into the bedrock under the City of Niagara Falls. By the mid-1980s, it only received overflows of wastewater from the sewers of a Niagara Falls industrial area and contaminated groundwater from major waste sites that infiltrated through cracks in the bedrock. Unlike flows from other point sources, flows from the Falls Street Tunnel entered the Niagara River untreated. In 1993, USEPA and NYSDEC required the City of Niagara Falls to treat the contaminated water flowing in the Falls Street Tunnel during dry weather at the Niagara Falls treatment plant. Information gathered by the U.S. shows that wastewater treatment has reduced loadings to the river of mercury by 70 percent, tetrachloroethylene by 85 percent, and four other priority toxic chemicals by almost 100 percent. The Tunnel's wet weather flow is intermittent and, in 1994, averaged about 3 million gallons on overflow days. Monitoring by the City of Niagara Falls continues to better characterize the Tunnel's wet weather loads of toxic chemicals.

Non-Point Sources — Given the limited available information on non-point sources, the U.S. has proceeded with its actions based on the conclusions of the NRTMP that hazardous waste sites and contaminated sediments are the most significant non-point sources of toxic chemicals to the river.

Under their non-point source plan, USEPA and NYSDEC surveyed their hazardous waste sites and identified 26 sites believed to have the greatest potential for toxic pollutant loadings to the Niagara River. Accelerated

remediation schedules were established for these sites. To date, remedial construction has been completed at 8 of these sites, and remedial activities are underway at 10 sites. The remaining sites are under design or study. Based on various simplifying assumptions that are still being tested, USEPA estimates that remediations to date have reduced loadings to the river by at least 25 percent. USEPA also estimates that remedial activities to be completed by 1998 will reduce the loadings to the river by 90 percent. Remedial measures designed to minimize or eliminate offsite loadings of contaminants include removal and/or containment of contaminated soils and groundwaters, and treatment of contaminated groundwaters. All of the sites will be remediated by the year 2000.

Under the Canadian non-point source plan, MOE surveyed its landfills in a 1981-1984 study. Five municipal landfills were identified as having the potential to contribute contaminants to the river. Later studies conducted by MOE, in 1991 and 1993, showed that these landfills had minimal impact on the river.

Under Canadian and U.S. programs, contaminated sediments in several tributaries to the Niagara River have been cleaned up. Using innovative dredging techniques, 10,500 m^3 (13,800 yds^3) of sediments contaminated with heavy metals, oil, and grease were removed from the Welland River. Adjacent wetlands are being restored. About 6,000 m^3 (8,000 yds^3) of contaminated sediments were removed from Gill Creek and 22,000 m^3 (29,000 yds^3) of contaminated sediments were removed from Bloody Run Creek. Pettit Creek Cove was restored to a wetlands after 18,000 m^3 (23,500 yds^3) of contaminated sediments were removed.

The progress made at the hazardous waste sites and in tributary cleanups appears to be reflected in a preliminary analysis of biomonitoring data recently collected by MOE. Data were from caged mussels placed at the mouth of Bloody Run Creek and in the Pettit Flume. Bloody Run Creek was historically contaminated with dioxin from the Occidental Chemical Hyde Park site. As shown in Figure 4-1, the concentrations of dioxin in caged mussels in 1994 and 1995 are less than half those found in 1993, suggesting that remedial actions may have considerably reduced the bioavailability of pollutants to the Niagara River from this area. The preliminary data in Figure 4-2 also show that concentrations of several chlorobenzenes in caged mussels at Pettit Flume were considerably lower in 1995 than those found in previous years, suggesting the positive effects of remedial activities undertaken to date at Occidental Chemical Durez in North Tonawanda.

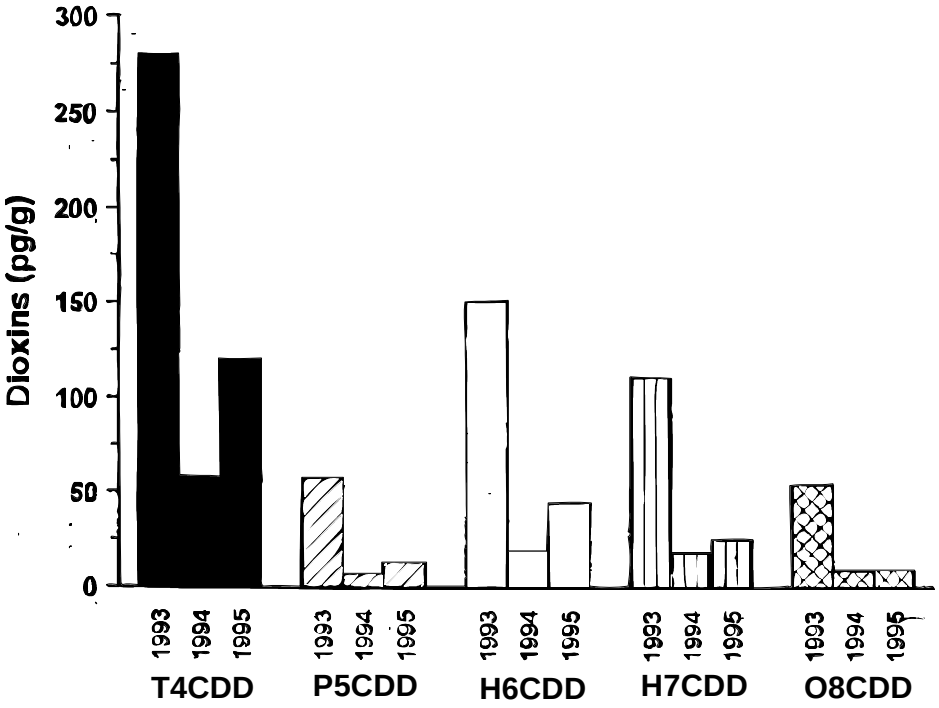


Figure 4-1. Caged Mussel Tissue Concentrations (n=1)
Niagara River, 1993-1995; Bloody Run Creek

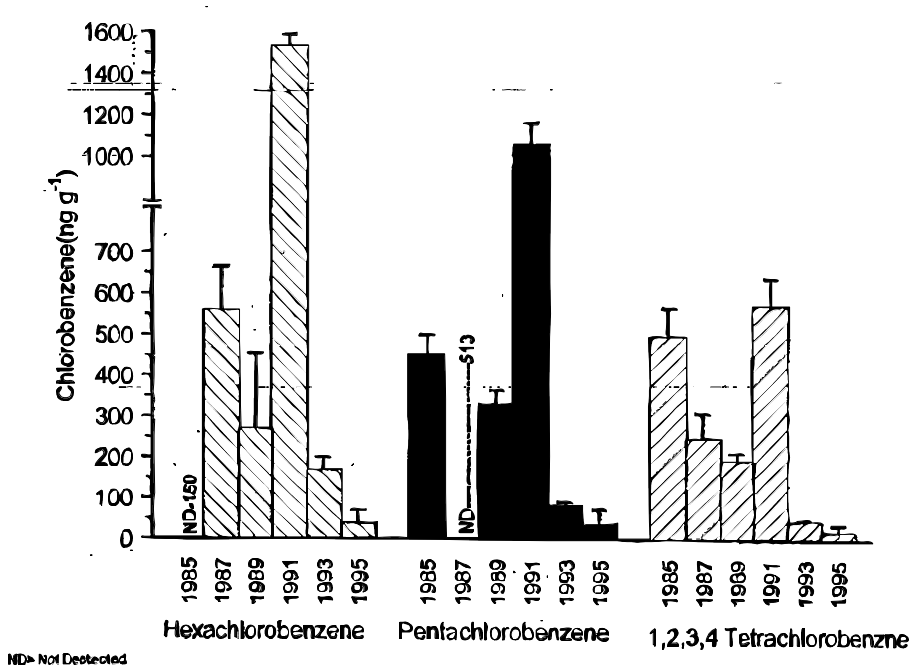


Figure 4-2. Caged Mussel Tissue Concentrations (mean±SD, N=3)
Niagara River, 1985-1995; Pettit Flume

Mass Balance Models

Mass balance models were developed that relate loadings of toxic contaminants to the lake to levels in water, sediment, and fish. These models provide an initial technical basis for determining load reduction targets, estimating how long it will take to meet these targets, and planning for additional measures necessary to achieve load reduction goals.

Draft Ecosystem Objectives

Draft ecosystem objectives were developed for wildlife, habitat, aquatic communities, human health, and stewardship. These have provided a basis for establishing targets, or ecosystem indicators, as a means to check on the effectiveness of remedial activities.

Setting Priorities for Toxic Chemicals

Toxic chemicals were categorized by comparing Lake Ontario ambient data (fish tissue, water column, and sediment) to U.S. and Canadian standards, criteria, and guidelines. This system is used to determine either that a toxic chemical warrants corrective action on a priority basis, or that it can be controlled more routinely through the implementation of existing and developing programs that apply to the control of all toxics.

United States Activities

Point Sources

The Clean Water Act (CWA) authorizes USEPA and approved states to administer the National Pollutant Discharge Elimination System (NPDES) program, which is the basic regulatory mechanism for controlling the discharge of pollutants from point sources to surface waters of the United States. The NPDES program was delegated to NYSDEC on October 28, 1975, and is referred to as the State Pollutant Discharge Elimination System (SPDES). New York's SPDES program regulates wastewater discharges to surface and ground waters, ensuring that all major industrial permits in New York's Lake Ontario basin include the best available technologies that are economically achievable for toxic pollutants, and all major publicly owned treatment works meet the requirements of secondary treatment or advanced treatment necessary to achieve water quality requirements. Permits have been revised to include more stringent limits as required to meet ambient *water quality standards*. In the New York portion of the Great Lakes basin, there is widespread compliance with SPDES permits. Through the SPDES program, NYSDEC also operates a data management system, compliance monitoring program, operator technical assistance program, enforcement program, and inspection program, as well as responds to citizen complaints and third party legal actions. USEPA and NYSDEC have established formal enforcement

processes to identify instances of significant non-compliance, and NYSDEC's enforcement program addresses all NYSDEC permit program violations of the approximate 1,620 universe of significant permitted dischargers in New York State. NYSDEC and USEPA conduct annual inspections at major facilities in the state. NYSDEC regularly updates permit development and enforcement data in the Permit Compliance System (PCS) national data base.

To achieve the LOTMP goal of 100 percent compliance with *Final Effluent Limits,* the Great Lakes Enforcement Strategy identified seven facilities with significant pollution violations in 1994. Follow-up activities returned three of these facilities to compliance; the remaining four are engaged in formal enforcement actions that will lead to the correction of their problems. All of the 39 major municipal dischargers are now in compliance with Final Effluent Limits (FEL) or have judicially enforceable schedules to meet FELs.

Pollution Prevention

New York State has banned the use of DDT, mirex, and dieldrin. Allowable uses of mercury have also been severely restricted. Production of PCBs and their use in the manufacture of new equipment are no longer allowed. Older equipment and transformers containing PCBs are being systematically removed from service and properly disposed.

In 1993, USEPA conducted pollution prevention inspections at seven industrial facilities in the Lake Ontario basin. These facilities included manufacturers of electrical insulators, treated wood products, and metal cans. As a result of the inspections, pollution prevention measures were implemented that eliminated about 43 percent (213,000 lbs.) of toxic chemical pollutants.

USEPA's *33/50 Program*, which was completed in 1996, targeted 17 toxic chemicals for reduction through voluntary partnerships with industries throughout the U.S. The program's goals were to reduce releases of the targeted chemicals by 33 percent, from 1988 to 1992, and by 50 percent by 1995. In New York State alone, 230 facilities participated in this program. 1994 data show a reduction of 49.8 million pounds of toxic chemicals (from a 1988 baseline of 72.9 million lbs.). Although still under review, these data demonstrate that the 50 percent goal has already been exceeded in New York.

Non-Point Sources

New York State's solid waste program promotes integrated waste management using the following priorities: 1) waste reduction; 2) recycling and reuse; 3) waste to energy; and 4) landfilling. New regulations require specific measures to be taken to safeguard public

health and the environment through monitoring, investigation, and the use of state of the art technologies. Solid waste facilities are required to demonstrate that recycling options have been explored. Programs within the Lake Ontario basin are working to achieve a 50 percent waste reduction/recycling target from 1989 levels, close the 55 environmentally unsound landfills, and close approximately 300 municipal, institutional, and private waste incinerators. All of these activities will contribute to achieving an overall reduction of emissions and releases of a wide variety of contaminants -- goals of the LOTMP.

New York State completed a registration program that compiles information on the installation, maintenance, and monitoring of bulk storage facilities. USEPA completed a user friendly data base and hotline which makes information on chemical spills more widely available to the public.

Hazardous waste treatment, storage, and disposal facilities (TSDFs) are managed under the federal Resource Conservation and Recovery Act (RCRA) through a permit process. Active waste facilities are required to meet minimum safety standards in the construction of facilities, treatment equipment, and storage tanks. Facility operators are also required to identify existing on-site contamination problems and to develop corrective action programs to address these problems. These facilities are also required to certify that waste minimization is an important component of the facility's operation. Forty-six hazardous waste management facilities operate in the Lake Ontario drainage basin on the U.S. side. Since 1988, eight of the nine hazardous waste land disposal sites have been or are in the process of being closed (e.g., these sites no longer accept hazardous waste). One facility (Chem Waste Management) currently operates an active land disposal facility and is in regulatory compliance. Thirty-five storage and treatment facilities are all in regulatory compliance, and 80 percent of these facilities are in the process of being closed. Two incinerator facilities are in regulatory compliance.

The LOTMP identified seven inactive hazardous waste sites in the Lake Ontario basin, under the federal Superfund program, where remedial actions had not been completed. Remedial actions at four of these seven sites have now been completed. Two of the remaining sites are under remedial construction and the other site is in design.

USEPA, in partnership with Erie County (New York), has established a "Clean Sweep" program to help farmers in the Lake Ontario basin dispose of unwanted and/or banned pesticides in an environmentally safe manner. Starting with a pilot program in Erie County, the Clean Sweep program has spread to 14 other New York State counties, and more are expected to be added. To date, over 120,000 pounds (gross) of agricultural hazardous or toxic products have been collected and properly disposed, including DDTs, dioxin-contaminated pesticides, chlordane, arsenic, lead, and mercury.

Clean Sweep (Pesticide Collection) Monroe County, New York
(Monroe County Cooperative Extension)

USEPA funded Genesee, Livingston, Orleans, and Wyoming Counties to hold two Household Hazardous Waste Collection Events in April 1996. The purpose of these events was two-fold: 1) to recycle or safely dispose of household hazardous waste; and 2) to educate the public about managing existing hazardous materials to reduce waste in the future. A total of 510 citizens participated in this event, and the following materials were collected: 3,717 pounds of pesticides, 86 pounds of dioxin-contaminated pesticides, 32,000 gallons of various hazardous materials, and other waste materials such as tires and lead acid batteries. Some materials were incinerated or landfilled, but as much as possible was recycled.

In January of 1990, USEPA approved NYSDEC's Non-point Source (NPS) Management Program, which makes recommendations for reducing the most significant sources of NPS pollution in waters of New York State. Since that time, USEPA has provided $19.17 million to NYSDEC for implementation of this program, including funding for local implementation efforts. Funding provided by USEPA is supplemented by New York State's Environmental Protection Fund (EPF). The EPF is a dedicated environmental fund that can be used to finance non-point source water pollution abatement and control projects. Six of the seven separate programs under the EPF provide funding to eligible recipients in the Lake Ontario watershed:

- Non-point Source Implementation Grants Program (non agriculture) whose eligible recipients are municipalities or entities designated to act on their behalf;

- Agricultural Non-point Source Abatement and Control Grants Program whose eligible recipients are County Soil and Water Conservation Districts;

- Title 3 and Title 5 Solid Waste Program whose chief goal is the funding of the proper closure of municipally-owned solid waste landfills;

- Open Space Program for the purchase of sites and easements that are listed in the State Open Space Conservation Plan;

- Agricultural Open Space Program for projects that implement approved local agricultural protection plans; and

- Title 11 - Local Waterfront Revitalization Program for the funding of planning and construction of projects including waterfront revitalization, public access, natural resource protection including water quality improvement, and water dependent uses and activities. Eligible recipients are cities, towns, and villages located along coastal areas of the state and certain inland waterways.

A number of other programs support the implementation of non-point source control projects in the Lake Ontario watershed including:

 # Clean Water State Revolving Fund (CWSRF)
Pursuant to the Clean Water Act, USEPA provides grants to NYSDEC to help capitalize the CWSRF, enabling NYSDEC to provide loan assistance for non-point source projects. To be eligible for CWSRF financing, a project must be publicly-owned and the primary purpose of the project must be water quality protection.

 # Clean Water/Clean Air Bond Act of 1996
In November 1996, New York voters approved the expenditure of $1.75 billion for the Clean Water/Clean Air Bond Act. A portion of these funds will be used to construct non-point source projects. Projects located within specific geographic areas and identified as a need in water quality management plans (including the Lake Ontario LaMP) will receive a higher priority for funding.

 # Environmental Quality Incentives Program (EQIP)
This program is derived from the 1996 Federal Farm Bill. It is designed to provide grants to farmers for eligible conservation practices including those whose primary purpose is water quality protection.

 # Conservation Reserve Program
Like the EQIP Program, this is a new program derived from the 1996 Federal Farm Bill. It is designed to provide grants to farmers, land owners, and producers for eligible conservation practices including those whose primary purpose is water quality protection and wildlife management.

 # Skaneateles Lake Watershed Agricultural Program
This program was created by the City of Syracuse. The primary emphasis is to ensure the long-term protection of the water supply source for the people served by this water system. The funding takes the form of "whole farm planning" and covers a multitude of point and non-point source pollution abatement projects within the Skaneateles Lake Watershed.

 # Clean Vessel Assistance Program
With funds provided by the U.S. Department of the Interior's Fish & Wildlife Service, NYSDEC assists local marina operators to install pump-out facilities. Approximately $2 million in grants has been provided to date to fund these activities.

Canadian Activities

Activities conducted by Canadian federal and provincial agencies have focused on addressing the sources, fate, and impacts of persistent toxic substances. These activities have, in large measure, addressed the commitments under the LOTMP. The LOTMP list of priority pollutants was derived based on these individual or binational activities (see Appendix B). This list, along with the chemicals identified in the Niagara River Toxics Management Plan, the Lake Superior Binational Program, and the International Joint Commission's list of 11 priority chemicals subsequently provided the basis for Canada's and Ontario's Tier I substance list. Tier I substances are targeted for virtual elimination in the 1994 Canada-Ontario Agreement respecting the Great Lakes Basin Ecosystem (COA). COA has adopted the philosophy of zero discharge for local or direct sources, and the agency activities under COA (described more fully in section 4.3 and Chapter 5) have targeted the chemicals PCBs, mirex, dieldrin, DDT, dioxins, and mercury, which are also critical pollutants of the Lake Ontario LaMP.

Point Sources

Since 1993, Ontario has promulgated Clean Water Regulations under its MISA (Municipal and Industrial Strategy for Abatement) program for nine industrial sectors: organic chemicals, iron and steel, pulp and paper, petroleum refineries, metal casting, metal mining, inorganic chemicals, industrial minerals, and electric power generation. Initiated in 1988, these regulations predate the LaMP, but recognize the LOTMP goals and objectives in that the MISA goal is to ensure necessary treatment or technology is applied to direct discharges to eliminate toxicity or local impacts and achieve the virtual elimination of persistent toxic and bioaccumulative substances. The regulations provide for reductions of toxic contaminants that are discharged to Ontario's waterways and stipulate that these discharges must not be acutely lethal to fish or water fleas. The goal for the 34 regulated plants located within the basin is the use of best available treatment technologies to substantially reduce pollutant loadings. Compliance with the MISA regulations will achieve more than a 70 percent reduction in the release of toxic pollutants to the waters of Lake Ontario by 1998. The virtual elimination of releases of persistent toxic substances, such as dioxins, is one benefit of this activity.

New federal pulp and paper regulations, effective in 1992, apply to eight pulp and paper mills in the Lake Ontario basin, five in the St. Catharines/Thorold area and three in the Bay of Quinte. These regulations prevent the formation of highly toxic dioxins and furans and also set stringent controls on acute toxicity.

Pollution Prevention

Canada and Ontario have established a number of voluntary partnerships with industrial and commercial associations, communities, municipalities, and member companies to prevent toxic chemical discharges to the Great Lakes. These partnerships use a variety of instruments, such as Memoranda of Understanding (MOUs) and the Pollution Prevention Pledge Program (P_4). Voluntary projects under these programs are designed to target reductions in the use, generation, and release of toxic substances, such as chlorinated solvents, volatile organic carbons, and PCBs.

Substantial progress has occurred as a result of pollution prevention projects. The Auto Parts Manufacturers, Chemical Producers, and Metal Finishers reported a reduction of over 16,000 metric tonnes of toxic substances and wastes, province-wide, by the end of 1995. An additional reduction of 21,000 metric tonnes has been reported by facilities involved in the P_4 program. The Motor Vehicle Manufacturing Association has reported reducing/eliminating over 800 metric tonnes of PCBs from plants located in the Lake Ontario basin.

The national program, Accelerate Reduction/Elimination of Toxics (ARET) also focuses on voluntary reductions of emissions; 101 substances are targeted for reduction from either direct or indirect industrial discharges to air, land, and water. The goal is a 90 percent reduction of persistent bioaccumulative toxic emissions and a 50 percent reduction of other toxic substance emissions by the year 2000. Under the ARET challenge, a total of 287 organizations across Canada have responded, over 100 of which are located in Ontario. Together, these facilities have committed to voluntary reductions in emissions of toxic substances of nearly 17,500 metric tonnes nationally (as of year-end 1995). By tying this voluntary program to the national Pollutant Release Inventory, which requires an annual reporting of 187 chemicals, the amounts of chemicals reduced will be tracked.

Non-Point Sources

MOE, in conjunction with municipalities, has implemented measures designed to improve water quality and restore degraded areas. To abate sewer overflows and stormwater discharges, combined sewer overflow (CSO) storage facilities have been constructed and sewage treatment plant operations have been changed to reduce CSO by-passes. MOE financially supported a number of abatement projects in communities in the Lake Ontario basin. These projects will significantly reduce beach pollution, control algae problems, and enhance nearshore

aquatic ecosystems that have been stressed by contaminants from combined sewer overflows and stormwater. MOE has also developed several guidance documents and procedures to assist communities in the development of stormwater management/CSO control measures and the preparation of sub-watershed management plans.

Farmers in Ontario are developing and implementing Environmental Farm Plans (EFPs) with up to $5.6 million in support through the year 2000 from the Agriculture Adaptation Council. A number of agricultural organizations, such as Ontario Soil and Crop Improvement Association, Ontario Federation of Agriculture, AgCare, and the Christian Farmers Federation, are lending support. The Ontario Ministry of Agriculture, Food and Rural Affairs (OMAFRA) will continue to provide technical support to the EFP initiative. Approximately 10,000 farmers have voluntarily attended farm plan workshops, and 5,186 approved integrated action plans and implementation strategies are in place to improve pest management and control erosion and agricultural runoff from farms.

Over the past five years, the partnership of OMAFRA and the Crop Protection Institute, MOE, and AgCare has instituted an Agricultural Pesticides Container Collection Program. One million containers have been collected over the past two years. These containers are then recycled into agricultural products, such as 475,000 fence posts in 1996. By diverting containers from landfill sites, this program reduces the potential for environmental impacts from the residual pesticides in the container. The number of containers collected is expected to decrease in forthcoming years because more efficient pesticide use results in the generation of fewer containers. Ontario has banned the use of several of the Lake Ontario critical pollutants (DDT, dieldrin, and mirex) and, in cooperation with Environment Canada (EC), recently confirmed that no legal use is taking place in Ontario. Long-standing restrictions on the use of PCBs to closed systems have prevented any deliberate releases to the ecosystem; accidental releases are a possibility, which is why the decommissioning and destruction of PCBs are being accelerated in Ontario.

Remedial Action Plans in Areas of Concern

Remedial Action Plan development and implementation continues in the Niagara River, Hamilton Harbour, Toronto Harbour, Port Hope, Bay of Quinte, Oswego, Rochester Embayment, and Eighteenmile Creek Areas of Concern. Table 4-1 outlines the status of RAP development for all Lake Ontario Areas of Concern. RAPs are developed and implemented in three phases:

1) problem definition,
2) recommended actions and implementation plan, and
3) monitoring to confirm restoration of beneficial uses.

		Stage 1	Stage 2	Stage 3
Canadian Remedial Action Plans	Hamilton Harbour	X	X*	
	Metro Toronto	X	X	
	Port Hope	X		
	Bay of Quinte	X	X	
Niagara River	Canada	X	X	
	U.S.	X	X	
United States Remedial Action Plans	Oswego River	X	X	
	Rochester Embayment	X	X	
	Eighteenmile Creek	X	X	

*Hamilton Harbour's Stage 2 includes an implementation annex.

Table 4-1. Status of RAP Development

In addition to RAPs, other local environmental planning efforts are underway that will contribute to a reduction in Lake Ontario critical pollutants. These efforts include a wide range of pollution prevention programs. For example, the Onondaga Lake Management Conference (OLMC), in the Syracuse area, is developing a comprehensive restoration, conservation, and management plan to coordinate a wide range of state, federal, and local efforts aimed at improving the environmental quality of Onondaga Lake. Although this plan is primarily focused on conventional pollutants common to most municipal sewage systems, the plan also identifies waste sites that contain Lake Ontario critical pollutants, such as PCBs. The OLMC makes specific action recommendations to ensure that contaminants at these waste sites, which include Lake Ontario critical pollutants, will be fully addressed.

4.3 Progress Under Initiatives Outside the Scope of the LOTMP

Lake Ontario Specific Initiatives

United States Activities

USEPA and NYSDEC are conducting a "Source Trackdown" project in order to facilitate the identification and remediation of contaminant sources to the lake. "Trackdown" involves the use of qualitative tools (Passive In-Situ Chemical Extraction Samplers, or "PISCES") for organic sampling in order to find tributaries that have the highest concentrations of PCBs. Once these tributaries are identified, the PISCES are moved upstream to trackdown the source of the contamination. The findings of the initial sampling are provided in NYSDEC's April 1996 report entitled "Trackdown of Chemical Contaminants to Lake Ontario from New York State Tributaries". USEPA and NYSDEC are forming a federal/state workgroup to use the findings of this report to focus source reduction efforts on the most contaminated sub-basins throughout Lake Ontario, as well as to confirm unknown sources, determine the effectiveness of remediation activities, and plan follow-up sampling activities. NYSDEC has conducted similar sampling efforts in the Niagara River. Additionally,

NYSDEC developed and maintains a Great Lakes Sediment Inventory to identify hot spots of contaminated sediments and to prioritize remediation efforts.

USEPA and NYSDEC have implemented a long-term plan to improve modeling capabilities, with a small but steady outlay of funds, to increase confidence in the use of models over time and obtain results that can be practically applied. The Great Lakes Research Consortium (GLRC) has been funded to determine the steps necessary to enhance existing models for Lake Ontario. These agencies expect to be able to implement a set of improvements each year and hope to obtain matching funds from interested parties. USEPA and NYSDEC will consult with Canadian scientists/modelers in the development of this program. The agencies expect to make incremental improvements over an approximate 10 year time period. The program will be evaluated annually and necessary modifications will be made.

Canadian Activities

EC has completed the demonstration of a number of contaminated sediment removal and treatment technologies from around the world. Many of these technologies have been used in completing full-scale sediment removal and cleanup along Toronto's waterfront (47,000 m^3) and others have been demonstrated in Hamilton Harbour.

EC has also been working closely with municipalities and MOE to demonstrate cost effective solutions to control urban drainage and CSOs, as well as optimize sewage treatment plants. In Hamilton, the installation of two CSO settling tanks has resulted in the opening of beaches at the revitalized Pier 4 Park and the new Harbourfront Park. Throughout Lake Ontario communities, the Cleanup Fund and MOE are working with municipalities and research agencies to retrofit stormwater ponds for improving water quality. Pollution Control Plans that identify sources of urban drainage pollution and recommendations for their control have also been undertaken at St. Catharines, Toronto, Hamilton-Wentworth, Scarborough, Kingston, and Belleville. In addition, two Metro Toronto waterfront improvement planning projects have been completed.

A preliminary Historical Land Use Inventory was prepared for the Waterfront Regeneration Trust's Lake Ontario Greenway which extends from Burlington to Trenton along the north shore of Lake Ontario. This inventory consists of locations of past and current land uses that could have caused contamination of structures, soils, groundwater, and/or surface water.

Great Lakes-wide or State/Province-wide Initiatives

United States Activities

The Great Lakes Water Quality Guidance (GLWQG) represents a major United States-specific effort to reduce the loadings of persistent bioaccumulative chemicals of concern (BCCs) to the Great Lakes basin and establish consistency among the water pollution control programs of the U.S. Great Lakes States. The final GLWQG is the result of the 1990 Great Lakes Critical Programs Act, which required USEPA to develop and publish the GLWQG. The eight Great Lakes States have completed the adoption process and are beginning to implement the regulations, policies, and procedures contained in the Guidance. More details on the effects of New York's implementation of the Guidance are provided in Chapter 5.

Over the last five years, USEPA has published hazardous air pollutants (HAP) emission standards for many industries. These Maximum Achievable Control Technology (MACT) standards will require about 80 percent HAP emission controls from chemical, refining, coke-ovens, chromplating, degreasing, dry-cleaning, and other industries. These standards also require sources to control fugitive emissions and are expected to reduce the air emission loading substantially. NYSDEC is currently planning to modify its air toxics program to meet the MACT program.

A workgroup of the eight Great Lakes States and three USEPA Regions was formed in 1992 to develop an Enforcement Strategy to ensure consistent enforcement for persistent toxic substances in the Great Lakes. The Great Lakes Enforcement Strategy was issued on September 17, 1993, and was implemented beginning October 1, 1993. Since that time, the number of critical pollutant violations has been reduced by 30 percent, and point source loadings for these pollutants have also diminished.

Canadian Activities

In Canada, the implementation of the Great Lakes Water Quality Agreement is a shared federal-provincial responsibility. The COA was signed in 1994 and follows federal/provincial agreements which have been in place since 1971.

The Second Progress Report under the 1994 Agreement was released in the fall of 1997 and focuses on the progress achieved toward the reduction of substances of concern by Canada, Ontario, and their partners, since the publication of the First Progress Report in September 1995:

- Forty-six percent of the high level liquid PCBs in Ontario have been decommissioned (i.e., placed in storage) from a baseline of 10,650 metric tonnes. Thirty percent of the high level PCB wastes in Ontario have been destroyed from a baseline of 18,600 metric tonnes. Twenty percent of the stored low level PCB wastes have been destroyed from a baseline of 98,000 metric tonnes.

- Total releases of seven Tier I substances targeted for 90 percent reduction have been estimated at 22 metric tonnes per year. Some reductions have occurred with respect to alkyl-lead (85%), octachlorostyrene (18%), dioxins and furans (66%), and B(a)P (20%). Reductions have occurred in the release of four of the eight Tier II substances: cadmium (20%), 1,4-dichlorobenzene (40%), PAH (30%), and pentachlorophenol (5%).

- COA Target Achieved: Based on a comprehensive review, no legal commercial use or availability within Ontario's commercial sectors of the five priority substances (aldrin/dieldrin, chlordane, DDT, toxaphene, and mirex) have been confirmed.

- Some success has been achieved in attaining industry commitments and implementation of pollution prevention programs province-wide. Reductions reported through MOUs include:

  -- 1,600 metric tonnes volatile organic compounds;
  -- 1,500 metric tonnes hydrocarbons;
  -- 660 metric tonnes wastewater treatment sludges;
  -- 450 metric tonnes metal working fluids; and
  -- 330 metric tonnes paints/paint sludges.

In 1996, two new guidelines were introduced in Ontario which will contribute to Canada's overall load reduction effort in the Lake Ontario basin. An Incineration Guideline includes stringent emission limits for new municipal incinerators. The new guideline is based on emission levels that are protective of the environment and human health and requires the best currently available technology. This requirement is equivalent to the limits imposed in other jurisdictions. Guidelines for Use at Contaminated Sites in Ontario (Decommissioning Guidelines) have replaced existing guidelines and provide clearer direction and information on approaches to managing and restoring contaminated sites.

4.4 Progress In Improving Fish and Wildlife Habitat and Populations

Many habitat restoration and protection projects are underway in the Lake Ontario basin (Figure 4-3). The following information provides some highlights of the projects supported, in part, by federal, provincial, and state agencies as well as various county, conservation authority, municipal, and private organizations.

Over the last two decades, governmental regulations protecting lake-connected wetlands, shorelines, and *littoral* zones have significantly reduced the rate of loss of these valuable habitats. Since the loss of significant wetland and shoreline habitats has been curtailed, more attention is now being given to identifying the opportunities to restore and replace degraded or lost habitats.

United States Activities

Several New York State habitat restoration and protection projects are being conducted through the cooperative efforts of county, city, local, and private organizations as well as state and federal agencies. The New York

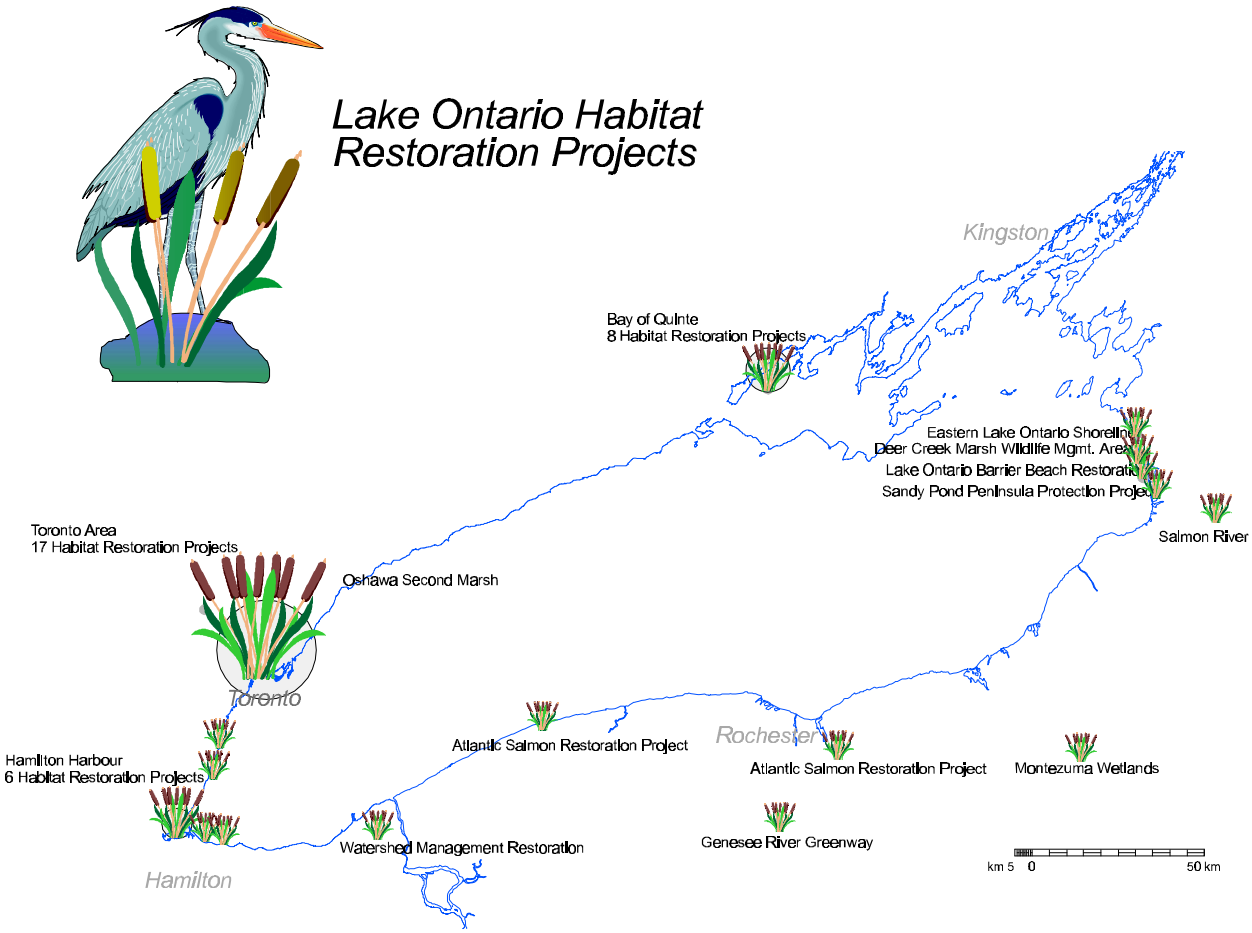


Figure 4-3. ***Lake Ontario Habitat Restoration Projects*** [Many local restoration projects are in progress or proposed in the Lake Ontario basin which are not highlighted in this figure.]

State Open Space Conservation Plan provides a statewide process to identify and acquire undeveloped habitats. The state works in partnership with local governments, non-profit conservation organizations, and private landowners to establish and achieve land conservation goals. Funding for the program is provided by the state's Environmental Protection Fund and, where possible, leveraged by federal and other sources of funding. Ongoing habitat acquisition programs include: Salmon River Corridor, Northern Montezuma Wetlands, Genessee Greenway, and Eastern Lake Ontario shoreline.

The Ecological Protection and Restoration Program of USEPA's Great Lakes National Program Office provides funding for a variety of Great Lakes habitat restoration projects. For Lake Ontario, projects include: wetland creation in the Lower Genessee River/Irondequoit Bay; barrier beach and wetlands habitat restoration on the Lake's shoreline; barrier beach restoration and stabilization; public education; creation of wildlife nesting habitat and exotic vegetation control at Deer Creek Marsh Wildlife Management Area; and protection and restoration of Sandy Pond Peninsula.

Wildlife population rehabilitation occurs primarily indirectly through habitat creation and restoration projects. However, direct efforts are currently underway to assist the recovery of river otter populations in the Lake Ontario basin. In 1995, the non-profit New York River Otter Project began the process of introducing nearly 300 river otters to the Lake Ontario basin.

Canadian Activities

EC's Cleanup Fund is currently supporting, in conjunction with its many partners, more than 30 habitat rehabilitation projects in the Lake Ontario watershed. These projects, primarily in Toronto, Hamilton, and the Bay of Quinte, include creating various nesting and loafing areas for birds such as eagles, ospreys, and terns; enhancing fish spawning habitats; improving littoral and deep water habitats; improving fish access; rehabilitating and creating riparian habitat; and placing structural fish habitat in the form of shoals, reefs, brush bundles, and log cribs. Other projects focus on coastal wetland rehabilitation and reforestation activities on flood plains and stream banks. A total of 76 projects has been initiated in the Lake Ontario basin since 1990. The Cleanup Fund's support of these projects is over $16 million, with additional partners contributing $33 million.

In the Lake Ontario basin, by March of 1996, 45 km of riparian and 40 hectares (ha) of wetland habitats had been rehabilitated as a result of project activities supported by the Cleanup Fund and its partners.

Rehabilitation of an additional 18 km of riparian habitat and 409 ha of wetlands is in progress. Further, approximately 80 km of riparian habitat has been protected through activities associated with the rehabilitation projects.

Re-establishing aquatic vegetation at Bluffers Park, Toronto, Ontario
(Metro Toronto Region Conservation Authority)

Throughout Lake Ontario, initiatives are underway that will benefit other rehabilitation projects such as techniques for the control of carp, nesting platforms, re-establishing tall grass prairie, erosion control using bio-engineering techniques, and techniques to prevent wildlife from consuming newly planted vegetation.

Canada's Great Lakes Wetlands Conservation Action Plan (GLWCAP) is a five year plan that focuses on the conservation of coastal wetlands along the lower Great Lakes. A priority acquisition list for coastal wetland sites has been developed (Great Lakes Wetlands Conservation Action Plan, 1995a). Of the 15 sites identified, 10 are on Lake Ontario; several of these are marsh complexes rather than single discrete sites. Specific actions and priority areas for protection and rehabilitation have also been identified, including 5 along the western Lake Ontario shoreline between the Niagara River and Hamilton, 17 along the northern shore, and the remainder in eastern Lake Ontario (Great Lakes Wetlands Conservation Action Plan, 1995b). GLWCAP is being implemented through a cooperative partnership between governments and non-governmental organizations in Canada. So far, nearly 900 hectares of wetlands have been protected at priority Lake Ontario sites.

The Waterfront Regeneration Trust, a Crown Corporation, was created by a provincial act of the Legislature and received royal assent in 1992. Working with a steering committee consisting of representatives of waterfront municipalities, conservation authorities, provincial and federal ministries, and community groups, the Trust prepared and published the Lake Ontario Greenway Strategy in 1995. The strategy describes the actions needed to regenerate the waterfront from Burlington Bay to Trenton by protecting and restoring ecological health, and developing community and economic vitality. Between 1993 and 1995, the Waterfront Regeneration Trust conducted a natural heritage study, identifying significant natural areas and corridors along the north shore of Lake Ontario. This natural heritage system has been mapped on GIS and a database of associated sources of information has been tagged to each area ("A Natural Heritage Strategy for the Lake Ontario Greenway"). The Trust has also conducted an analysis of coastal processes along the north shore ("Shore Management Opportunities for the Lake Ontario Greenway").

Binational Activities

Fish population restoration activities are managed jointly by the natural resource agencies with jurisdiction for Lake Ontario. These include the Ontario Ministry of Natural Resources (MNR), the Department of Fisheries and Oceans (DFO), the U.S. Fish and Wildlife Service (USF&WS), and the NYSDEC. A binational process to develop Fish Community Objectives is underway, led by MNR and NYSDEC, and including public consultation. This process will produce long term directions for management actions such as fish stocking and habitat protection. The development of Fish Community Objectives by the Lake Ontario Committee will take into consideration a variety of interests including commercial and recreational fisheries, stocking policies, and food web dynamics. The rehabilitation of lake trout is guided by the Joint Plan for Rehabilitation of Lake Ontario Lake Trout (Schneider *et al.*, 1995). Some progress has been achieved. By 1994, natural production of lake trout in the Kingston Basin had been documented for several years (Rawson *et al*., 1994). The survival rate of adult lake trout in 1994 and 1995 exceeded the rehabilitation target of 60 percent per year. In addition, mortality induced by sea lamprey wounding has been reduced.

Efforts to restore partial self-sustainability of Atlantic salmon populations have been limited due to the damming, deforestation, and stream modification of tributaries used for spawning, as well as competition with rainbow trout.

There has been a dramatic recovery of lake whitefish and walleye populations in the east end of the lake. More active management could contribute to the further recovery of these native species.

4.5 Environmental Trends in the Lake Ontario Ecosystem

Due in part to the programs and initiatives described above, environmental progress has been documented in Lake Ontario, both in the reductions of levels of contaminants found in the organisms, water quality, and sediments within the lake and in the population numbers and reproductive success of various species found in the Lake Ontario basin. The following sections will provide a summary of trends for the lake, based on monitoring of fish and lower trophic species, water quality, and sediment during the last 20 to 25 years.

Trends in the Niagara River

The agencies' efforts to reduce point and non-point sources of toxic chemicals, combined with other widespread efforts, such as pollution prevention programs, may account for the overall reductions in toxic chemical levels that the Four Parties have observed in water, fish, and sediment data.

The Upstream/Downstream water sampling program operated by EC shows substantial decreases in the concentrations of several chemicals (e.g., octachlorostyrene, hexachlorobutadiene, and mirex). These data can be used as indicators of progress in reducing the concentrations of chemical pollutants in the river (Figures 4-4, 4-5, and 4-6). The data show decreases, not only in overall concentrations, but also in the number and magnitude of the “spikes”.

Spottail shiner (fish) monitoring data show that PCB concentrations have decreased substantially from the 1970s to the 1980s, although the decreases appear to have slowed or reversed in the latter half of the 1980s (Figure 4-7). The reasons for the recent trends are being investigated.

Sediment cores collected from the bottom of Lake Ontario at the mouth of the Niagara River tell the history of chemical inputs from the river to the lake, because many toxic pollutants are transported through the water attached to suspended sediments that eventually settle to the lake bottom. Analyses of core sample segments can show the concentrations of chemicals on deposits from different time frames. The results presented in Figures 4-8 and 4-9 show that the input of toxic chemicals associated with suspended sediment from the river has declined, most significantly between 1960 and 1990. The results were similar for all priority toxic chemicals. Figure 4-9 also shows a column entitled "MOE’s LEL (Lowest Effect Level)", that indicates the level at which a toxic contaminant can be expected to begin to affect some benthic organisms. The surface concentrations of all priority chemicals, except PCBs, in these core samples are now less than these toxic levels.

Fish-Eating Birds

Over the last 20-25 years, perhaps the most dramatic examples of the effects of toxic chemicals in the Great Lakes have been associated with fish-eating birds.

The fish-eating bird community in Lake Ontario is dominated by two species: gulls and cormorants. While the numbers of birds within these species have increased dramatically in the last 20 years, other species have remained relatively stable. Reproductive failures of cormorants from severe eggshell thinning, during the 1960s and 1970s, are associated with high levels of DDE in the cormorant diet. Cormorant numbers began to recover in the 1970s, coinciding with bans on the use of DDT products. The cormorant population exploded in the 1980s. In recent years, the rate of increase in the cormorant population has slowed, perhaps in response to declining food supplies, habitat competition, and

Herring Gull
(National Park Service, Indiana Dunes National Lakeshore)

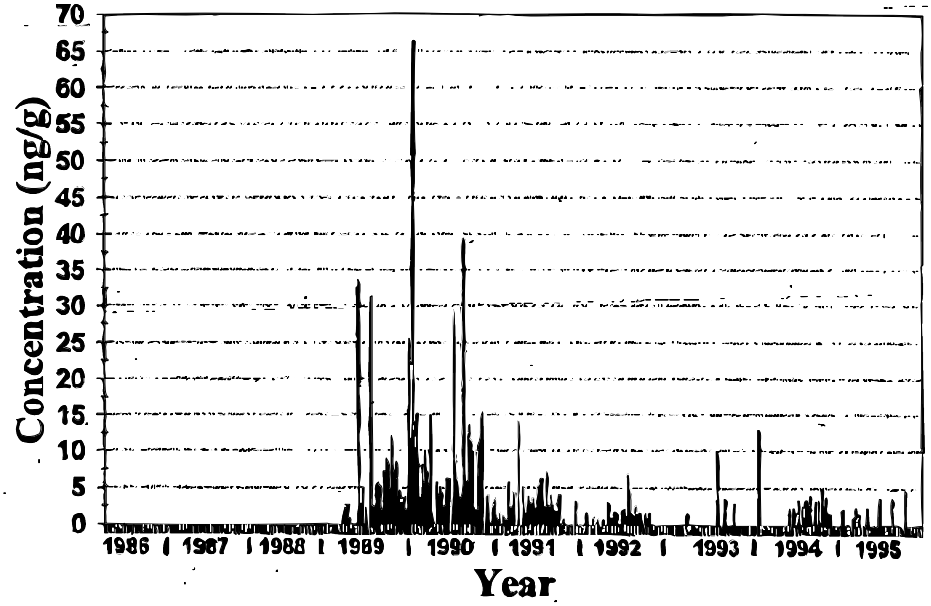


Figure 4-4. OCS Concentrations on Suspended Solids at Niagara-on-the-Lake, 1989-1995 (sampling begun 1989)

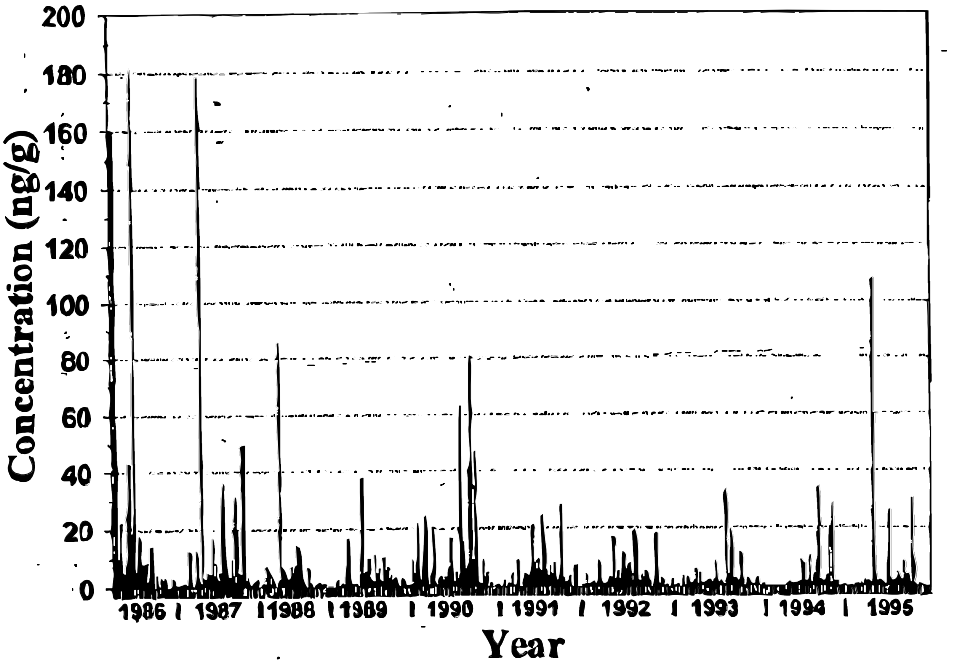


Figure 4-5. HCBD Concentrations on Suspended Solids at Niagara-on-the-Lake, 1986-1995

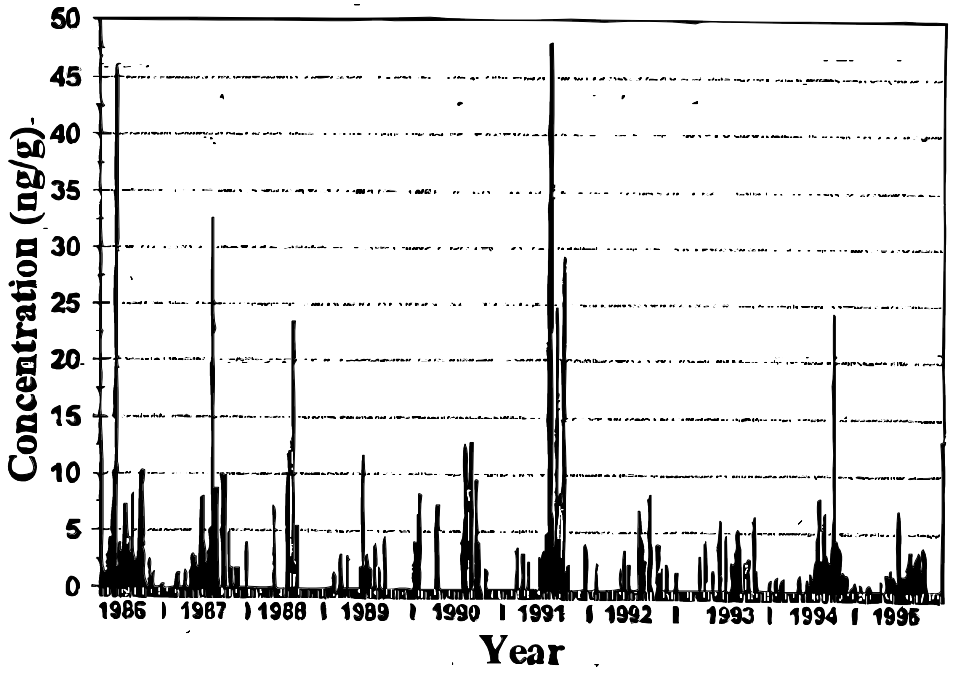


Figure 4-6. Mirex Concentrations on Suspended Solids at Niagara-on-the-Lake, 1986-1995

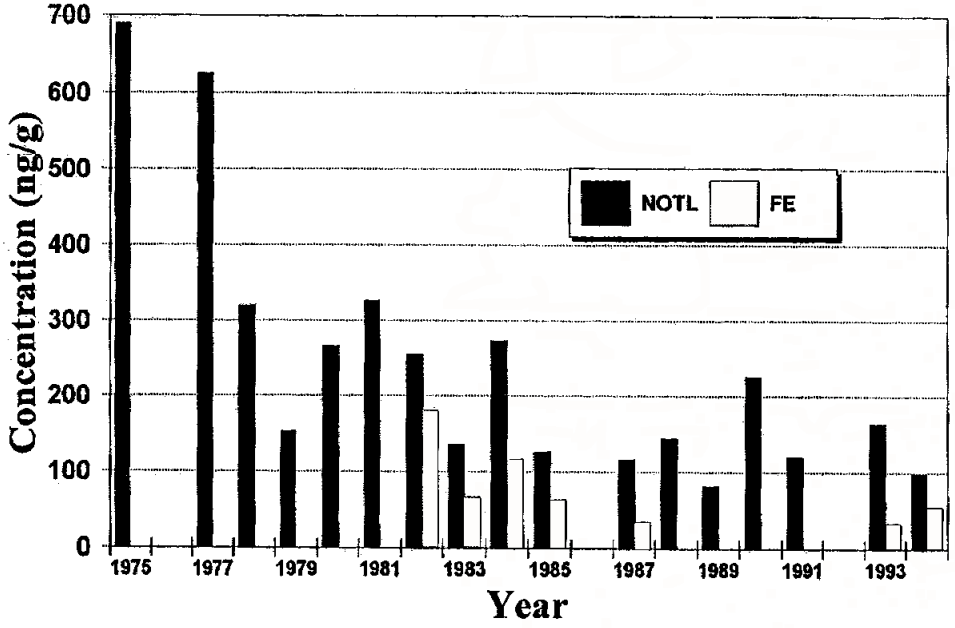


Figure 4-7. PCB Concentrations in Spottail Shiners at Fort Erie and Niagara-on-the-Lake

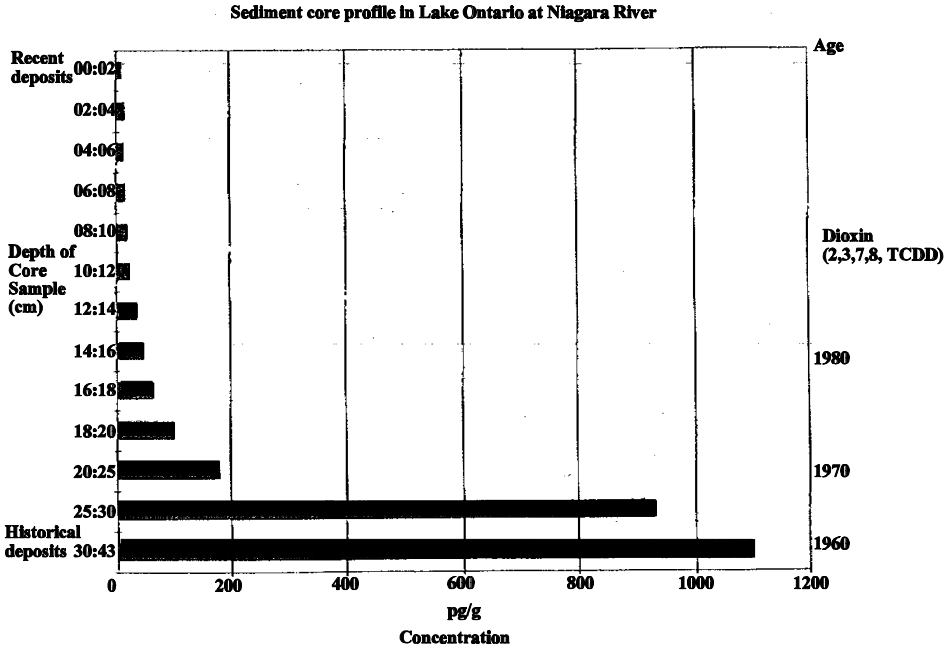


Figure 4-8. Dioxin analyses of sediments from the mouth of the Niagara River, taken at various depths below the lake bottom, show that levels of this contaminant decreased significantly between 1960 and 1980.

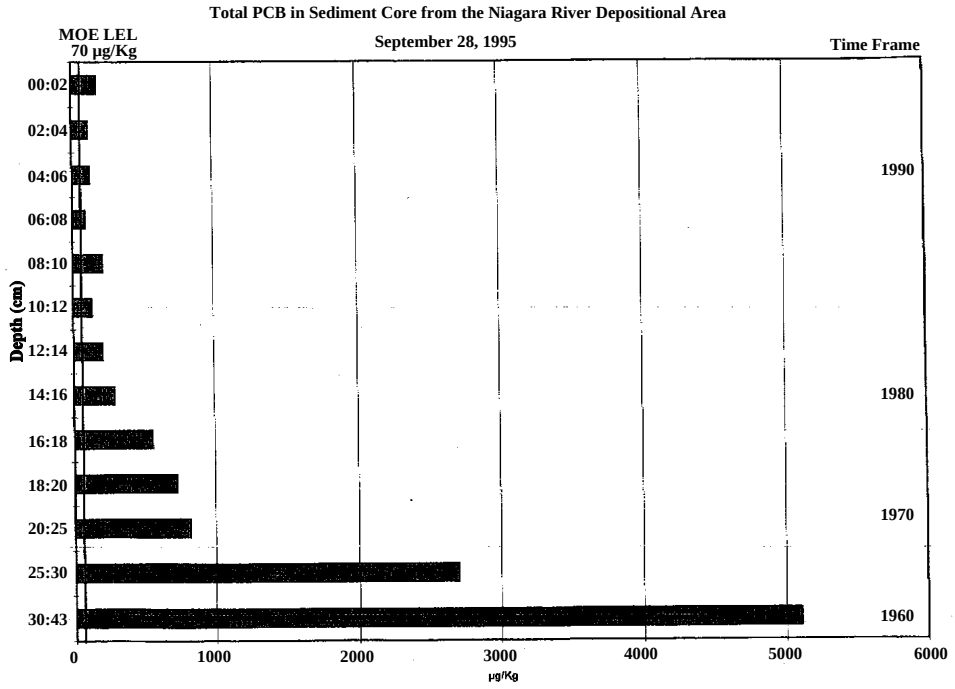


Figure 4-9. Total PCB congener analyses of sediments from the mouth of the Niagara River, taken at various depths below the lake bottom, show that levels of this contaminant decreased significantly between 1960 and 1980. Although PCBs have decreased significantly, current levels continue to exceed Ontario Ministry of the Environment's (MOE) lower effect level sediment quality guideline.

predation. In a similar pattern, the low reproductive success rate of herring gulls in the 1960s and 1970s shifted to a full recovery, with no signs of contaminants, by the early 1980s.

The direct correlation of load reduction activities and ecosystem improvements, such as reduced contaminants in herring gull eggs, is further illustrated in Figures 4-10 and 4-11. PCB levels in herring gull eggs decreased by an order of magnitude from the mid-1970s to the late 1980s; dieldrin levels decreased by 80 percent and some Lake Ontario colonies have shown reductions of more than 90 percent. Dioxin (2,3,7,8 TCDD) levels declined dramatically until 1982. The rate of decline in dioxin levels has been much slower since 1982, and this contaminant is still an issue for Lake Ontario. Levels of dieldrin in herring gull eggs have declined. For example, dieldrin concentrations in herring gull colonies in the eastern part of the lake declined from 0.36 ug/g in 1982 to 0.12 ug/g in 1992.

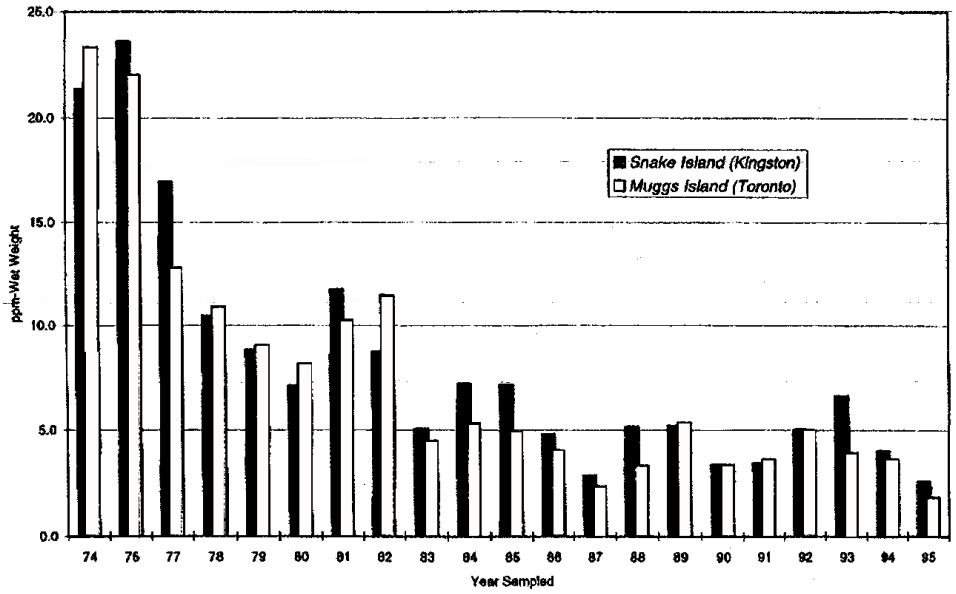
Populations of bald eagles, once plentiful in the Great Lakes basin, also suffered as a result of toxic contaminants in the ecosystem. With efforts to reduce contaminant levels and provide nesting platforms, the return of the bald eagle to the Lake Ontario shore is anticipated. In 1993, 20 bald eagle breeding territories were confirmed in New York State. Six breeding territories are located in the Lake Ontario basin and one breeding territory is within 8 kilometres of the shore. New York's bald eagle population is estimated to be growing at an annual rate of between 15 and 30 percent since 1988 (Nye, 1992).

Fish

Information on contaminant levels in Great Lakes fish provides a comprehensive picture of trends over time and spatial patterns in fish from different trophic levels. Open lake and nearshore fish monitoring programs have been conducted since 1975. These programs collect sport and forage fish to determine contaminant concentrations in the fish community at various trophic levels and to provide information for the setting of consumption advisories.

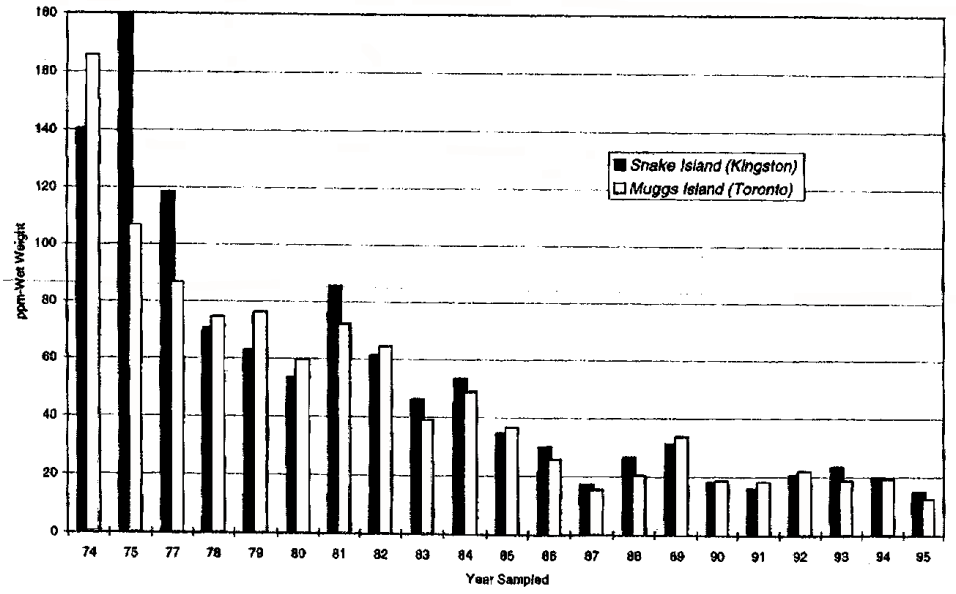
Concentrations of PCBs, DDE, and mirex in lake trout and smelt tend to be higher in the western basin of Lake Ontario than the eastern basin. This reflects the magnitude of contaminant inputs from the upper lakes and the Niagara River and the industrialized nature of the western end of the lake. Spottail shiner results have also shown mirex at consistently elevated levels in the Niagara River and the Credit River.

Overall, the fish community has experienced a dramatic reduction in contaminant levels since the mid-1970s and a slower rate of decline since



Source: Bishop et al.*, 1992; Pettit* et al.*, 1994 ; CWS Unpublished Data*

Figure 4-10. DDE in Herring Gull Eggs



Source: Bishop et al.*, 1992; Pettit* et al.*, 1994 ; CWS Unpublished Data*

Figure 4-11. PCBs in Herring Gull Eggs

the mid-1980s. This trend is best illustrated by lake trout, smelt, and spottail shiners for PCBs, DDT, and dieldrin (Suns *et al*., 1985, 1991a,b; MOE unpublished data). In the case of mirex, the downward trend continued until the early 1990s and has since leveled off. Considerable fluctuations have been observed in dioxin (2,3,7,8 TCDD) levels with no discernable trend. The most recent collections still indicate that PCB levels in lake trout and smelt often exceed the GLWQA Objective of 0.1 ppm (whole fish), and spottail shiners often exceed the guideline of 100ng/g for the protection of fish-eating birds and mammals. Recent changes in Lake Ontario's food web may result in increases or decreases in contaminant levels in some fish. This can result if fish such as lake trout or salmon become dependent on or switch to a different food source that is more or less contaminated than their previous diet. Potential changes in Lake Ontario's food web and the resulting effect on contaminant levels in fish need to be closely monitored.

Bottom Sediments/Water Quality

The determination of trends in bottom sediment and water quality is difficult given the wide range of variability encountered among sampling events. Differences in water and sediment sampling locations from year to year account for much of the variation in the results. Water movement patterns vary greatly and also influence results on a much smaller time scale.

Bottom sediments do reflect water quality conditions and sediment core samples that can be dated provide one means to establish trends over many decades. Based on a 1995 sediment coring project, levels of persistent toxic substances in Lake Ontario sediments have steadily decreased since the 1970s at most locations that were sampled. Of particular interest are the data from the Niagara River that show that concentrations of most persistent toxic contaminants in sediments have decreased significantly over time (Figure 4-9). PCBs, however, continue to be found at elevated levels (exceeding New York and Ontario criteria and objectives) in the uppermost portion of the sediment cores, which reflects the most recent inputs.

The 10 year data-set from the Niagara River Upstream/Downstream ambient water monitoring program is the most complete water quality sampling effort in the Great Lakes basin and has provided weekly data on contaminant levels flowing into the lake from the river, including contributions from the upper Great Lakes. Preliminary statistical analyses have been carried out by EC on the 18 priority toxic chemicals by comparing 1994 data with 1986 data. The initial results show that, with the exception of a few chemicals in the suspended sediment phase, most of the chemicals have been considerably reduced in concentration since 1986.