# NIAGARA RIVER

# REMEDIAL ACTION PLAN

# SUMMARY

September 1994

New York State Department of Environmental Conservation

This Summary of the Niagara River Remedial Action Plan is a condensation of the "Niagara River Remedial Action Plan," prepared by the New York State Department of Environmental Conservation, in cooperation with the Niagara River Action Committee. Both the Summary and the full report are available from the NYSDEC Region 9 Office, 270 Michigan Avenue, Buffalo, New York 14203-2999.

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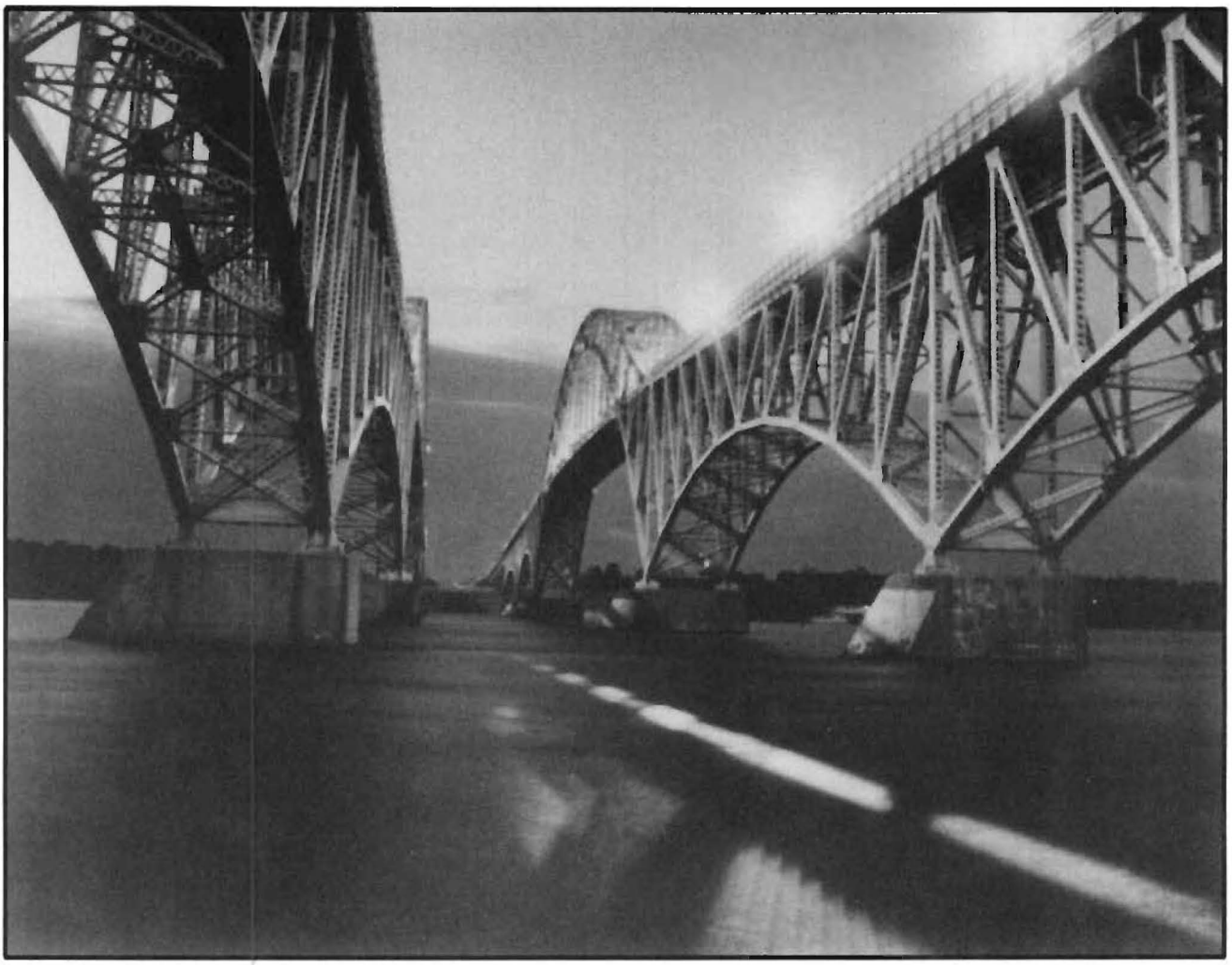
The photographs in this report are a sampling of the entries from the Niagara River Action Committee's Environmental Photography Contest, "Fall Over Niagara". The contest was conducted to promote greater understanding and appreciation of the Niagara River as an important natural resource. All pictures were taken over a four-day period in October 1992.



South Grand Island Bridge Spans,
East Branch Niagara River
*Benjamin Wiech*

# NIAGARA RIVER REMEDIAL ACTION PLAN
# EXECUTIVE SUMMARY

## INTRODUCTION

This report is in response to a recommendation of the Water Quality Board of the International Joint Commission that Remedial Action Plans (RAPs) be prepared for the 43 Areas of Concern in the Great Lakes Basin. The Niagara River is one of six Areas of Concern in New York State. The Niagara River RAP is a joint product of the New York State Department of Environmental Conservation and the Niagara River Action Committee, a group representing environmental, economic, academic, and local government interests appointed by the Department. It was prepared with the assistance and participation of many representatives of local, state, and federal government, business, and private citizens.

## RAP MISSION AND GOALS

The mission of the RAP is to restore the chemical, physical, and biological integrity of the Niagara River ecosystem in a manner that reflects the community's concern for the remediation, preservation and protection of the river. Specific goals of the RAP are the protection and enhancement of human health, fish and wildlife, aesthetics and recreation, and the economy of the Niagara River Area of Concern. Drinking water, bathing and aquatic life have been established as the best uses of the Niagara River through a public process under the New York State Stream Classification System. The RAP is designed to restore these uses where they have been impaired and to move toward the reduction of all sources of pollutants.

## PROBLEMS AND CAUSES

The Niagara River has been polluted by past industrial and municipal discharges and disposal of waste. Fishing and the survival of aquatic life within the Area of Concern have been impaired by PCBs, mirex, chlordane, dioxin, dibenzofuran, hexachlorocyclohexane and polynuclear aromatic hydrocarbons (PAHs). Fish and wildlife habitat have been degraded by bulkheading, filling and other alterations of the shoreline. In addition, hexachlorobenzene, DDT, DDE and dieldrin are likely causes of aquatic life degradation, but they have not yet been definitely established as such. Metals and cyanides in the sediment prevent open lake disposal of bottom sediments dredged from the river.

## SOURCES OF PROBLEMS

Contaminated embayment sediments, inactive hazardous waste sites and inflow to the Niagara River from Lake Erie are certain sources of pollutants causing impairments. Other sources have been identified as potential sources because the pollutants causing impairments are known to exist at these locations, but the link between the source and the impairment has not been clearly established. The potential sources include bottom sediments, groundwater, combined sewer overflows, and other point and nonpoint sources of pollution.

## REMEDIAL OBJECTIVES AND RECOMMENDATIONS

A comprehensive and focused strategy has been developed to:

- remediate the embayment sediments and inactive hazardous waste sites;
- continue participation in a river monitoring program that will determine whether potential sources contribute to impairments;
- continue the on-going programs that control point source discharges and manage nonpoint sources; and
- improve fish and wildlife habitat.

The recommended program is:

### Remediate Embayment and Bottom Sediments

Objective:

Correct the impairments to the Niagara River's fishery and aquatic life caused by contaminated embayment and bottom sediments.

Recommendation:

1. Continue ongoing programs for the remediation of embayment sediments.

2. Develop sediment criteria that will allow decisions to be made about which particular bottom sediments are causing impairment of the fishery and aquatic life.

3. Assess the river sediments based on criteria to determine specific areas of the river where remedial work is needed.

4. Evaluate removal/armoring alternatives and then carry out appropriate remedial work.

### Continue Participation in Stream Water Quality Monitoring

Objective:

Ensure that all sources have been addressed in the remedial action plan.

Recommendation:

Continue participation in the monitoring activities of the Niagara River so that the amounts of contaminants of concern can be accurately determined.

### Remediate Inactive Hazardous Waste Sites

Objective:

Prevent inactive hazardous waste sites from contributing contaminants to the river.

Recommendation:

Continue the ongoing program for remedial work in the Niagara River drainage area with particular attention to protecting the Niagara River itself.

Remediate Other Nonpoint Sources As Necessary

Objective:

Prevent the nonpoint sources from adversely affecting the river. (Nonpoint sources are sources that do not discharge to the river at well-defined points such as through a pipe.)

Recommendation:

1. Use stream water quality monitoring to determine whether or not these sources are making a significant contribution to the amount of pollutants in the river.

2. If nonpoint sources are important, determine which ones require remedial action.

3. Select and carry out appropriate control or remedial actions.

Maintain Controls On Municipal And Industrial Wastewater Facilities

Objective:

Insure that municipal and industrial wastewater facilities do not significantly contribute to impairment of the Niagara River.

Recommendation:

1. Renew permits incorporating water quality enhancement measures (pollution prevention), current technology and water quality based limits.

2. Carry out monitoring of industrial and municipal discharges and compliance or enforcement actions as needed.

Improve Combined Sewer Overflow Systems

Objective:

Insure that combined sewer overflows do not significantly contribute to river impairment. (Combined sewer overflows are used to relieve the flow to sewage treatment plants during storms when surface runoff would cause the flow in the sewers to exceed the capacity of the system.)

Recommendation:

1. Carry out system modeling and assessment to determine where improvements can be made within the systems to minimize overflow.

2. Maintain systems, plus design and carry out improvements as necessary.

Remediate Other Point Sources As Necessary

Objective:

Insure that other point sources do not significantly contribute to impairment of the river.

Recommendation:

1. If stream water quality shows that other point sources are likely to be a problem, then identify these sources.

2. Design and carry out remedial work as required.

Restore Fish and Wildlife Habitat

Objective:

Improve fish and wildlife habitat in and along the river.

Recommendation:

1. Carry out an assessment of habitat conditions and the potential for improvement in the Area of Concern.

2. Develop a habitat improvement plan.

3. Acquire the necessary land.

4. Design and carry out specific habitat improvement projects.

COMMITMENTS AND FUTURE ACTIONS

The Department of Environmental Conservation has committed to a number of initial actions in this plan where funding is available. As further funding becomes available, further commitments can be made. DEC has made commitments for specific actions to begin the remediation strategy:

- Continue water quality monitoring of the Niagara River - Ongoing

- Complete remedial design activities for embayment sediments - March 1995

- Complete the remaining Phase II hazardous waste site investigation - Completed

- Complete six Remedial Investigation/Feasibility Studies at hazardous waste sites - March 1996

- Complete nine remedial designs at hazardous waste sites - March 1996

- Continue discharge permit monitoring and reissue permits for industrial and municipal dischargers to include water quality enhancement measures (pollution prevention) - Ongoing

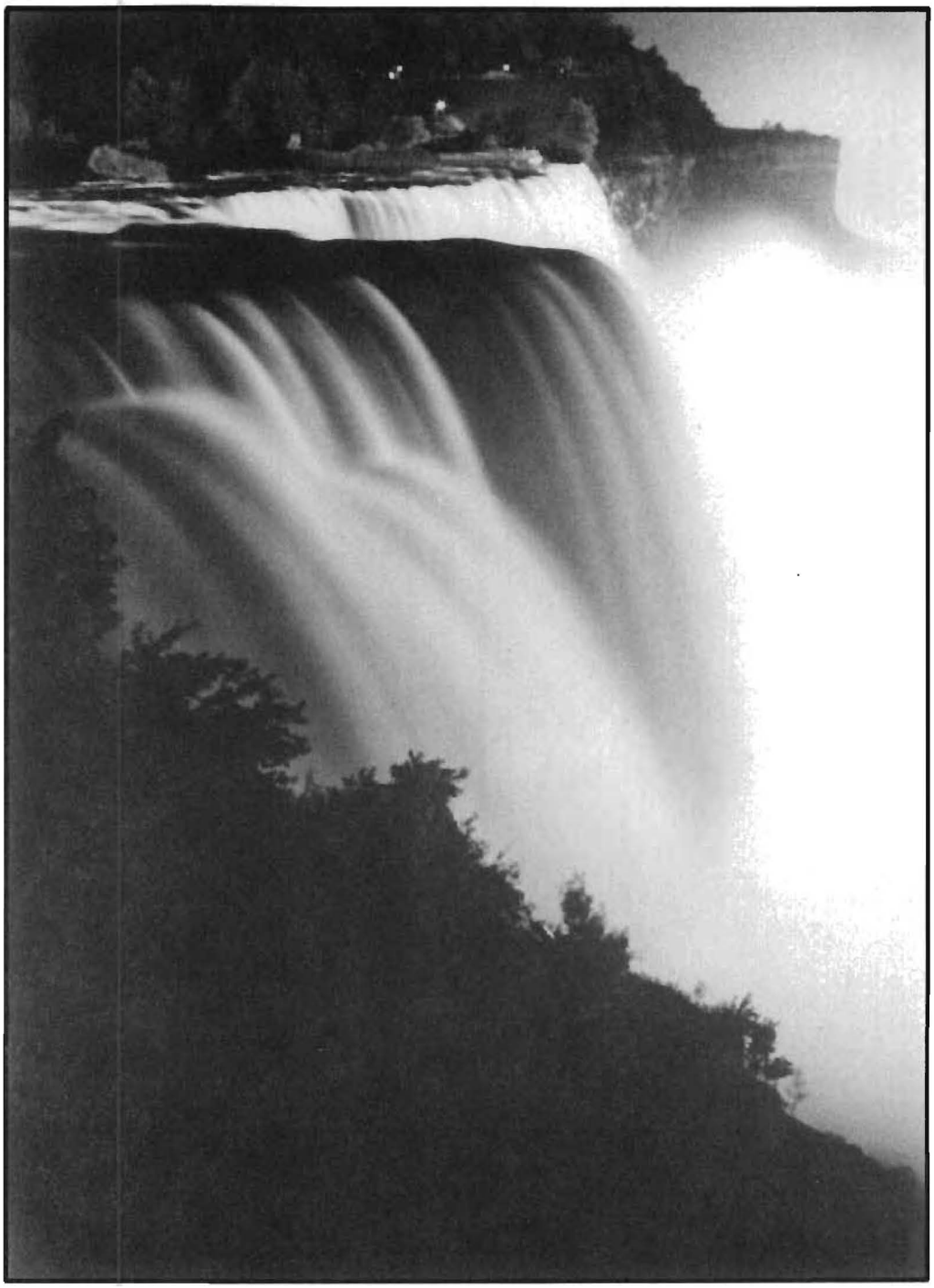
- Develop a plan to assess habitat conditions to determine the potential for habitat improvement to include contaminant monitoring in fish and management of non-indigenous aquatic species - March 1995

A continuing process, based on annual status reports and workplans, has been established for reporting on remedial progress, for making commitments as funding becomes available, and for revising the remedial action plan as new information develops.

The Department, having received public comment on the draft RAP, will submit the final Remedial Action Plan to the International Joint Commission.

NIAGARA RIVER ACTION COMMITTEE SPECIAL CONTRIBUTION

The Niagara River Action Committee has prepared a chapter on land use along the river, with recommendations related to future development.



Niagara Falls at Night

*Chris Jadoch*

# CHAPTER ONE: INTRODUCTION

As an interconnecting channel within the Great Lakes, the largest freshwater basin in the world, the Niagara River is part of one of North America's most important ecosystems. Conditions originating in the upper Great Lakes as well as along the river that impact the water quality of the Niagara River may affect the water quality of the downstream waters of Lake Ontario and the St. Lawrence River. Improvements to the environmental integrity of the Great Lakes as a whole can best start in localized urban areas associated with the system's harbors as well as the interconnecting channels such as the Niagara River.

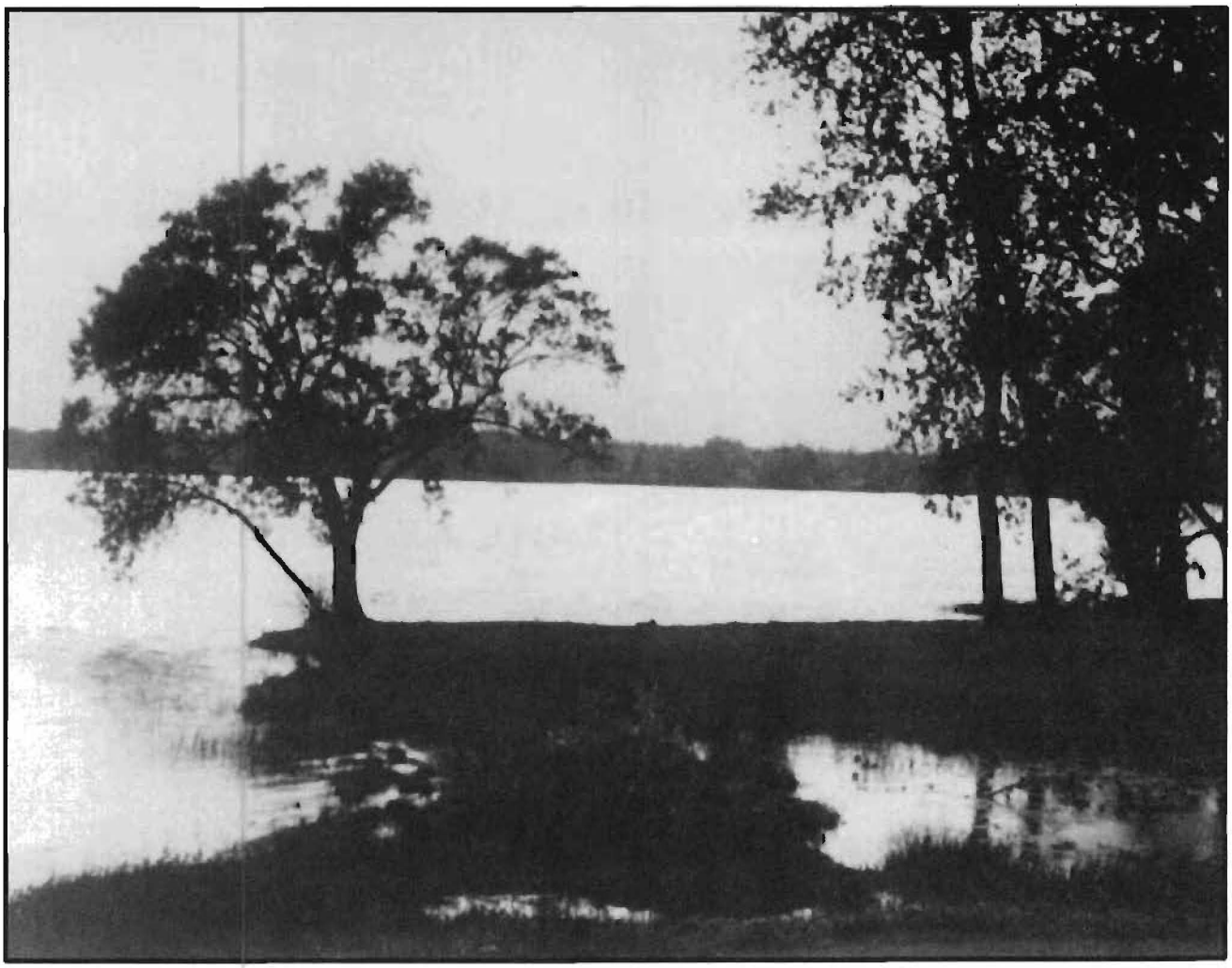
The Niagara River's strategic location and abundant supply of water brought economic prosperity to the region during the nineteenth and early twentieth centuries. However, past municipal and industrial discharges and waste sites have been a source of contaminants in the Niagara River. A long history of development has changed the original shoreline along much of the river, affecting fish and wildlife habitat. Many improvements in water quality have been achieved in recent years. The Niagara River is an international resource from which many beneficial uses are derived.

The United States-Canada International Joint Commission (IJC) designated the Niagara River as one of 43 Areas of Concern where some beneficial uses of the water or biota are impaired. The IJC requested that the responsible jurisdictions prepare plans for remediation of the Areas of Concern. In communication with each other, New York State and the Province of Ontario, which share the Niagara River as an international boundary water between the United States and Canada, have each accepted responsibility for the preparation of plans to undertake necessary remedial activities within their respective jurisdictions.

The 1987 amendments to the United States-Canada Great Lakes Water Quality Agreement (GLWQA) specify requirements for "remedial action plans" (RAPs) for the Areas of Concern. The RAPs are to define environmental problems and identify actions needed to restore beneficial uses of the waterbody. Plans are to embody a systematic, comprehensive, ecosystem approach to restoring and protecting the biota and water quality. They should set time schedules, name responsible agencies, and describe processes to monitor the Area of Concern environment and track implementation. The lead agency for a RAP should work closely with citizens to develop an ecosystem-based plan that represents the concerns of the local community.

The Niagara River RAP was developed by the New York State Department of Environmental Conservation (DEC) in cooperation with citizens concerned about the river's revitalization. In 1989 a group of interested citizens was appointed by DEC as the Niagara River Action Committee (NRAC) comprising 26 environmental, industrial, sportsmen, academic, community, and local government representatives. NRAC representatives and key DEC staff created an Executive Committee that directed the development of the Niagara River RAP. The Executive Committee established the goals for the RAP, mapped out a project workplan, defined responsibilities, and reviewed document drafts.

This document summarizes the Niagara River Remedial Action Plan that resulted from this cooperative endeavor. More detailed information about problems and sources affecting the Niagara River, remediation programs, recommendations, and agency commitments is contained in the full RAP report.



West Branch Niagara River

*Mitchell Bradt*

# CHAPTER TWO: SETTING

To understand the setting of the Niagara River the following is described in this chapter: (1) where it is located and the general character of its surroundings (the geography); (2) the occurrence, distribution, and movement of water (hydrology) in the Area of Concern; (3) the past and present uses of the river from which benefits are derived (beneficial uses); and (4) the characteristics of the seven U.S. tributaries that enter the AOC between Lake Erie and Lake Ontario.

This chapter describes the Niagara River Area of Concern and local tributary area (U.S.) and sets the scene for the more technical discussions of problems, causes, sources, and remedial actions that follow.

## AREA OF CONCERN

### Geography

The Niagara River is a strait connecting Lake Erie to Lake Ontario. Along its 37 mile length it drops 328 feet in elevation, with more than half the drop occurring at Niagara Falls.

The Niagara River Area of Concern is located in Erie and Niagara Counties in western New York State (Figure 2.1). The Area of Concern extends from Smokes Creek near the southern end of the Buffalo Harbor, north to the mouth of the Niagara River at Lake Ontario. The international border between Canada and the U.S. divides the Niagara River and serves as a jurisdictional boundary.

The river passes through varied terrain, including heavily industrialized areas, major transportation corridors, residential areas, and both natural and developed parks.

### Hydrology

The water flow in the Niagara River, averages 200,000 cubic feet per second (cfs). The flow is considered generally stable due to the storage capacity of the upstream Great Lakes. Daily flows have ranged from 90,000 cfs to 347,000 cfs based on lake level and wind conditions.

The Niagara River begins at the City of Buffalo near the mouth of the Buffalo River. Both Smokes Creek and the Buffalo River discharge into Lake Erie upstream of the head of the Niagara River; however, due to the near-shore currents associated with the Lake Erie outflow, plumes from both are normally directed along the eastern shoreline of the Niagara River.

To allow safe navigation past the swift currents which occur at the uppermost section of the Niagara River, the Black Rock Canal was constructed along the U.S. shore. The canal, set apart from the river by the Bird Island Pier and Squaw Island, extends from the head of the Niagara River to the locks at the north end of Squaw Island.

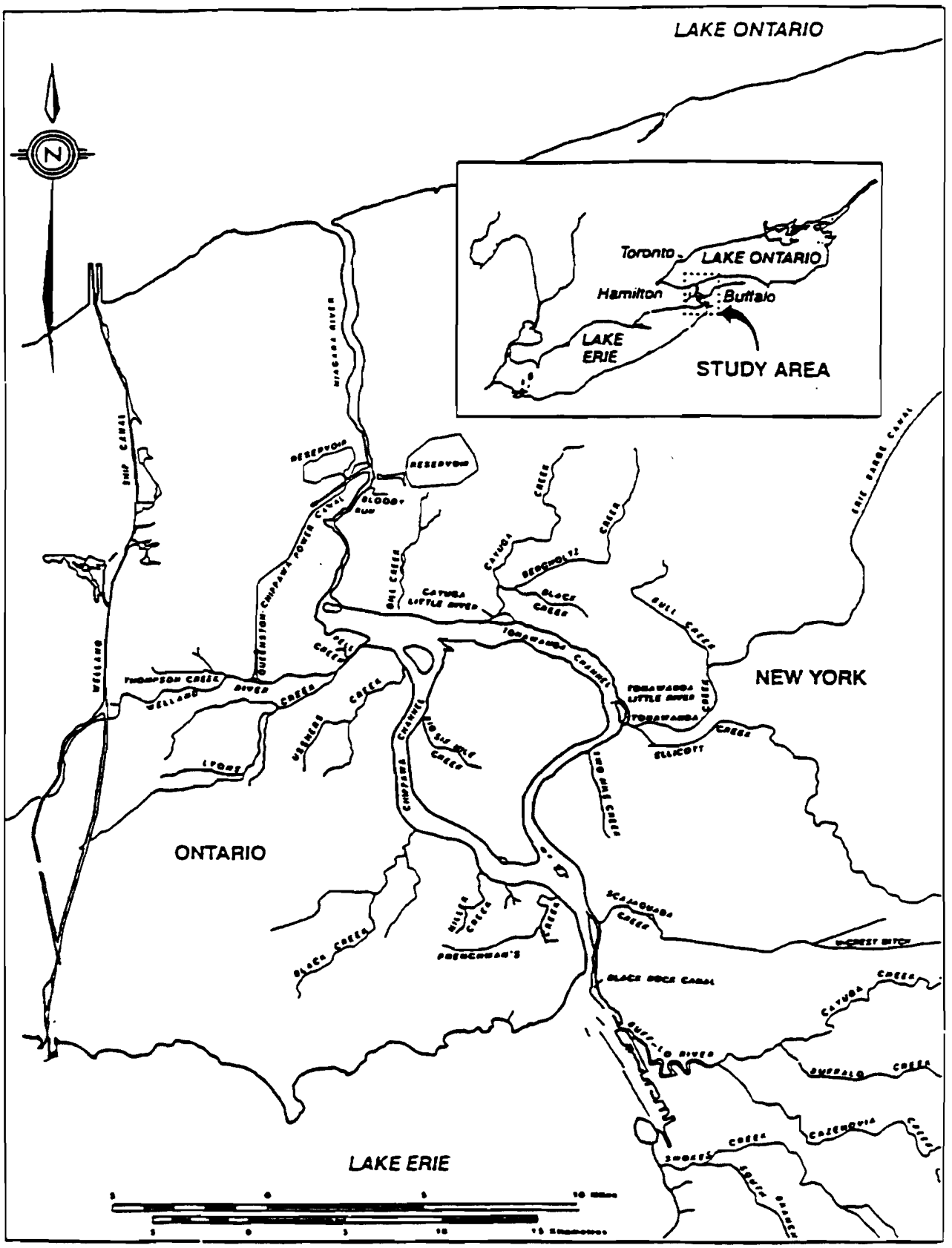



Figure 2.1 Niagara River Area of Concern Location Map

North of Squaw Island the river widens as it flows past Strawberry Island (U.S.). Grand Island (U.S.), the largest island in the river, just downstream of Strawberry Island, divides the Niagara River into two channels, the Chippawa Channel to the west of Grand Island and the Tonawanda Channel to the east. The U.S./Canadian border lies to the west of Grand Island in the Chippawa Channel. Beyond Grand Island and neighboring Navy Island (Can.), the Chippawa and Tonawanda Channels recombine to form the Chippawa-Grass Island Pool.

Water is diverted from the pool to hydro-electric power generating stations on both sides of the river, all of which discharge downstream of Niagara Falls. Withdrawal rates are governed by the terms of the 1950 Niagara River Treaty, which was signed to preserve the scenic spectacle of Niagara Falls and to make more efficient use of the Niagara River for power generation purposes. As a result of the treaty, a control structure was built at the lower end of the Chippawa-Grass Island Pool which extends from the Canadian shore about halfway across the river.

More than half the flow in the Niagara River is diverted for power generation. The 1950 Treaty requires that a minimum flow of 100,000 cubic feet per second (cfs) be maintained over the Falls during the daylight hours of the tourist season from April through October. At all other times, the minimum required flow over the Falls is 50,000 cfs. The control structure permits a rapid changeover between daytime and nighttime flows during the tourist season and regulates the water level in the Chippawa-Grass Island Pool. While the operation of the control structure has a negligible effect on the outflow of Lake Erie, some fluctuations in water levels and velocities in the Chippawa and Tonawanda Channels do occur. During periods of low power demand, water in excess of that required to meet minimum flow requirements over the Falls can be diverted and stored in pump-storage reservoirs and released when power demand is high. This results in a daily variation of the flow in the lower Niagara River.

Downstream from the control structure the river drops about 50 feet through a one-half mile section of rapids to the brink of the Falls. Here Goat Island (U.S.) divides the Falls into the Horseshoe Falls between Goat Island and the Canadian mainland and the American Falls between Goat Island and the U.S. mainland. Water drops about 182 feet over the Falls into the Maid-of-the-Mist Pool at the bottom of the Niagara Gorge. Beyond this pool the lower Niagara drops another 75 feet through the Whirlpool Rapids and Devil's Hole Rapids. Below the rapids the Niagara River recombines with the discharges of hydro-electric plants at Queenston (Can.) and Lewiston (U.S.). A short distance below this point the steep gorge walls end at the east-west lying Niagara Escarpment, the river widens, and the water flows rapidly northwards into Lake Ontario.

For ease of discussion, the Niagara River has been divided into sub-areas (Figure 2.2). The Buffalo-Lackawanna sub-area runs from Smokes Creek to the northern Buffalo City limit, and includes the Buffalo Harbor, Black Rock Canal, and Bird Island-Riverside segments. Smokes Creek, Buffalo River, and Scajaquada Creek discharge into this sub-area. The Tonawanda-North Tonawanda sub-area consists of the Tonawanda Channel of the Niagara River and extends from the northerly Buffalo City line to the northerly boundary of the City of North Tonawanda. Two Mile Creek and Tonawanda

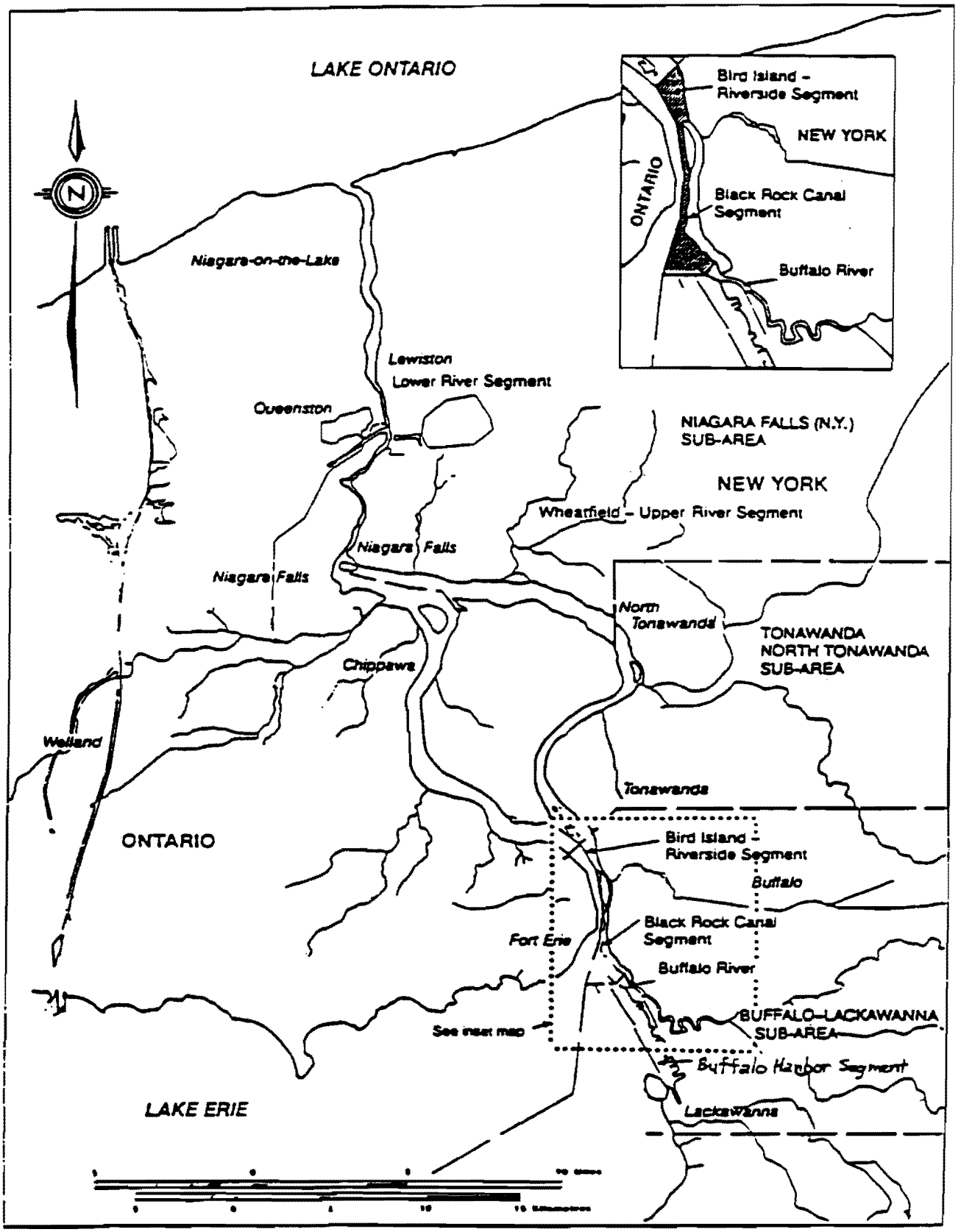



Figure 2.2 Sub-Areas and Segments Along the Niagara River

Creek enter the Niagara River in this sub-area. The Niagara Falls sub-area extends from the northerly boundary of North Tonawanda to the mouth of the Niagara River and includes the Wheatfield-Upper River segment and the Lower River segment. Cayuga and Gill Creeks are tributaries to the Niagara River in this sub-area.

## Beneficial Uses

### Water Supply

The main stream of the Niagara River has been designated by the NYSDEC as a Class A-Special waterway, which defines its best use as a source of water supply for drinking purposes. The Niagara River serves as a source of municipal drinking water to a population of more than 600,000 people through eight active U.S. intakes and one active Canadian intake along the river proper. An additional 330,000 U.S. residents are served by the City of Buffalo, which obtains water at the junction of Lake Erie and the Niagara River. A number of industrial users withdraw water directly from the Niagara River for process and cooling purposes.

### Wastewater Discharges

The Niagara River serves the communities and industries along its banks as a receptacle for treated wastewater. Currently seventeen significant U.S. industrial facilities and nine major U.S. municipal wastewater treatment plants discharge to the Niagara River and its tributaries under strict pollution control regulations. Combined sewer system overflows from the Buffalo Sewer Authority and the City of Niagara Falls periodically discharge into the Niagara River and its tributaries.

### Hydro-electric Power Generation

The drop in elevation between the upper and lower reaches of the Niagara River is used to generate hydro-electric power in both Canada and the U.S. The New York Power Authority Plant in Lewiston has a generating capacity of 2,275 megawatts. Water for the powerplant is diverted above the Falls through two aqueducts which run under the City of Niagara Falls to the powerplant in Lewiston, and is returned to the Niagara River after passage through the plant's turbines.

### Commercial Shipping

Niagara Falls is a physical barrier to navigation between Lake Erie and Lake Ontario. The completion of the Erie Canal in 1825 caused the upper Niagara River corridor to become a major transportation hub for raw materials and finished products for many years. Subsequent development of the St. Lawrence Seaway and the Welland Ship Canal (Can.) made the Erie Canal obsolete for commercial shipping. However, commercial lake vessels still visit the upper portion of the Niagara River, servicing firms in the Lackawanna, Buffalo and Tonawanda areas.

Recreation

Recreational boating is increasingly popular in the Area of Concern. Several public and private marinas and boat launch ramps are located along the navigable portions of the upper and lower Niagara River.

Swimming access is available at the public beach at Beaver Island State Park, located at the southern tip of Grand Island. Other water sports include water skiing, tubing, and scuba diving.

A number of state, county, and municipal parks are located along the shoreline in the AOC, offering a variety of recreational activities including boating, camping, boardwalks, nature trails, picnicking, swimming, bandshells and theaters, and ball diamonds. The Niagara Riverwalk, a paved pathway suitable for walking and biking, extends along or near the shoreline in parts of Buffalo and Tonawanda.

Tourists from all over the world come to the area, drawn primarily by Niagara Falls.

Fish and Wildlife Habitat

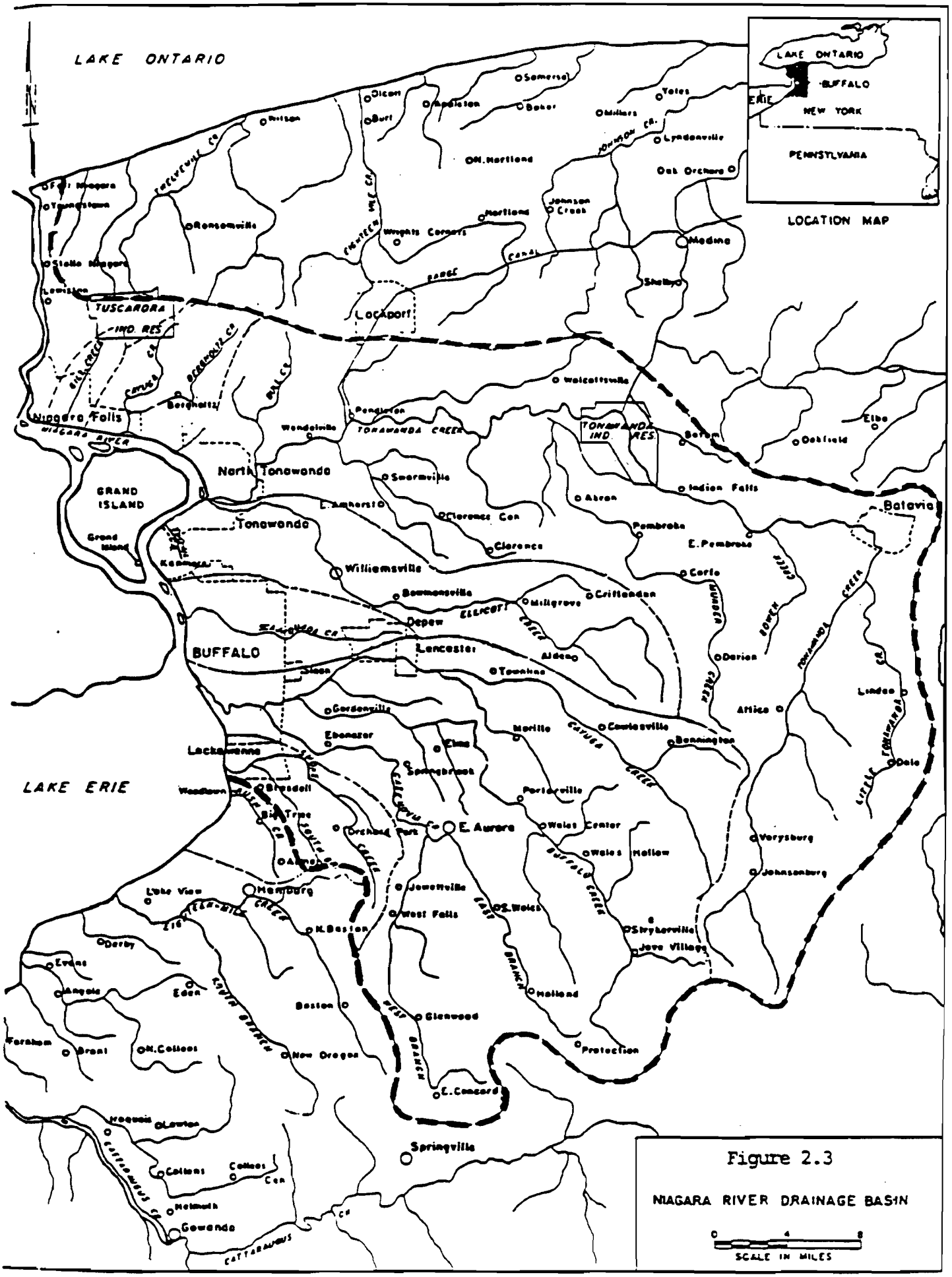
The Niagara River is an active sport fishery for both boat-based and shoreline anglers, rated in the 1988 New York Statewide Angler Survey as the fifth most popular fresh water fishery in the state. Gamefish such as bass, walleye, and trout are found along the entire river, with muskellunge found primarily in the upper river and salmon in the lower. Numerous panfish such as perch, rock bass, and white bass are found along the entire river, while smelt are found primarily in the lower river.

Due to the extent of urbanization, there are few undisturbed fish and wildlife habitat areas along the Niagara River. However, key spawning areas still exist around Grand Island and in and near the Buffalo Harbor area. Wetland habitat has been reclaimed from a former industrial site (Tifft Farm Nature Preserve) and has been naturally established in a dredged spoils area (Times Beach) in the Buffalo Harbor area. Remaining natural wetlands are still found in Tonawanda near Two Mile Creek and in Buckhorn Island State Park at the northern tip of Grand Island. The area around Niagara Falls, including the upper rapids and the gorge below the Falls, is a significant habitat for numerous species of gulls, terns, and waterfowl. The lower Niagara River is an important habitat for migrating waterfowl and other water-dependent birds.

LOCAL TRIBUTARY AREA (U.S.)

Geography

The local U.S. watershed of the Niagara River has a drainage area of 1225 square miles (see Figure 2.3). Seven mainland tributaries, whose watersheds account for 97 percent of the U.S. portion of the local Niagara River drainage basin, enter the Niagara River between Lake Erie and Lake Ontario: Smokes Creek, Buffalo River, Scajaquada Creek, Tonawanda Creek, Two Mile Creek, Cayuga Creek, and Gill Creek. Several smaller waterways drain to the Niagara River from Grand Island.


LAKE ONTARIO
LAKE ERIE
LOCATION MAP
LAKE ONTARIO
BUFFALO
ERIE
NEW YORK
PENNSYLVANIA
Niagara Falls
North Tonawanda
Tonawanda
GRAND ISLAND
Williamsville
BUFFALO
Depew
Lancaster
Lackawanna
Hamburg
E. Aurora
Lockport
Medina
Batavia
Springville
TUSCARORA IND. RES.
TONAWANDA IND. RES.
NIAGARA RIVER
TONAWANDA CREEK
ELLICOTT CREEK
CAZENOVIA CR.
CATTARAUGUS CR.
BUFFALO CREEK
EAST BRANCH
WEST BRANCH
SOUTH BRANCH
CAZENOVIA CREEK
CAYUGA CREEK
ERIE CANAL
Figure 2.3
NIAGARA RIVER DRAINAGE BASIN
SCALE IN MILES

Although farmland and wooded areas are found in the upland areas of Smokes Creek, Buffalo River, Tonawanda Creek, and Cayuga Creek (Niagara County); the lower reaches of these waterways, as well as Scajaquada, Two Mile, and Gill Creek, are predominantly urban in character. Residential and commercial development is found along all these waterways. All have been channelized or dredged along some portion of their lengths. Smokes Creek, Buffalo River, Scajaquada Creek, and Gill Creek are industrialized along their lower reaches. Tonawanda Creek, which is coincident with the New York Barge Canal for 11 miles upstream from the Niagara River, contains combined industrial, commercial, and residential development activity along its banks.

Watershed Hydrology

The local tributaries generally have a very mild slope and small drainage areas and, as a result, their flows are not large except during times of heavy runoff. Both Smokes Creek and the Buffalo River in their lower reaches are influenced by water levels in Lake Erie. Scajaquada Creek, which flows into the Black Rock Canal, experiences backwater effects from canal operations. During the navigation season (April/May through November/December) the flow in the New York Barge Canal portion of lower Tonawanda Creek reverses and an average of about 1100 cfs from the Niagara River enters the lower Tonawanda Creek. The diverted flow is returned to Lake Ontario at various points east, beginning at Lockport. Both Cayuga Creek (Niagara County) and Gill Creek are affected in their lower reaches by level changes in the Niagara River attributable to hydro-electric power project operations.

Within the local watershed area, groundwater interacts with the Niagara River and its tributaries. In the Niagara Falls area there are indications that groundwater movement is affected to varying degrees by fluctuating river levels and various manmade structures related to power project operations.

Beneficial Uses

Wastewater Discharges

Our society is dependent on waterbodies as receptacles for treated industrial and municipal wastewater. Smokes Creek, Buffalo River and Tonawanda Creek receive treated discharges from industrial and municipal treatment facilities. The City of Buffalo's combined sewer overflow system discharges excess sanitary sewage and wet-weather storm flow to the Buffalo River and Scajaquada Creek during times of heavy runoff. Storm sewers also discharge excess wet-weather storm flow to the creeks.

Recreation

Numerous parks and recreational areas are located along each of the local tributaries of the Niagara River.

Recreational boating is possible along the Buffalo River, which is dredged to maintain commercial shipping access, as well as along the New York Barge Canal portion of Tonawanda Creek. Unofficial, unsupervised swimming has been observed along several of the tributaries.

Fish and Wildlife

The local tributary area supports a variety of fish habitats. Conditions range from brook trout habitat in some upper streams to warm water species habitat in the lower, urban areas. To enhance recreational opportunity, DEC stocks trout and pan fish. Health department advisories against consuming fish caught in the Buffalo River, Cayuga Creek (Niagara County), and Gill Creek have been issued due to the presence of contaminants in these waterways. Many small creeks found on Grand Island provide a variety of sport fishing opportunities, primarily for warm water game fish and pan fish.

Tributary In-stream Quality

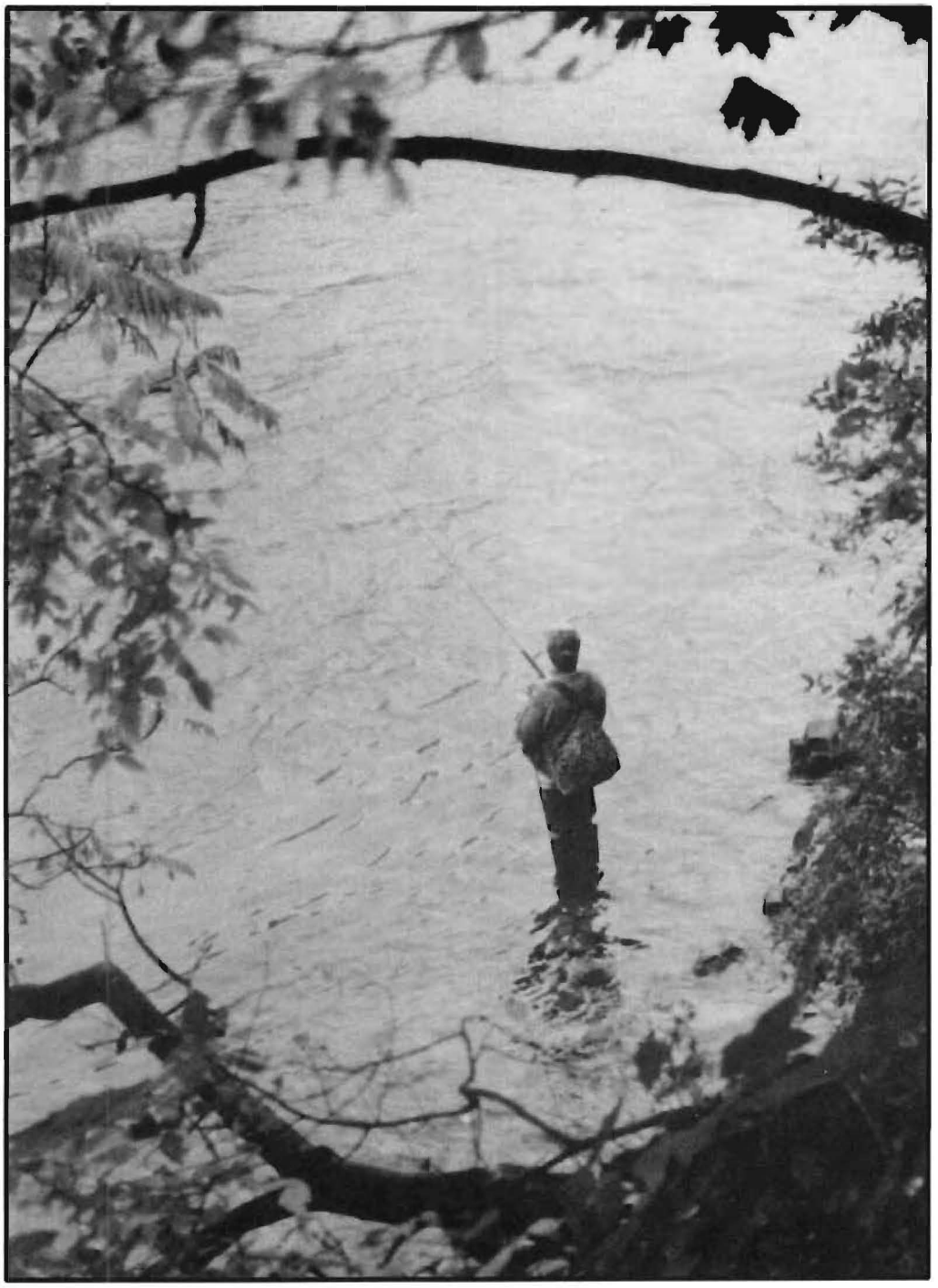
The in-stream quality of the tributaries is indicated by consumption advisories based on fish species collections as well as toxicity and bioaccumulation studies of aquatic species exposed to bottom sediments collected from the lower reaches of these streams.

A consumption advisory has been issued to eat no carp from the Buffalo river and to eat no fish species from Cayuga or Gill Creeks.

The Buffalo River consumption advisory is based on elevated PCBs and chlordane in carp. Significant toxic effects were noted on test species from Buffalo River sediments. Bioaccumulation experiments showed uptake of PCBs and heptachlor expoxide in young-of-the-year fish exposed to Buffalo River sediment. The Buffalo River is an Area of Concern designated by the International Joint Commission (IJC). A Remedial Action Plan has been submitted and accepted by the IJC for the Buffalo River.

Young-of-the-year fish collected from the Cayuga Creek basin, which received drainage from the Love Canal, have been found to contain dioxin at levels above NYS human health criteria, resulting in an advisory to eat no fish from Cayuga Creek. Drainage from the Love Canal was stopped in 1983 and contaminated sediments were dredged in 1989. Contaminant levels in fish have been reduced as a result and are projected to continue to decline as the primary source of dioxin has been abated.

Toxicity studies conducted in 1986-87 showed Gill Creek bottom sediments to be unequivocally toxic to test species (no organisms survived). A remedial project to remove contaminated sediments from Gill Creek was completed in 1992.



Fisherman at Devil's Hole,
Lower Niagara River
*Margit Goris*

# CHAPTER THREE: THE RAP GOALS AND THE PLANNING PROCESS

This chapter describes the process used to develop the Niagara River Remedial Action Plan (RAP) and the goals which will guide its implementation. The overall mission of the RAP was identified at the beginning of the process jointly by DEC and NRAC.

## MISSION STATEMENT

The overall mission of the Niagara River Remedial Action Plan is to restore the chemical, physical and biological integrity of the Niagara River ecosystem in a manner that reflects the community's concern for the remediation, preservation and protection of the river.

To complete this mission, this plan takes steps to restore and maintain water quality to provide for drinking water, contact recreation, and the propagation of fish, shellfish, and wildlife, consistent with state law, rules, and regulations as they continue to evolve. This mission is also consistent with the guidance set forth by the International Joint Commission (IJC) in the Great Lakes Water Quality Agreement (GLWQA) for restoration of all Areas of Concern.

## SPECIFIC GOALS

Specific goals of the Remedial Action Plan are the protection and enhancement of human health, fish and wildlife, aesthetics and recreation, and the economy of the Niagara River Area of Concern.

Actions involved in the process include virtual elimination of persistent toxics, restoration of habitat, control of exotic species, and improvement of public awareness and involvement in river-related activities. The 14 ecosystem impairment indicators identified in Annex 2 of the GLWQA are used to determine which beneficial uses of the river are impaired. They also provide a means of measuring progress toward the achievement of the mission and the specific goals of the RAP. The following ecosystem impairment indicators are addressed:

1. restrictions on fish and wildlife consumption
2. tainting of fish and wildlife flavor
3. degradation of fish and wildlife populations
4. fish tumors or other deformities
5. bird or animal deformities or reproduction problems
6. degradation of benthos (bottom-dwelling organisms)
7. restrictions on dredging activities
8. eutrophication or undesirable algae
9. restrictions on drinking water consumption, or taste and odor problems
10. beach closings
11. degradation of aesthetics
12. added costs to agriculture or industry
13. degradation of phytoplankton and zooplankton populations
14. loss of fish and wildlife habitat.

## WAYS OF DETERMINING IF THE GOALS ARE BEING MET

### NYS Stream Classification

Impairments are ultimately determined by criteria derived from the NYS stream classification system, which classifies every waterbody in New York State according to the public's desired "best use" of the water resource. The classification takes into account such factors as the character of bordering lands, stream flow, water quality, and present, past, and desired future uses of the water. After a formal public participation process, including public hearings, DEC assigns to each fresh surface waterbody one of the following classifications. Each class includes all the best uses for classes below it.

| Class | Best Use |
|---|---|
| AA, A, A-Special | Drinking Water |
| B | Primary Contact Recreation |
| C | Fishing and Fish Propagation |
| D | Fishing |

Each designated classification has a set of standards defining the type and quantity of substances the water can contain and still be used as intended. Specific numerical objectives identified in the GLWQA for quality of boundary waters are considered in the adoption of NYS standards for such waters. The Niagara River is classified as A-Special, reflective of its status as an international boundary water. This classification is the basis for restoration of impaired best uses of the river.

### Great Lakes Water Quality Agreement

The GLWQA (Annex 2) lists 14 impairment indicators to be examined by the RAP process. Most of these indicators can be related to the Niagara River's best uses under its A-Special stream classification. The river's classified best use as a drinking water supply is equivalent to the GLWQA impairment indicator, "restrictions on drinking water consumption, or taste and odor problems". Class A-Special waters also include swimming as a best use, which corresponds to the GLWQA impairment indicator, "beach closings."

Several GLWQA impairment indicators relate to the Niagara River's other best uses of fishing and fish propagation, including: "restrictions on fish and wildlife consumption, tainting of fish and wildlife flavor, degradation of fish and wildlife populations, fish tumors or other deformities, bird or animal deformities or reproduction problems, degradation of benthos, eutrophication or undesirable algae, degradation of phytoplankton and zooplankton population, and loss of fish and wildlife habitat."

Two GLWQA impairment indicators go beyond the best uses defined in the NYS classification system. These are, "restrictions on dredging activities" and "added costs to agriculture or industry."

All 14 impairment indicators are addressed in determining whether or not an impairment requiring remediation exists.

Reduction of Persistent Toxic Substances

In addition to addressing impairment of beneficial uses, the RAP must be consistent with the GLWQA policy of the virtual elimination of discharges of persistent toxic substances. Various ongoing program activities in New York State, such as technology-based discharge permit limits, will continue to reduce the loadings of persistent toxic substances. The NYS water quality enhancement and protection policy being developed will continue the movement toward the goal of virtual elimination of the discharge of persistent toxic substances.

RAP DEVELOPMENT

The process of developing the RAP proceeded as follows:

* Identify Goals

* Assess Impairments - The goals are addressed by examining information on water quality, sediments, and aquatic life that shows whether or not the best uses are impaired. The 14 specific indicators provided by the GLWQA in conjunction with NYS water quality standards help determine these impairments.

* Identify Pollutants or Disturbances - When an impairment indicator suggests an impairment, all available information is examined to determine the cause of the impairment. In some cases, definite causes cannot be assigned with a high degree of certainty.

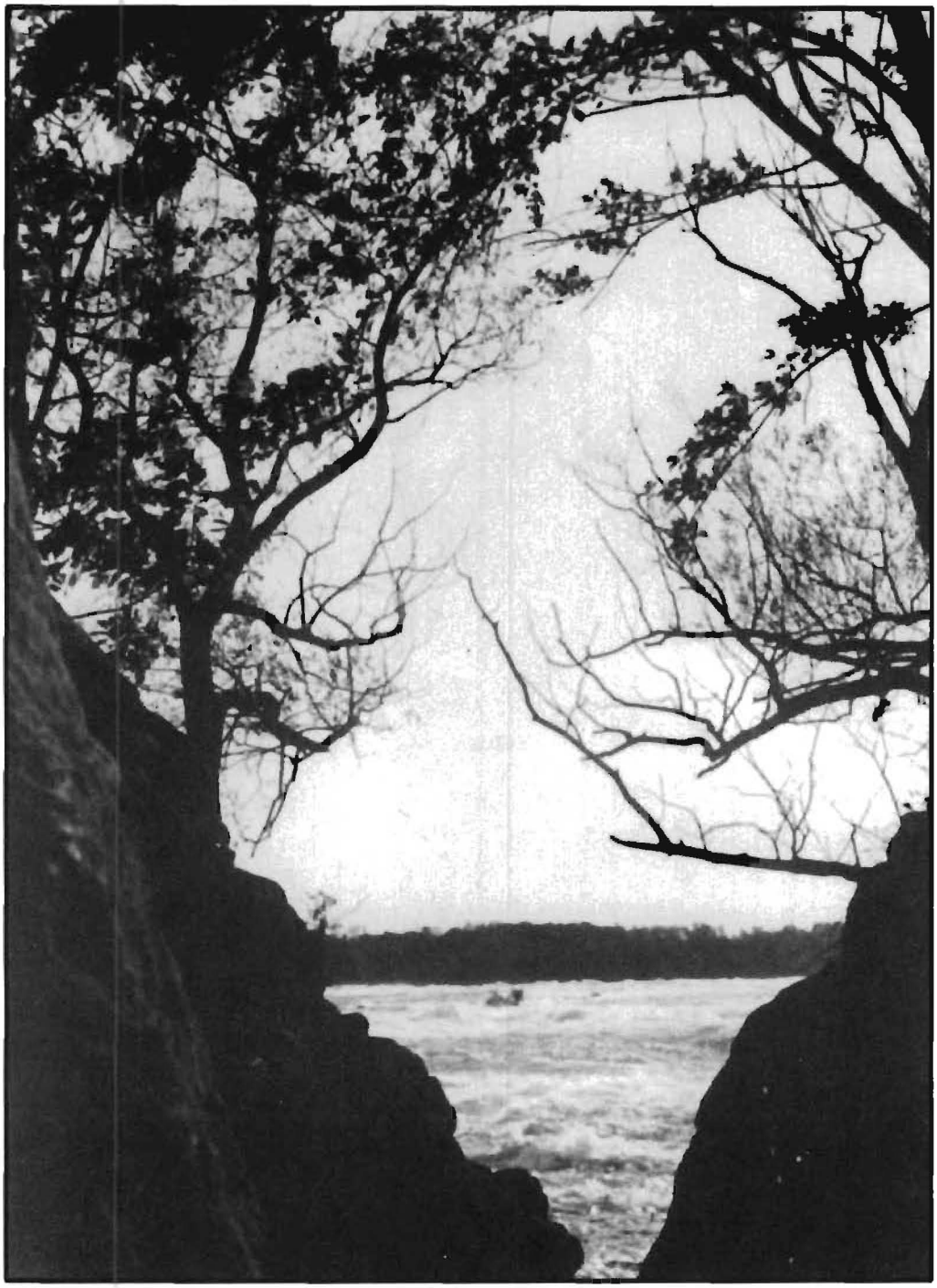
* Identify Sources of Pollutants or Disturbances - The points of entry of pollutants or the origins of disturbances are determined.

* Describe Remediation Strategy and Commitments - The overall remedial strategy identifies actions to address the sources of pollutants and disturbances causing impairments. Where information is not sufficient to recommend remedial action, the strategy identifies investigations needed to obtain this information.

* Describe Monitoring Program - Measurements and examinations of the ecosystem reveal whether or not the remedial actions work as planned, and whether or not the indicators of use impairment show recovery.

* Describe Tracking - Progress reports and periodic RAP updates, both with participation of the concerned public, provide a process for tracking plan implementation.

The results of each of the above steps are described in this summary.



Rapids Above Falls Near the
Three Sister Islands

*Judy Wilder*

# CHAPTER FOUR: THE PROBLEMS: IMPAIRMENTS, POLLUTANTS, AND DISTURBANCES

To determine the problems that need to be addressed by the remedial actions, it is necessary to find out what best uses of the river are or may be impaired and what factors (either pollutants or disturbances) may cause these impairments. The 14 Great Lakes Water Quality Agreement impairment indicators are examined, using New York State standards and guidance values as quantitative guideposts in the evaluation. Where an impairment is indicated, available data are used to identify possible causes.

Data examined include:

- physical and chemical information on the water which identify current conditions;
- physical, chemical, and toxicity data on bottom sediments which illustrate current conditions on the river bottom and impairment causes that may have come from past or present discharges into the river; and
- information on biological effects that may have come from either past or present uses of the river.

The most current available information has been used to assess current impairments and their causes. In the early 1980's, discharges of toxic contaminants from municipal and industrial facilities to the Niagara River decreased markedly. As documented in 1986, this was due primarily to additional treatment, sewerage system remediation and plant shutdowns. Data taken prior to 1986 may not reflect current conditions in the river.

Before the 14 GLWQA impairment indicators are examined, the water and sediment quality in the Area of Concern are summarized since, unlike biota information which tends to be specific for each impairment indicator, water and sediment quality are generally useful in assessing all impairments and their causes.

## WATER COLUMN AND BOTTOM SEDIMENT QUALITY

Water quality is determined by comparing the concentrations of pollutants in the water column (water collected without disturbing bottom sediments) with numerical standards and guidance values (concentrations above which desired uses are likely to be impaired). Although some exceptions are noted below, water quality generally meets New York State standards and guidance values for Class A-Special waters.

In accordance with the Niagara River Toxics Management Plan and the four-party Declaration of Intent (1987), Canada, the United States, New York State, and the Province of Ontario have developed an upstream/downstream water quality monitoring program involving the collection of water and suspended solids samples at the head (Fort Erie) and the mouth (Niagara-on- the-Lake) of the Niagara River. The purpose of the program is to estimate input loadings of specific metals and organic chemicals to the Niagara River from Lake Erie and output loadings to Lake Ontario, using state-of-the-art sampling and analytical methods capable of

quantifying the presence of chemicals at very low concentrations. Water quality samples are collected weekly by Environment Canada at the two stations. Statistical methods are applied to give annual mean concentrations of each chemical at both ends of the river.

Data collected for 74 chemical parameters during the three sampling years April 1986-March 1987, April 1987-March 1988, and April 1988-March 1989 showed that some mean concentrations exceeded the strictest New York State standards or guidance values applicable to New York State Class A-Special waters for nine chemicals at Niagara-on-the-Lake and seven chemicals at Fort Erie in at least one of the three sampling years (see Table 4.1). Only iron, which is a naturally-occurring non-priority pollutant, exceeded New York State water quality standards. The other chemicals exceeded the most restrictive guidance values established by New York State.

As part of a statewide Water Quality Surveillance Network, NYSDEC sampled Niagara River water quality monthly at an upstream station at Broderick Park (1981-1988) and at a downstream station at Fort Niagara (1981-1989). The analyses performed varied somewhat over the years. Volatile organics, metals, and conventional parameters were analyzed for all years, while full priority pollutant scans were undertaken from 1981-1985.

Fecal and total coliform bacteria exceeded the Class A-Special standards on a number of occasions at both sampling stations. However, the monitoring data is based upon a once per month sampling whereas the standard is based on the geometric mean of a minimum of five samples per month. At Broderick Park, phenols exceeded the DEC drinking water standard in 1988, and lead exceeded the DEC aquatic standard in 1987. At Fort Niagara cadmium exceeded the DEC aquatic standard in 1987.

There are no New York State standards or criteria for bottom sediments, although the U.S. Environmental Protection Agency Region V Great Lakes National Program Office has developed dredging guidelines to assess the suitability of dredged sediments for open lake disposal.

Side scan sonar studies show that the main channel of the Niagara River is scoured to exposed bedrock and stable compact sediment. Fine-grained sediment deposits are limited to nearshore areas, the downstream side of islands in the river, and the sediment bar at the mouth of the river in Lake Ontario.

Sediment data indicate the presence of a wide variety of organic and inorganic contaminants in sediments from the Buffalo Harbor, the Black Rock Canal, the Bird Island-Riverside nearshore area, the Tonawanda Channel nearshore area, the Wheatfield-Upper River nearshore area, and the Lower Niagara River nearshore area. The U.S. Environmental Protection Agency (EPA) Region V, and the U.S. Army Corps of Engineers - Buffalo District (COE) sampled bottom sediments in the Buffalo Harbor and along the upper river in 1981. EPA Region II collected samples from 15 sites along the river's length in 1982. The COE performed additional sampling in 1983 in the Buffalo Harbor and in the Cayuga Island Little River. NYSDEC sampled sediments in the Buffalo Harbor in 1983. Canadian agencies also have

TABLE 4.1
EXCEEDANCES OF NEW YORK STATE STANDARDS OR GUIDANCE VALUES IN
1986-1989 UPSTREAM/DOWNSTREAM WATER QUALITY SAMPLING OF THE NIAGARA RIVER

| | 1986 - 1987 | | 1987 - 1988 | | 1988 - 1989 | |
|---|---|---|---|---|---|---|
| | Fort Erie | Niagara-on-the-Lake | Fort Erie | Niagara-on-the-Lake | Fort Erie | Niagara-on-the-Lake |
| dichloromethane | x | x | | | | |
| tetrachloroethylene | | x | | | | |
| benzo(a)anthracene | | x | | x | x | x |
| benzo(a)pyrene | | x | | | | x |
| benzo(b)fluoranthene | | x | x | x | | x |
| benzo(k)fluoranthene | | x | x | | | x |
| chrysene | x | x | x | x | | x |
| PCBs | x | x | x | x | x | x |
| iron 1/ | x | x | x | x | x | x |

1/ Only iron exceeded New York State water quality standards. The other chemicals exceeded the most restrictive New York State guidance values.

collected sediment samples along the Niagara River: Ontario Ministry of the Environment (MOE) in 1979, and Environment Canada (EC) in 1981.

Core samples allow scientists to determine how sediments and associated contaminants have collected over time. Analyses of core samples from the sediment bar at the mouth of the Niagara River show a significant decrease in contaminants over the past twenty years.

## STATUS OF THE 14 GLWQA IMPAIRMENT INDICATORS AND AN ASSESSMENT OF THE CAUSES OF IMPAIRMENT

The Great Lakes Water Quality Agreement (GLWQA) lists 14 indicators for determining how beneficial uses in an Area of Concern are impaired. When there is strong scientific evidence to determine the status of an impairment or when an impairment is defined in regulatory terms (e.g., a fish consumption advisory), a definite "Yes" or "No" is noted. When there is only indirect evidence or weak direct evidence of an impairment, the impairment is termed "Likely".

### 1. Restrictions on Fish and Wildlife Consumption

Impairment status: Yes.

Elevated levels of polychlorinated biphenyls (PCBs) in various fish species in the upper river (above Niagara Falls) and PCB's, mirex, chlordane, dioxin (2,3,7,8-tetrachlorodibenzo-p-dioxin, or 2,3,7,8-TCDD), and dibenzofuran (2,3,7,8-tetrachlorodibenzofuran, or 2,3,7,8-TCDF) in fish tissue in the lower river and Lake Ontario have led to New York State fish consumption advisories, thus causing an impairment of the river for fish consumption. (Fish from Lake Ontario migrate into the lower Niagara River.) No wildlife consumption advisory exists specific to the Niagara River, although a statewide waterfowl consumption advisory has been issued to "eat no mergansers since they are the most heavily contaminated waterfowl species" and to limit consumption of other waterfowl to two meals per month.

The New York State Department of Health issues fish consumption advisories based on fish sampling data collected by the Department of Environmental Conservation. Concentrations of chemicals found in the fish are compared to the U.S. Food and Drug Administration's (FDA) allowable tolerance levels for food and to New York State criteria for the protection of human health. When high levels of contaminants are found, consumption advisories are issued by the New York State Department of Health to alert fishermen to the potential adverse health impacts of eating contaminated fish.

DEC sampling data show that PCBs exceeded the FDA tolerance level in carp (1981, 1984), smallmouth bass (1984), and brown bullhead (1984) in the upper Niagara River. PCB levels also exceeded the FDA tolerance level in carp taken from the Buffalo River and Harbor area (1984). PCB exceedances were observed in American eel (1981, 1984), smallmouth bass (1981, 1984), rock bass (1981), and carp (1981, 1984) sampled in the lower Niagara River. PCB exceedances were also observed in lake trout 6 years of age and older

(1987, 1989) taken from Lake Ontario. Whole body fish samples taken by EPA in 1987, while not directly comparable to the standard fillets used for all other adult fish samples, showed PCB exceedances in white sucker and sucker in the upper Niagara River and in white sucker in the lower Niagara River.

Mirex concentrations exceeded the FDA tolerance level in American eel taken in the lower Niagara River (1981, 1984) and in chinook salmon, coho salmon, lake trout, and rainbow trout taken in Lake Ontario (1987, 1989). Chlordane concentrations also exceeded the FDA tolerance level in American eel (1981, 1984) taken from the lower Niagara River.

Dioxin (2,3,7,8-TCDD) levels exceeded the New York State human health criterion in lake trout (1987, 1989), brown trout (1987), and white perch (1987) taken in Lake Ontario. They were at the criterion level in white sucker taken from the lower river by EPA in 1987 and in chinook salmon taken from Lake Ontario in 1989. Dibenzofuran (2,3,7,8-TCDF) exceeded the comparable criterion in lake trout in Lake Ontario in 1987.

Based on data quantifying contaminant levels in fish tissue, specific fish consumption advisories have been issued in the Niagara River and its tributaries. The New York State Health Department has issued a 1992-93 fish and wildlife advisory to eat no more than one meal per month of carp from the upper Niagara River. In the lower Niagara River (below Niagara Falls) the advisory is to eat no American eel, channel catfish, white perch, lake trout, chinook salmon, coho salmon over 21 inches, rainbow trout over 25 inches, brown trout over 20 inches and carp. In addition, along the lower Niagara River it is advised that not more than one meal per month be eaten of smallmouth bass, white sucker and smaller coho salmon, rainbow trout and brown trout. The advisories which apply to the lower Niagara River, with the exception of smallmouth bass, also apply to Lake Ontario and reflect the fact that fish from Lake Ontario migrate into the lower Niagara. The advisory also is to eat no carp from the Buffalo River and Buffalo Harbor, and eat no fish species from the Cayuga and Gill Creek tributaries of the Niagara River.

The fish species that are listed for these waters have contaminant levels that exceed federal food standards or state human health criteria, and most fish taken from these waters contain elevated contaminant levels. To minimize potential adverse health impacts, the New York State Department of Health also recommends that women of childbearing age, infants, and children under the age of fifteen not eat fish from these waters.

2. Tainting of Fish and Wildlife Flavor

Impairment status: No.

There is currently no evidence that tainting of fish or wildlife flavor due to chemical contaminants is a problem in the Niagara River.

Substances associated with tainting of fish include phenols and chlorinated benzenes. NYSDEC water quality sampling data taken from both ends of the Niagara River between 1981 and 1989 and Canadian data taken between April 1986 and March 1989 indicated levels of chlorinated benzenes

were well below the food-tainting level of 50 ug/l. Canadian data for specific phenolic compounds showed mean annual levels were well below the food-tainting level of 5 ug/l for unchlorinated phenols and the 1 ug/l level for chlorinated phenols. NYSDEC measurements of total phenols by the aminoantiprine method (4AAP), which reflects a mixture of both chlorinated and unchlorinated compounds, showed limited water quality exceedances in recent years (in 1988 the 1 ug/l level was exceeded in 3 out of 8 samples at the upstream Broderick Park station and in 2 out of 7 samples at the downstream Fort Niagara station). Although these limited water quality exceedances for total phenols create a potential for fish tainting, no occurrences of fish tainting have been reported to NYSDEC. Likewise, although organochlorine compounds have been found in goldeneye ducks as part of NYSDEC studies, no occurrences of tainting of waterfowl attributable to to contaminant levels have been reported.

3. Degradation of Fish and Wildlife Populations

Impairment status: Likely.

Populations of several fish, bird, semi-aquatic mammal, and reptile and amphibian species have experienced significant declines or are believed to have become extirpated (extinct locally) from the Niagara River and the adjacent portions of Lake Erie and Lake Ontario. Several possible causes have been suggested, but definite causative factors specific to the Niagara River Area of Concern have not been confirmed. However, available information suggests that impairment due to localized habitat alterations and chemical contaminants is likely. Habitat assessments and confirmation of contaminant toxicity are needed.

The Niagara River supports a very productive and diverse sport fishery. During 1988, upper Niagara River anglers fished primarily for bass, muskellunge, walleye and yellow perch, while lower river anglers fished mostly for rainbow/steelhead trout, bass, coho or chinook salmon, and lake trout. However, a number of commercially important species have declined or disappeared over the years, including blue pike, lake sturgeon, and northern pike. Possible causes proposed by various researchers include overfishing; destruction of river, marsh, and tributary spawning habitats by dredging, land drainage, and stream channelization; degraded water quality; genetic swamping (interbreeding with closely related species); rapid fluctuations in water level in tributaries and nearshore areas caused by power project operations; changes in spring water temperature patterns associated with operation of the Lake Erie ice boom; parasites; and exotic species.

It is highly likely that populations of other fish species in the Niagara River system also have been historically degraded. Documentation of changes in fish populations is scant and is usually restricted to those fishes of economic or social significance. In addition, the cause and effect linkages for degradation of many fish populations are poorly understood. However, extensive human-induced alterations in the watershed clearly have occurred, and many of these activities adversely affect fish populations. Introduction of exotic species (such as sea lampreys and zebra mussels) has had impacts on fish populations throughout the Great

Lakes. Other historical activities which likely have degraded fish populations include: construction of dams and other barriers on tributaries which limit fish migrations, dredging and filling of important/critical fish spawning/nursing habitats, alteration/diversion of flows, degradation of riparian (shoreline) habitats, siltation, channelization of streams, extraction of sand and gravel deposits from waterways, degradation or loss of important wetlands, and introduction of contaminants to waterways.

A search of the historical literature concerning Niagara River wildlife indicates that several species have been extirpated from the river, while populations of some remaining species have been greatly reduced. Among bird species, bald eagles and ospreys have been eliminated from the area, while black-crowned night herons and canvasback have declined from numbers recorded historically. These losses are likely the result of several factors including the uptake of chemical contaminants leading to eggshell thinning and reduced productivity, loss of wetland and forested shoreline habitat, human disturbance of nesting areas, shooting, and regional decline. Efforts to restore species such as osprey in locations where suitable habitat still exists will need to consider chemical contaminant levels in animals and fish used for food by these species. Several other resident species have likely declined from historic populations as a result of marsh and wetland habitat loss.

With the loss of marsh and wetland habitat associated with the river, semi-aquatic mammal species such as mink, muskrats, and beavers have likely declined from historic levels. The river otter has been extirpated. The effect of chemical contaminants on these Niagara River mammals is unknown, although PCB levels in likely food fish species are high enough to reduce reproductive success in mink and river otters.

As with birds and mammals, the loss of wetland habitats along the river has most likely caused similar declines in several wetland-dependent species of reptiles and amphibians, including the spiny softshell turtle, Blanding's turtle, common snapping turtle, eastern painted turtle, stinkpot turtle, map turtle, and mudpuppy. There are no data specific to the Niagara River to indicate what, if any, role contaminants have in the degradation of these populations, although some of these species are known to be intolerant of pollution.

4. Fish Tumors or Other Deformities

Impairment status: Yes.

Fish tumors and other deformities have been reported to be above the natural background level in localized study areas in the upper Niagara River. This indicator therefore demonstrates an impairment which has been related, at least in part, to polynuclear aromatic hydrocarbons (PAHs) in the river sediments.

Brown bullheads caught in the Buffalo River appear to have a high prevalence of liver and skin tumors. Scientists who have studied the Buffalo River fish are convinced that the tumor incidence is well above the level expected from natural causes. A study by Black showed that extracts of Buffalo River sediments induce fish tumors.

Freshwater drum collected in 1981 from a site downstream of the Black Rock Canal in the Niagara River were shown by Black to have incidences of skin tumors significantly higher than levels found in fish from reference sites in Lake Erie.

Another study by Hickey, Bennett, Reimschuessel and Merckel using brown bullheads collected in 1987 from an embayment adjacent to the Love Canal-102nd Street Landfill found liver tumors occurring above IJC's suggested rate of zero. Although liver tumors were not reported in brown bullheads collected from the reference site on Black Creek (Ontario), a tributary to the Niagara River along the Chippawa Channel, several non-parasitic conditions which are indicative of problems were not significantly different between the reference site fish and the embayment area fish. These data, though localized, indicate that this indicator is impaired. Additional research is necessary to more comprehensively address the question of the extent of this impairment indicator in the Niagara River.

5. Bird or Animal Deformities or Reproduction Problems

Impairment status: Likely.

While there are no direct data to indicate bird or animal deformities or reproduction problems along the Niagara River, high levels of chemical contaminants in fish used as food by birds and other animals suggest that such effects are likely. NYSDEC criteria for the protection of fish-eating wildlife have been exceeded in small fish species less than one year old by PCBs, BHC (hexachlorocyclohexane), hexachlorobenzene, and dioxin (2,3,7,8-TCDD), and in adult fish by PCBs, DDT, DDE, dieldrin, chlordane and dioxin (2,3,7,8-TCDD).

Small fish less than one year old, or young-of-the-year fish, would be the likely prey of many fish-eating birds and mammals. NYSDEC collected young-of-the-year spottail shiners from several locations along the Niagara River from 1984 through 1987. PCB levels exceeded the NYSDEC wildlife criterion in fish collected from the Tonawanda Channel and the North Grand Island Bridge in 1986, and from the lower river at Lewiston in 1984.

Young-of-the-year spottail shiners were also collected by the Ontario Ministry of Environment (MOE) at various sites from 1975 through 1990. The NYSDEC wildlife criterion for PCBs was exceeded in at least one of the sampling years at the following locations: Fort Erie (Ont.), Frenchman's Creek (Ont.), Pettit Flume (Occidental Chemical Durez hazardous waste site), Wheatfield (along Tonawanda Channel), 102nd Street Landfill site, Cayuga Creek (Love Canal site), Gill Creek (DuPont-Olin site), Usher's Creek (Ont.), Queenston (Ont.), Lewiston, Peggy's Eddy, and Niagara-on-the-Lake (Ont.). In 1984 hexachlorobenzene, octachlorostyrene, and aldrin in the MOE samples exceeded the NYSDEC wildlife criteria at the Pettit Flume.

At Gill Creek in 1985 total BHC (hexachlorocyclohexane) and hexachlorobenzene exceeded the NYSDEC wildlife criteria.

Dioxin (2,3,7,8-TCDD) was first reported in young-of-the-year fish in Cayuga Creek (Love Canal site) in 1982. Although drainage from the Love Canal site was stopped in 1983 and dioxin-contaminated sediment was dredged from tributary creeks in 1989, sampling conducted by NYSDEC in 1990 showed that the NYSDEC wildlife criterion of 0.0000023 ug/g was still being exceeded in young-of-the-year fish in both the Cayuga Creek basin and the Cayuga Island Little River (through which Cayuga Creek flows). Since the primary source of 2,3,7,8-TCDD has been abated, it is anticipated that further declines in fish contamination will occur.

Fish-eating birds and mammals may also eat older fish of other species. PCB levels exceeding the NYSDEC wildlife criterion were found in all species sampled in the Niagara River by NYSDEC in 1981 and 1984 and by EPA in 1987 with the exception of largemouth bass in the lower river. Total DDT was observed in 1981 and 1984 at levels exceeding the DEC wildlife criterion in carp, smallmouth bass and American eel. In 1987 the DDT metabolite DDE exceeded the DEC wildlife criterion in white sucker in the lower Niagara River. Dieldrin exceeded the DEC wildlife criterion in carp and American eel in 1981 along the Niagara River. Dieldrin and chlordane levels in American eel were also above the NYSDEC wildlife criteria in 1984 along the lower Niagara River. Dieldrin and chlordane levels were below the criteria in adult fish samples collected in 1987 except for dieldrin in one white sucker sample.

Lake Ontario fish contaminant data analyzed by NYSDEC in 1987 indicate PCBs and total DDT exceeded the NYSDEC wildlife criteria in brown trout, chinook salmon, coho salmon, lake trout and rainbow trout. Total mirex in 1987 and 1989 exceeded the NYSDEC wildlife criterion in lake trout greater than six years of age. Dieldrin in 1987 also exceeded the NYSDEC wildlife criterion in brown trout and lake trout. Smallmouth bass and carp from Lake Ontario sampled by NYSDEC in 1988 exceeded the NYSDEC wildlife criterion for PCBs. In 1989 NYSDEC fish sampling indicated that PCBs and DDE exceeded the NYSDEC wildlife criteria in chinook and coho salmon as well as lake and rainbow trout. Dieldrin levels exceeding the NYSDEC wildlife criterion were also observed in lake trout.

Dioxin (2,3,7,8-TCDD) levels in 1987 exceeded the NYSDEC wildlife criterion in carp near Niagara Falls and in white sucker and smallmouth bass in the lower river. NYSDEC fish analyses from Lake Ontario in 1987 and 1989 showed dioxin exceedance of the NYSDEC wildlife criterion in all species sampled.

PCBs and DDT (and metabolites) were analyzed in herring gull eggs and black-crowned night heron eggs collected from 1979 through 1986 by the Canadian Wildlife Service from colonies on the Niagara River above the Falls. A general decline of both contaminants was observed with the exception of a single sample of black-crowned night heron eggs in 1986. A similar downward trend in dioxin (2,3,7,8-TCDD) was observed by the Canadian Wildlife Service in herring gull eggs collected at Niagara Falls from 1981 to 1986.

PCB levels were observed by NYSDEC in a variety of waterfowl species collected across New York State from 1979-80 through 1983-84. In a 1984-85 study of common goldeneye ducks during their overwintering period along the upper Niagara River near Niagara Falls, NYSDEC found an increase of levels of a variety of PCB and organochlorine compounds in fat tissue during the overwintering period. Subsequent sampling of common goldeneye in 1988 showed a substantial decrease from 1984 in PCB and organochlorine contaminant levels in fat.

Research with birds in the Great Lakes Region has focused primarily on quantifying contaminant levels. Investigations into bird and animal deformities and reproduction problems are limited, although chemical contaminants have been associated with eggshell thinning, embryo toxicity, behavioral toxicity, teratogenicity, and target organ toxicity.

DDT-induced eggshell thinning and embryonic mortality resulted in the decline of bald eagle, peregrine falcon and osprey in the Great Lakes. Organochlorine compounds have been implicated in great horned owl mortality throughout New York State.

Monitoring of contaminants in Niagara River mammals has been very limited. Organochlorine and PCB levels in Lake Ontario and Lake Erie mink are very high. PCBs are known to be toxic to mink and have been associated with reproductive complications.

Data on contaminant levels and associated impacts in reptiles and amphibians along the Niagara River are not known to exist.

While there are no data to indicate bird or animal deformities or reproduction problems, the exceedance of PCB, BHC (hexachlorocyclohexane), hexachlorobenzene and dioxin wildlife criteria in young-of-the-year fish as well as the exceedance of PCB, DDT, DDE, dieldrin, chlordane and dioxin in adult fish that may be consumed by wildlife suggest that such impairment is likely.

6. Degradation of Benthos

Impairment status: Yes.

Due to its swift current, the main channel of the Niagara River does not contain substantial deposits of the fine-grained sediments required as habitat by benthic macroinvertebrates (organisms that live in sediments at the bottom of a body of water); therefore, this impairment indicator does not apply to the main channel of the Niagara River. However, impairment caused by chemical contaminants does exist in localized sediment pockets at certain tributary mouths and nearshore areas.

Macroinvertebrate organisms (such as insect larvae and worms) serve as a food source for higher organisms such as fish and as an indicator of pollutant and habitat stresses. In the absence of proper habitat for most bottom-dwelling organisms in the mainstream of the Niagara River, NYSDEC sampled macroinvertebrates living in the water column in 1976, 1982, 1987, and 1988. Sampling at Strawberry Island near the head of the Niagara River

and at Fort Niagara near the mouth of the Niagara River showed some improvement in community structure from 1976 to 1982 which has been sustained since. Diversity of species is considered fair to good at both sites. Decreases in population counts at both sites between 1976-82 and 1987-88 may be attributed to reduced organic inputs to the Niagara River from municipal and industrial wastewater treatment facilities over that time period. The dominance of stress-resistant species such as the midge and the absence of more sensitive species such as the mayfly indicate stress, although this is probably primarily attributable to the physical habitat (width, depth, and swift current) at the sites. Caddisflies collected at both Strawberry Island and Fort Niagara in 1987 were analyzed for uptake of metals, but concentrations did not exceed normal background levels.

Contaminants are present in sediment samples collected in nearshore areas (especially adjacent to hazardous waste sites) and in sediments collected near the mouths of tributaries to the Niagara River.

Laboratory testing of organisms that live either on or directly above sediments was undertaken by NYSDEC in 1986-87 to assess acute toxicity and bioaccumulation resulting from exposure to sediments taken from the mouths of Niagara River tributaries. Based on these studies, benthos are impaired at certain of these tributaries. Toxicity testing showed Gill Creek bottom sediments to be unequivocally toxic to both crustacean test species as no organisms survived. Contaminated bottom sediments from Gill Creek were removed in 1992. Significant toxic effects on both test species were noted from Buffalo River sediments. Smokes Creek sediment was found to have toxic effects on one of the test species. Bioaccumulation studies using juvenile fish indicated significant uptake of BHCs (hexachlorocyclohexane) and PCBs in Gill Creek, and PCBs in the Buffalo River. Benthos also are undoubtedly impaired in embayment areas along the Niagara River near inactive hazardous waste sites (Pettit Flume - Durez site and 102nd Street Landfill).

While benthos are not impaired in the main channel of the Niagara River due to the absence of fine grained sediments, impairment does exist at selected tributary mouths and nearshore areas.

7. Restrictions on Dredging Activities

Impairment status: Yes.

If contaminants in dredged sediments exceed certain levels established by U.S. EPA, there are restrictions on how and where these sediments may be disposed. Buffalo Harbor and Black Rock Canal sediments, which periodically must be dredged to maintain commercial navigation, are contaminated to a level that prohibits open lake disposal. This constitutes a use impairment.

Along the mainstream of the Niagara River the bottom is generally scoured due to high flow velocities. Sediment accumulation is limited to the low velocity nearshore areas and at the mouth of the Niagara River in

Lake Ontario. Sediment samples have been collected by various agencies from several of these deposition areas.

Comparison of the median concentrations of substances found in the sediments to U.S. EPA guidelines shows that sediments from four river segments exceed open lake disposal criteria. They are the Buffalo Harbor, Black Rock Canal, Bird Island-Riverside and Tonawanda-North Tonawanda segments.

The median values of nine substances (arsenic, barium, copper, iron, lead, manganese, nickel, zinc and cyanide) found in the Buffalo Harbor exceeded dredging criteria. Median values for contaminants in Black Rock Canal sediment show exceedances of dredging criteria for ten substances (PCBs, arsenic, barium, cadmium, chromium, copper, iron, lead, mercury, zinc and cyanide). This means that sediments dredged to maintain commercial navigation in these segments cannot be disposed in the open lake but must be placed in specially constructed confined sites.

Sediments in the Bird Island-Riverside segment show seven substances (six metals and cyanide) whose median concentration values are greater than open lake disposal criteria. In sediment samples for the Tonawanda-North Tonawanda river segment, median values of five substances (four metals and cyanide) exceeded dredging guidelines. In both of these segments, dredging for commercial navigation is not required due to the high flow velocity of the river which precludes sediment deposition in the main channel.

8. Eutrophication or Undesirable Algae

Impairment status: No.

Eutrophication and undesirable algae growth are not currently a serious problem in the Niagara River.

Eutrophication is a process in which excessive nutrients and organic matter inputs from a watershed result in overproduction of algae, reduced transparency (light penetration), and oxygen depletion. Measurements of concentrations of phosphorus and chlorophyll a, which are used to assess eutrophication and algal growth, indicated a decline in the open waters of Lake Erie between 1968 and 1985. This is attributed to the phosphorus reduction programs which have been in place throughout the Great Lakes since the early 1970s. The high dissolved oxygen levels measured in the Niagara River along with the absence of nuisance algal blooms or accumulation further support the finding of no impairment.

9. Restrictions on Drinking Water Consumption or Taste and Odor Problems

Impairment status: No, except for taste and odor concerns associated with the impact of zebra mussels.

There are no restrictions on consumption of drinking water which has been treated by standard methods. Taste and odor problems, which had been infrequent and short-lived until the Summer of 1991, are believed to be

associated with zebra mussels and their impact on algae growth. Aside from the new taste and odor concerns, there is no impairment to the ability of communities to use the Niagara River as a source of drinking water.

The Niagara River is classified A-Special, which means that this international boundary water's best use is as a source of water supply for drinking. As a source of municipal drinking water, the Niagara River serves a population of more than 600,000 people through eight active U.S. water intakes and one active Canadian intake located along the upper river. An additional 330,000 U.S. residents are served by the City of Buffalo, which obtains water at the junction of Lake Erie and the Niagara River.

Standards and guidelines to protect human health have been established which identify acceptable limits in drinking water supplies for densities of disease-causing organisms and concentrations of hazardous or toxic chemicals and radioactive substances. Water quality monitoring has been undertaken by both NYSDEC and Environment Canada near the head and mouth of the Niagara River, and by water treatment plants at their intakes.

The chemical data indicate that some standards and guidance values have been exceeded in the river. For certain substances, such as polynuclear aromatic hydrocarbons (PAHs) and iron, the data indicate that the majority of each compound is in the suspended sediment phase which would be removed in the water treatment process. For other substances, such as total phenols (4AAP), dichloromethane, and tetrachloroethylene, data obtained since 1986-87 do not show guidance value exceedances. The water treatment process further reduces chemical concentrations well below standards.

Sampling for bacteriological parameters (total and fecal coliform) suggests possible exceedances at nearshore locations; however, standards are met at the drinking water intakes, which are located near the center of the Niagara River channels.

Testing for radioactive substances, performed in 1982 and 1986 at water treatment plants for the New York State Health Department, shows compliance with standards.

Over the past decade taste and odor problems occasionally arose when temperature conditions in Lake Erie were elevated and blue-green algae increased in the water flowing into the Niagara River. These algae combined with chlorine used for disinfection in water treatment resulted in taste and odor problems. This condition was very infrequent, usually short- lived, and substantially diminished in intensity until the Summer of 1991. Investigations indicate that the filtering action of the zebra mussel has resulted in increased clarity of the water, allowing greater penetration of sunlight which promotes increased algae growth and generates new by-products of algae. Two by-products of blue-green algae known as geosmin and MIB (methylisoborneol) have been linked to the taste and odor problem. The addition of powdered activated carbon in the water treatment process is a means of reducing or eliminating this taste and odor problem. Research in this area is ongoing.

There are no restrictions on drinking water consumption. Taste and odor problems were not prevalent until the Summer of 1991. This indicator is not impaired except for the new taste and odor concerns believed to be associated with the spread of zebra mussels.

10. Beach Closings

Impairment status: No.

The only public swimming beach on the U.S. side of the Niagara River, located at Beaver Island State Park on the southern tip of Grand Island, has consistently met New York State bacterial water quality standards for public bathing and has never been closed due to water quality problems. Therefore, no use impairment exists for this indicator in the Niagara River.

The development of future public swimming areas along the Niagara River is inhibited by the extensive urban development along the upper river which limits areas available for beach development; the steep banks along the lower Niagara gorge which limit access; and high flow velocities along most of the river which pose a physical hazard.

11. Degradation of Aesthetics

Impairment status: No. (Water Quality Aesthetics)

Although some aesthetic concerns such as debris, storm-related turbidity, foam (at the base of Niagara Falls), discoloration from algae, and localized nuisance weed growth have been noted along the Niagara River, the majority of these problems are not caused by the presence of persistent unnatural substances in the Niagara River. Therefore, water quality related aesthetics is not a problem.

Unsightly conditions exist along portions of the Niagara River shoreline due to historical decisions regarding land use. At the same time, many scenic areas exist along the river shoreline, both man-made and natural. Aesthetics concerns associated with land use are addressed more directly in Chapter 10.

12. Added Costs to Agriculture or Industry

Impairment status: No, except for the impact of zebra mussels.

The water quality of the Niagara River did not impose added costs for commercial or industrial uses until the spread of zebra mussels began in the Great Lakes. Industrial water users have installed equipment for the application of chemicals to prevent the buildup of zebra mussels in their water systems. Thermal treatment is also used where it is applicable. Agriculture is not a direct use associated with the Niagara River.

13. Degradation of Phytoplankton and Zooplankton Populations

Impairment status: No, except for the impact of zebra mussels.

Degradation of phytoplankton and zooplankton populations has not been considered a problem in the Niagara River. The impact of zebra mussels on plankton is uncertain and must be monitored.

Due to the high velocity of flow in the Niagara River, phytoplankton and zooplankton community development is naturally limited, and research on these organisms specific to the Niagara River has not been undertaken. It is known that plankton enter the Niagara River from Lake Erie and play a role in the Niagara River ecosystem. The dominance of filter-feeding organisms in macroinvertebrate samples taken by NYSDEC at Strawberry Island near the head of the Niagara River and at Fort Niagara near the mouth of the river in 1987 and 1988 indicates high levels of plankton available for food.

In 1987 and 1988 NYSDEC performed laboratory tests to determine the toxicity to the zooplankton species Cierodaphnia in water samples collected at Strawberry Island and at Fort Niagara. No water column toxicity was shown.

Zebra mussels are known to be feeding on phytoplankton and small zooplankton species. Excessive removal of these plankton from the water column could cause a decline in zooplankton species which in turn could result in other food web impacts.

14. Loss of Fish and Wildlife Habitat

Impairment status: Yes.

The loss of fish and wildlife habitat on the upper Niagara River due to human activities has been dramatic. This loss has impaired use of the river and its shoreline for fishing and the observation, study, photography, and hunting of wildlife. It is likely that habitat loss has contributed to the degradation of fish and wildlife populations.

Small dams and other barriers to fish migrations have rendered large sections of Niagara River tributaries unavailable for spawning and nursery activities by lake-based and river-based migratory fishes.

Wetlands adjacent to the river were an integral part of the Niagara River ecosystem, providing spawning and nursery areas for certain fish species and feeding, breeding, rearing, and resting areas for many birds, semi-aquatic mammals, reptiles, and amphibians. The Tifft Street area in Buffalo, formerly the largest emergent marsh on the eastern end of Lake Erie, was segmented and largely filled to accommodate industrial and railroad development. Several hazardous waste sites lie adjacent to the remaining wetland segments and some segments are known to contain chemical contaminants. In spite of this, many species of wildlife still use the remaining wetlands.

Another significant loss was the filling of the marsh around Rattlesnake Island in the Tonawanda Channel, once the second largest marsh adjacent to the river. In addition, numerous small, shallow bays which previously existed on the east shore of the Tonawanda Channel have been filled for residential and marine development, and some are now the locations of hazardous waste landfills.

The largest marsh presently on the river, Buckhorn Island Marsh has escaped significant filling. However, human activities such as diversion of river water for power production and installation of a service road across the east end of the marsh have contributed to apparent dewatering of the marsh and elimination of deepwater plant species.

The second largest marsh presently on the river, located on the east side of Beaver Island State Park, has been degraded as habitat for waterfowl, marsh birds, and muskrats by the invasion of an alien plant, purple loosestrife.

Bays and shallow water areas containing beds of submerged aquatic plants are extremely important feeding habitat for resident and migating waterfowl. This habitat has been significantly reduced and degraded by filling, dredging, and the development of marinas and private docks. Affected areas include the bays once present along the eastern shore of the Tonawanda Channel, the bays above and below Rattlesnake Island, a bay located at the northern end of Bird Island, and the shallow water areas within the Buffalo Harbor near the Bethlehem Steel site. Remaining areas of shallow water habitat along the river have in the past and are continuing to be disturbed by dredging required for the development of boating facilities, excavation required for pipeline crossings, and fluctuating water levels.

Beach, mudflat, and cobble shore habitat areas have been lost due to extensive bulkheading and filling, especially on the American shoreline of the upper Niagara River. These alterations have eliminated much of the feeding and resting habitat for migrating shorebirds and other waterfowl. Forested shoreline habitat which provides needed perch sites and resting areas for many birds including bald eagle and osprey also has been greatly reduced along the upper river. Remaining areas of forested shoreline there include Navy Island, Buckhorn and Beaver Island State Parks, Strawberry Island, and a wooded wetland just north of Spicer Creek on Grand Island. The rest of the shoreline on the upper river is either treeless or contains occasional trees where the understory has been removed and is mowed.

A large variety of species still utilize remaining habitats. Opportunities exist to restore extirpated species provided suitable habitats are protected and restored. Use of the river ecosystem by fish, wildlife, and both migrating and resident birds can be preserved and encouraged with restoration and protection of remaining wetland and shallow water habitats.

IMPAIRMENT SUMMARY

Table 4.2 summarizes the status of each of the fourteen GLWQA impairment indicators and lists the likely causes when impairment status was found to be "yes" or "likely".

Known impairments are restrictions on fish and wildlife consumption, fish tumors and other deformities, degradation of benthos, restrictions on dredging activities, and loss of fish and wildlife habitat. The likely causes of these impairments include physical disturbances and the chemical substances PCBs, mirex, chlordane, dioxin (2,3,7,8-TCDD), dibenzofuran (2,3,7,8-TCDF), PAHs, BHCs, metals, and cyanides.

Impairments which existing evidence suggests are likely include degradation of fish and wildlife populations and bird or animal deformities or reproduction problems. For degradation of fish and wildlife populations, several possible causes have been suggested, but causes specific to the Niagara River Area of Concern have not been confirmed. While there are no direct data to indicate bird or animal deformities or reproduction problems along the Niagara River, levels of chemical contaminants in fish used as food by birds and animals suggest that such effects are likely. These contaminants include PCBs, BHCs, hexachlorobenzene, dioxin (2,3,7,8- TCDD), DDT, DDE, dieldrin, and chlordane.

The sources of pollutants and disturbances linked to impairments will be examined in Chapter Five.

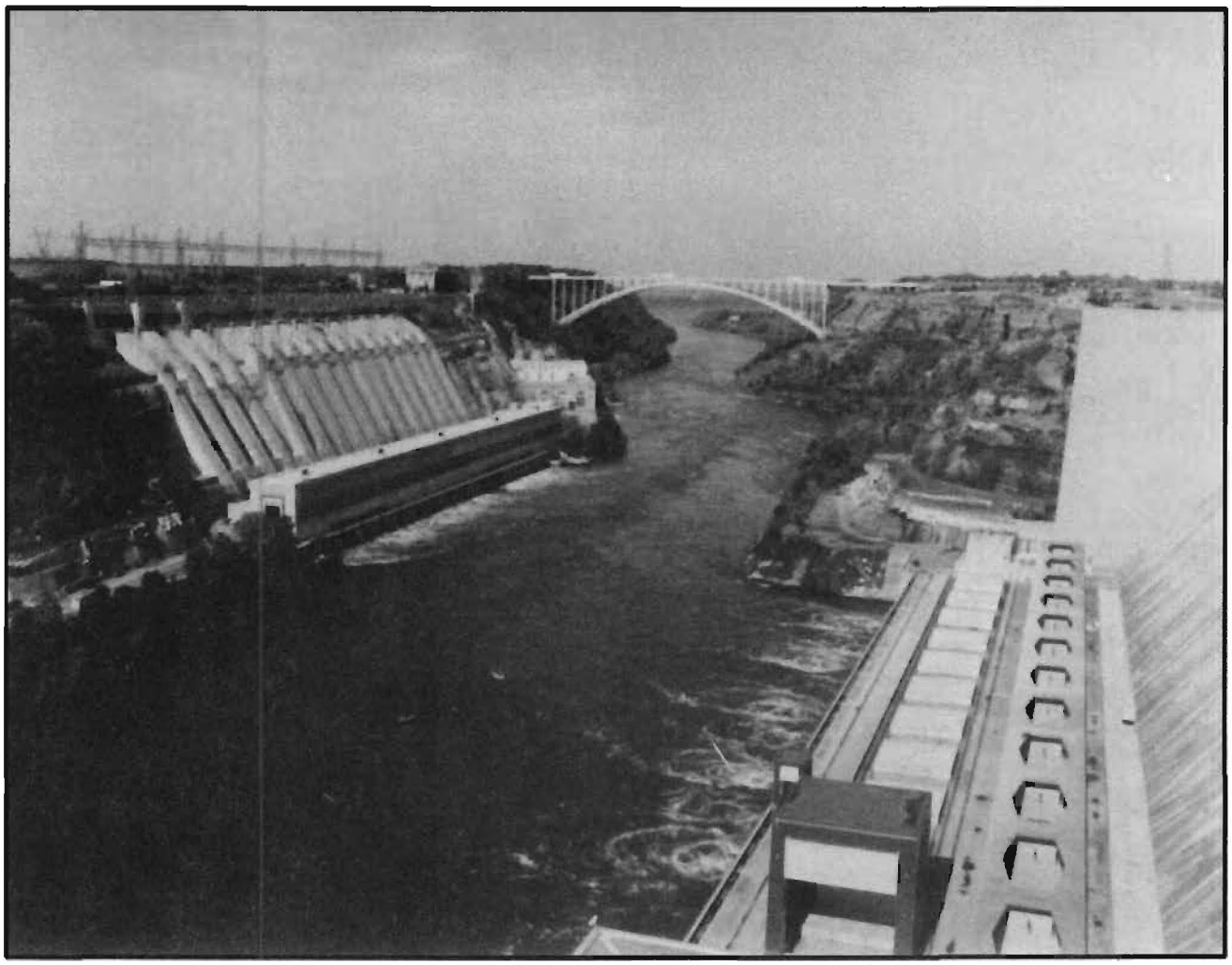
**TABLE 4.2**
**SUMMARY OF IMPAIRMENTS AND IMPAIRMENT INDICATORS OF BENEFICIAL USES OF THE NIAGARA RIVER**

| No. | Impairment Indicators | Impairment | Likely Causes |
|---|---|---|---|
| 1. | Restrictions on fish and wildlife consumption | Yes | PCBs, mirex, chlordane, dioxin, dibenzofuran |
| 2. | Tainting of fish and wildlife flavor | No | Not applicable |
| 3. | Degradation of fish and wildlife populations | Likely | None identified |
| 4. | Fish tumors or other deformities | Yes | PAHs |
| 5. | Bird or animal deformities or reproduction problems | Likely | PCBs, BHCs, HCB, dioxin, DDT, DDE, dieldrin, chlordane |
| 6. | Degradation of benthos | Yes | PCBs, BHCs |
| 7. | Restrictions on dredging activities | Yes | PCBs, arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, zinc, cyanide |

**TABLE 4.2 (Con't)**
**SUMMARY OF IMPAIRMENTS AND IMPAIRMENT INDICATORS OF BENEFICIAL USES OF THE NIAGARA RIVER**

| No. | Impairment Indicators | Impairment | Likely Causes |
|---|---|---|---|
| 8. | Eutrophication or undesirable algae | No | Not applicable |
| 9. | Restrictions on drinking water consumption or taste and odor problems | No 1/ | Not applicable |
| 10. | Beach closings | No | Not applicable |
| 11. | Degradation of aesthetics | No | Not applicable |
| 12. | Added costs to agriculture or industry | No 1/ | Not applicable |
| 13. | Degradation of phytoplankton and zoo-plankton populations | No 1/ | Not applicable |
| 14. | Loss of fish and wildlife habitat | Yes | Physical disturbance |

1/ Except for the impact of zebra mussels



New York and Ontario Hydropower Stations,
Lower Niagara River
*Jacqueline Letke*

# CHAPTER FIVE: SOURCES OF POLLUTANTS AND DISTURBANCES

## INTRODUCTION

A number of potential contaminant sources as well as physical disturbances may cause or contribute to one or more use impairments. A general overview of potential sources, their location and characteristics is summarized in this chapter. The source categories described have the greatest potential to be the origin of contaminants identified in the previous chapter as likely causes of impairments.

Specific pollutants or disturbances known or suspected to cause impairment, along with data on potential sources, are discussed in this chapter. The relationship of the following chemical pollutants to use impairments are presented: polychlorinated biphenyls, mirex, chlordane, dioxin, dibenzofuran, polynuclear aromatic hydrocarbons, BHC (hexachlorocyclohexane), hexachlorobenzene, DDT, DDE, dieldrin, metals and cyanide.

## GENERAL OVERVIEW OF POLLUTANT SOURCES

### Lake Erie

The contaminants listed above are the suspected causes of use impairments in the Niagara River. When evaluating the potential sources of the contaminants, point and nonpoint sources must be investigated. Additionally, the potential for pollutants to enter the area of concern from upstream must be considered. The levels of the suspected contaminants entering the Niagara River from Lake Erie can be compared with the levels in the river as it discharges into Lake Ontario by reviewing the data collected by Environment Canada from 1986 through 1989.

The levels of PAHs, PCBs and iron were elevated, however, the percentage of contaminants entering from Lake Erie varied considerably over the sampling period. Hexachlorobenzene and mirex were detected at the outlet of the river to Lake Ontario but were not detected entering the river from Lake Erie. Dioxin was not detected either in the inlet or the outlet of the Niagara River. The Environment Canada data indicates that both the pesticides and metals levels observed in the Niagara River enter predominately from Lake Erie.

### Municipal and Industrial Wastewater Discharges

Between April 1981 and March 1982, the New York State Department of Environmental Conservation (DEC) conducted a comprehensive sampling and analysis of municipal and industrial point source dischargers on the U.S. side of the Niagara River. As a result of this sampling 29 significant dischargers to the Niagara River were identified. These facilities discharged 95 percent of the total municipal and industrial loading to the Niagara River. The 29 facilities on the U.S. side are located on Figure 5.1 and are listed in Table 5.1.

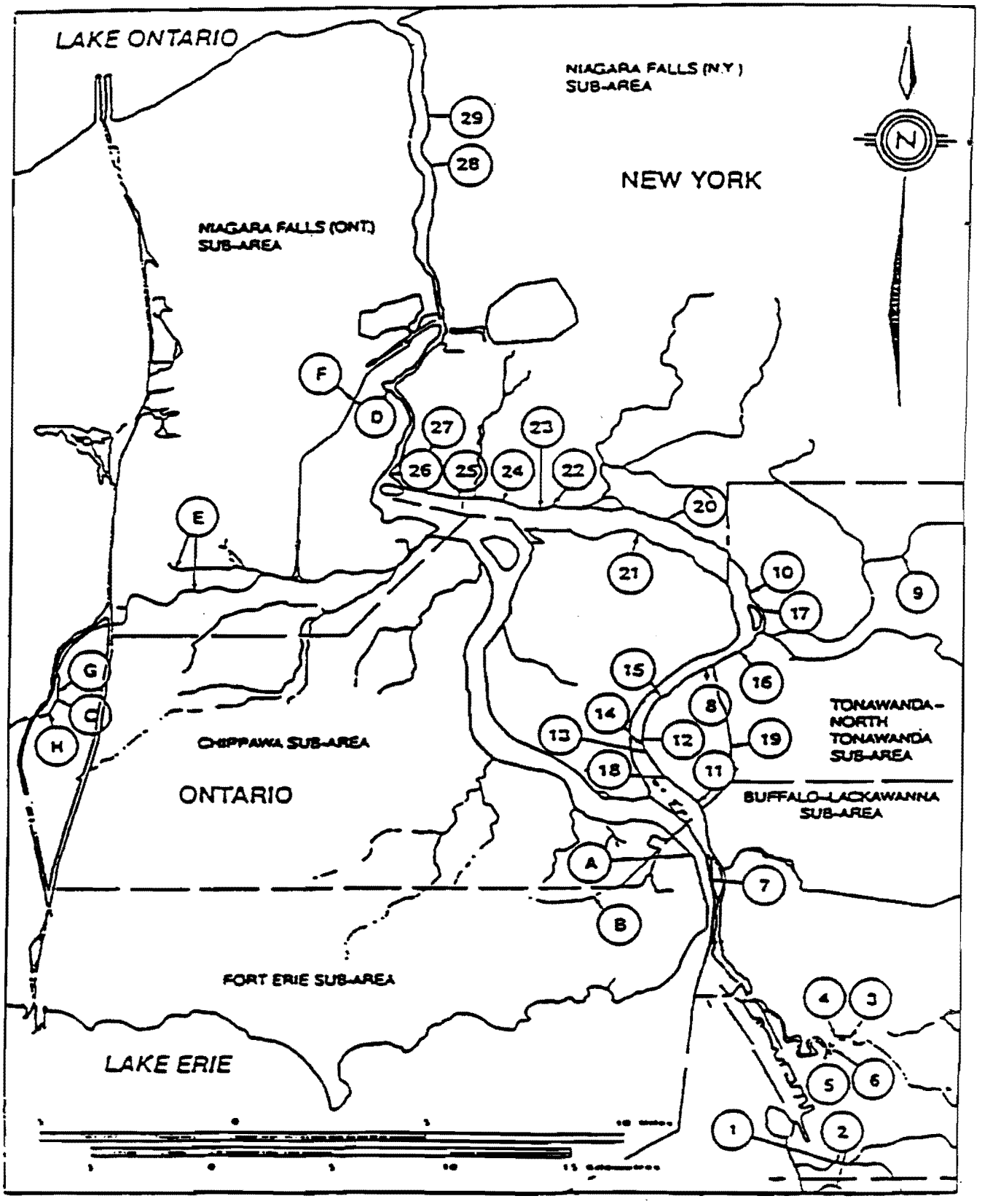



FIGURE 5.1 DISCHARGERS WITH SIGNIFICANT LOADINGS TO THE NIAGARA RIVER
(See Table 5.1 for site identification.)

# TABLE 5.1
## SIGNIFICANT MUNICIPAL AND INDUSTRIAL DISCHARGERS OF EPA PRIORITY AND SPECIAL POLLUTANTS TO THE NIAGARA RIVER

**Buffalo-Lackawanna Sub-Area (U.S.)**

1. Erie County Sewer District #6 WWTP [1/]
2. Bethlehem Steel Corp.
3. PVS Chemical Corp.
4. Buffalo Color Corp.
5. Donner-Hanna Coke [2/]
6. Republic Steel Corp. [2/]
7. Buffalo Sewer Authority WWTP

**Fort Erie Sub-Area (Canada)**

A. Fort Erie WPCP
B. Fleet Manufacturing

**Tonawanda-N. Tonawanda Sub-Area (U.S.)**

8. Town of Tonawanda WWTP
9. Town of Amherst WWTP
10. City of North Tonawanda WWTP
11. General Motors Corp.
12. Niagara Mohawk Power Corp.
13. Dunlop Tire & Rubber Corp.
14. FMC Corporation
15. Ashland Oil, Inc. [2/]
16. Spaulding Fibre Co.
17. Occidental Chemical Co. Durez. Div.
18. E.I. duPont deNemours & Co. (Tonawanda Plant)
19. Union Carbide Corp. Linde Div.

**Chippawa Sub-Area (Canada)**

No significant point sources

**Niagara Falls, New York Sub-Area (U.S.)**

20. Niagara County S.D. #1 WWTP
21. Town Grand Island S.D. #2 WWTP
22. Occidental Chemical Corp. (Niagara Plant)
23. L-TEC [3/]
24. E.I. duPont deNemours & Co. (Niagara Plant)
25. SOHIO Electro Mineral Co. [4/]
26. City of Niagara Falls WWTP
27. Olin Corp.
28. Town of Lewiston MSIA WWTP
29. CWM Chemical Services [5/]

**Niagara Falls Ontario Sub-Area (Canada)**

C. Atlas Steels
D. Cyanamid Canada Ltd. (Niagara Plant)
E. Cyanamid Canada Ltd. (Welland Plant)
F. Niagara Falls WPCP
G. Welland WPCP
H. McMaster Avenue Combined Sewer

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1/ Formerly City of Lackawanna WWTP
2/ Facility closed
3/ Formerly Union Carbide Corp. Welding Flux
4/ Formerly Carborundum Corp.
5/ Formerly SCA Chemical Services

Four years later, 26 of the U.S. significant dischargers were still operating, and no new ones had been added. Changes in toxics loadings (amounts discharged per day) to the Niagara River over the four-year period were determined by comparing measurements taken at these 26 facilities in 1981-82 and 1985-86. The 1981-82 and 1985-86 sampling periods are considered reference years representing the primary period when control measures came on line for the reduction of toxic discharges from point sources. Subsequent sampling years are then compared to the reference years. Reports containing the results of the 1981-82, 1985-86, 1986-87, 1987-88, 1988-89 and 1989-90 sampling have been issued by DEC. The data presented here details the findings of the 1989-90 sampling and compares those results with the 1981-82 and 1985-86 reference year values.

Total Priority Pollutants. In 1985-86, DEC measured a total loading of 540 pounds per day of organic and inorganic priority pollutants. In 1989-90, the total loading was 550 pounds per day. When compared with the 1981-82 total loading of 2740 pounds per day, both the 1985-86 values and the 1989-90 values represent approximately an 80 percent reduction. Table 5.2 shows the breakdown of the three total loading measurements by contaminant groups. As the table shows, in 1989-90 approximately 82 percent (450 pounds per day) of total priority pollutants were inorganic (metals and cyanides). The remaining 100 pounds (18 percent) were organic chemicals.

Comparison of DEC and Facility Monitoring Data. SPDES permits require dischargers to sample and analyze their own effluents and report the results each month to DEC. The DEC sampling provides an opportunity to check the reliability of facility self-monitoring data. In 1981-82, nine U.S. facilities discharged 90 percent of the loading to the Niagara River. For these facilities, a comparison was made between the DEC data and the facility self-monitoring data for the 1989-90 year. Both sets of data totaled just under 400 pounds of priority pollutants. The favorable comparison between the two sets of data lends credibility to each, and verifies the overall 80 percent reduction achieved since the early 1980's.

Factors Contributing to Pollutant Reductions. The priority pollutant reductions documented in 1985-86 and 1989-90 are due to several factors. Among them are completion of wastewater treatment plants; stabilization of start-up operations following new wastewater treatment plant construction; collection system remediation and process shutdowns. Similar actions have also been undertaken at smaller facilities. One-fifth of the reduction in discharge loading is attributable to manufacturing plant closings and process shutdowns.

The remaining four-fifths of the pollutant reduction results from operational changes mandated under DEC water pollution control programs. For example, second round SPDES permits issued since 1982 have required dischargers to modify and improve industrial processes to increase the efficiency of wastewater treatment facilities. Pretreatment program requirements have reduced contaminant loadings to municipal wastewater treatment facilities. Implementation of best management practices has improved control over leaks and spills at industrial facilities.

TABLE 5.2
PRIORITY POLLUTANT GROUPS DISCHARGED INTO THE NIAGARA RIVER FROM SIGNIFICANT MUNICIPAL AND INDUSTRIAL FACILITIES

| Contaminant Group | Loading to River 1981-82 (lb/day) | 1985-86 (lb/day) | 1989-90 (lb/day) |
|---|---|---|---|
| Acid extractables | 100.9 | 4.7 | 9.9 |
| Polynuclear aromatics | 37.8 | 0.1 | 0.0 |
| PCBs | 0.2 | 0.0 | 0.0 |
| Pesticides | 3.3 | 1.5 | 1.1 |
| Other base/neutral extractables | 46.2 | 14.0 | 4.2 |
| Purgeable compounds | 293.6 | 101.7 | 83.4 |
| Cyanides | 94.3 | 18.8 | 19.2 |
| Metals | 2168.8 | 403.5 | 428.3 |
| Total | 2745.1 | 544.3 | 546.1 |

A measure of the effectiveness of the SPDES program is seen in the level of compliance with permits. During the year April 1989 through March 1990, effluent limits for priority pollutants were exceeded less than two percent of the time.

DEC's SPDES program has played a key role in the dramatic reduction of toxic discharges to the Niagara River which has been documented over this period. Current municipal and industrial wastewater treatment facility discharges are not significant sources of priority pollutants to the Niagara River.

Inactive Hazardous Waste Sites

In 1979, an Interagency Task Force on Hazardous Waste, composed of representatives of DEC, EPA and the New York State Department of Health, identified 215 hazardous waste disposal sites in Erie and Niagara Counties. Of these and other sites identified since 1979, 164 are within three miles of the Niagara River.

Each of the 164 sites required evaluation to determine their potential for contaminant migration to groundwater or the Niagara River. Some sites did not warrant a detailed investigation based on the nature of the materials that were deposited. Most sites did require subsurface hydrogeological and chemical contaminant transport assessments to identify which were possible sources of groundwater contamination.

As a result of these investigations, 61 sites were designated as potential sources for contaminant migration to the Niagara River. In a number of cases, multiple sites are located in a single industrial complex. For example, the Occidental Chemical Corporation - Niagara Plant, contains nine sites. Consolidating sites such as these into site clusters results in 31 sites having potential for contaminant migration. The 31 sites are located on Figure 5.2 and are listed in Table 5.3. A description of each of the 31 sites is presented in Table 5.4.

The 31 site remedial programs are progressing on an individual basis, dependent upon litigation status in some instances and technical complexity. Based on data presently available, the contaminant migration potential for each of the sites can be summarized as follows:

Buffalo-Lackawanna Sub-Area. A total of eight sites having the potential for contaminant migration which could impact the quality of the Niagara River were identified in this sub-area.

Contaminant migration has been confirmed at Bethlehem Steel. The potential for contaminant migration is indicated for the Alltift site. Times Beach and Squaw Island have been delisted due to the absence of hazardous waste.

Four sites identified and located along the Buffalo River have been included as part of the Buffalo River Remedial Action Plan. Contaminant migration has been confirmed at the Buffalo Color site. The potential for contaminant migration requires confirmation at the Allied Chemical site.

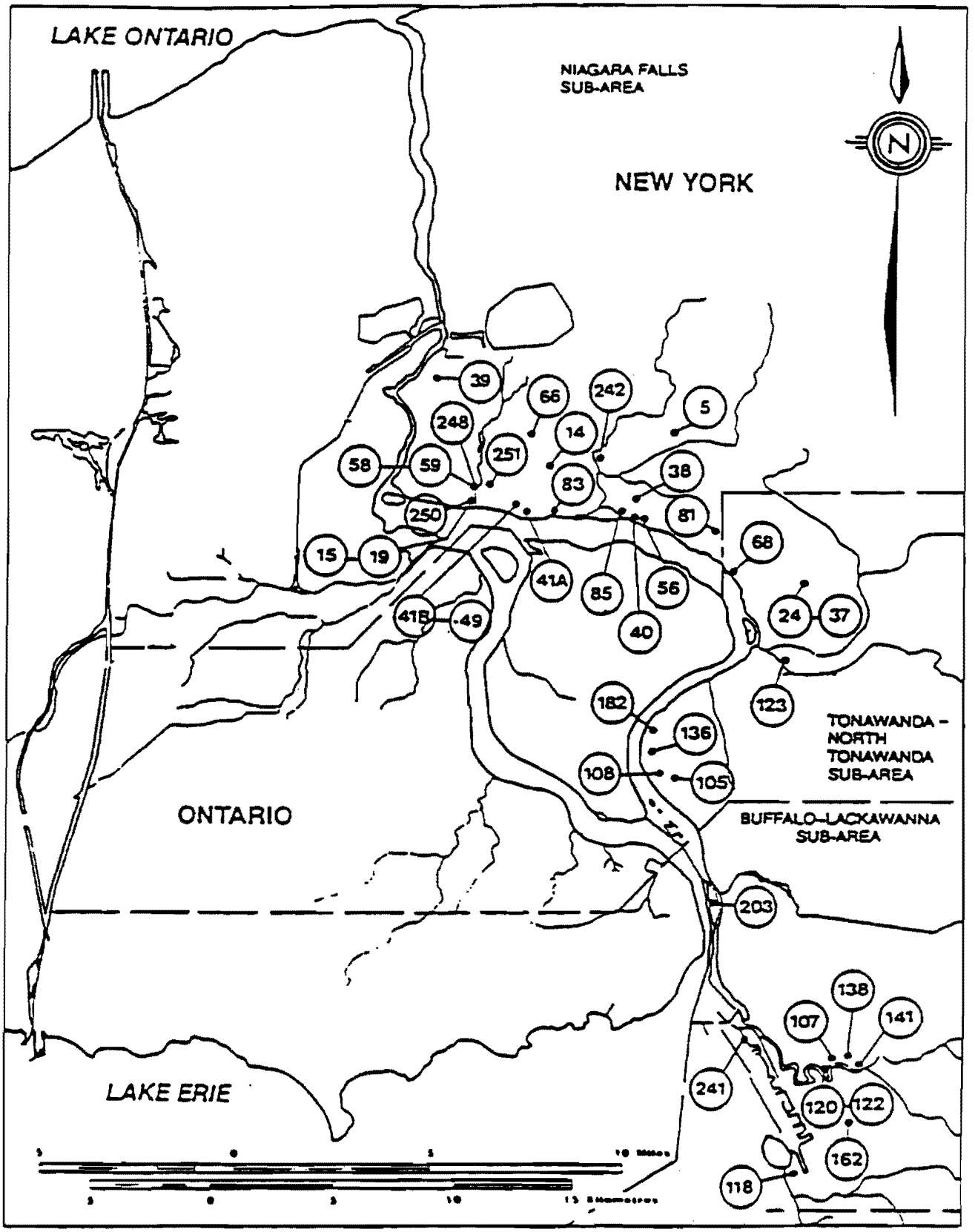



FIGURE 5.2 SITES HAVING A SIGNIFICANT POTENTIAL FOR CONTAMINANT MIGRATION
(See Table 5.3 for site identification.)

## TABLE 5.3

## IDENTIFICATION OF SITES SHOWN ON FIGURE 5.2

| MAP NO. | SITE NAME |
|---|---|
| | NEW YORK |
| | Buffalo-Lackawanna Sub-Area |
| 118 | Bethlehem Steel |
| 162 | Alltift |
| 241 | Times Beach |
| 141 | Mobil Oil Corporation |
| 138 | MacNaughton-Brooks, Incorporated |
| 107 | Allied Chemical |
| 120-122 | Buffalo Color (3 sites) |
| 203 | Squaw Island |
| | Tonawanda-North Tonawanda Sub-Area |
| 105 | Allied Spec. Chemical |
| 108 | Tonawanda Coke |
| 136 | INS Equipment Corporation |
| 182 | Niagara Mohawk |
| 123 | Columbus-McKinnon Corporation |
| 24-37 | Occidental Chemical, Durez Division (14 sites) |
| 68 | Gratwick-Riverside Park |

| MAP NO. | SITE NAME |
|---|---|
| | NEW YORK |
| | Niagara Falls, New York Sub-Area |
| 81 | Niagara County Refuse Disposal |
| 56 | Olin 102nd Street |
| 38 | Occidental Chemical, Love Canal |
| 40 | Occidental Chemical, 102nd Street |
| 85 | Griffon Park |
| 5 | Bell Aerospace Textron |
| 242 | Charles Gibson |
| 83 | Buffalo Avenue, PASNY |
| 14 | DuPont, Necco Park |
| 66 | Reichhold-Varcum (BTL) |
| 41A | Occidental Chemical, S-Area |
| 41B-49 | Occidental Chemical, Niagara Plant (9 sites) |
| 251 | Solvent Chemical |
| 250 | DuPont, Niagara Plant (6 sites) |
| 248 | Olin, Niagara Plant (3 sites) |
| 39 | Occidental Chemical, Hyde Park |

**TABLE 5.4**
**HAZARDOUS WASTE SITE DESCRIPTIONS**
**NIAGARA RIVER WATERSHED**

| SITE NUMBER | SITE NAME MAP NUMBER | SITE CODE | YEARS IN OPERATION | SITE SIZE | CONTENTS | SURFACE WATER COURSE |
|---|---|---|---|---|---|---|
| **BUFFALO - LACKAWANNA SUB AREA** | | | | | | |
| **NIAGARA RIVER** | | | | | | |
| 915009 | Bethlehem Steel (118) | 2 | 1900-1983 | 50 ac. | Tar decanter sludge, ammonia still lime, sludge, pickling liquor | Adjacent to L. Erie |
| 915054 | Alltift (162) | 2 | 1930s-1984 | 40 ac. | Various inorganic & organic chemicals, chrome sludge, copper sulfate, nitrobenzene, monochlorobenzene, napthalene. | 5000 feet from L. Erie 4000 feet from Buffalo River |
| 915080 | Times Beach (241) | D | 1971-76 | 51 ac. | Dredged material containing PCBs, aniline, heavy metals, PAHs | Adjacent to Lake Erie |
| 915052 | Squaw Island (203) | D | unk-1970 | 60 ac. | Industrial wastes, incinerator ash | Adjacent to Niagara River |

**TABLE 5.4 (Continued)**
**HAZARDOUS WASTE SITE DESCRIPTIONS**
**NIAGARA RIVER WATERSHED**

| SITE NUMBER | SITE NAME MAP NUMBER | SITE CODE | YEARS IN OPERATION | SITE SIZE | CONTENTS | SURFACE WATER COURSE |
|---|---|---|---|---|---|---|
| BUFFALO RIVER | | | | | | |
| 915040 | Mobil Oil (141) | 3 | 1951-1976 | 3 ac. | Tetraethyl lead & lube sludges, spent catalysts. Air flotation unit and gravity oil/water separator sludges | Adjacent to Buffalo River |
| 915034 | MacNaughton-Brooks (138) | D | 1960-66 | 0.5 ac. | Paint sludges, solvents, xylol, toluol. | 600 feet from Buffalo River |
| 915012 | Buffalo Color (120-122) | 2 | 1930-1976 | 2 ac. | Iron oxide sludges containing organics | Adjacent to Buffalo River |
| 915004 | Allied Chemical (107) | D | 1930-1977 | 1 ac. | Spent vanadium pentoxide catalyst, sulphur sludges, sulfuric acid tower sludges. | Adjacent to Buffalo River. |

**TABLE 5.4 (Continued)**
**HAZARDOUS WASTE SITE DESCRIPTIONS**
**NIAGARA RIVER WATERSHED**

| SITE NUMBER | SITE NAME MAP NUMBER | SITE CODE | YEARS IN OPERATION | SITE SIZE | CONTENTS | SURFACE WATER COURSE |
|---|---|---|---|---|---|---|
| TONAWANDA SUB AREA | | | | | | |
| **NIAGARA RIVER** | | | | | | |
| 915003B | Allied Spec. Chemical (105) | 2a | 1958-62 | 0.25 ac | Magnesium chromate impregnated on potassium aluminum silicate | 1800 ft. from Niagara River |
| 915055 | Tonawanda Coke (108) | 2 | 1927-78 | 160 ac. | Demolition material, spent iron oxide, cyanide wastes, and coal tar products | 1800 ft. from Niagara River |
| 915031 | INS Equipment (River Road) (136) | 2 | 1960's-1978 | 55 ac. | Foundry sand, cutting oils, industrial sludges, PCBs | Adjacent to Niagara River |
| 915063 | Niagara Mohawk Cherry Farm (182) | 2 | 1950s-1970s | 50+ ac. | Foundry sand, cutting oils, industrial sludges, PCBs | Adjacent to Niagara River |

**TABLE 5.4 (Continued)**
**HAZARDOUS WASTE SITE DESCRIPTIONS**
**NIAGARA RIVER WATERSHED**

| SITE NUMBER | SITE NAME MAP NUMBER | SITE CODE | YEARS IN OPERATION | SITE SIZE | CONTENTS | SURFACE WATER COURSE |
|---|---|---|---|---|---|---|
| 932018 | OCC - Durez Div. (24-37) | 2 | 1930-1973 | 40 ac. | Phenol tars containing chlorobenezenes and and chlorophenols | 1 1/2 miles primary tributary is Pettit Creek Flume |
| 932060 | Gratwick-Riverside (68) | 2 | 1962-1968 | 53 ac. | Phenolic resins, PCBs | Adjacent to Niagara River |
| ELLICOTT CREEK | | | | | | |
| 915016 | Columbus McKinnon (123) | 2 | 1930-65 | 1 ac. | Cutting oil with PCBs | Adjacent to Ellicott Creek |
| **NIAGARA FALLS SUB AREA** | | | | | | |
| **NIAGARA RIVER** | | | | | | |
| 932026 | Niagara County Refuse Disposal (81) | 2 | 1968-1976 | 50 ac. | Phenolic resins, plating tank sludges, brine sludge | 1/4 mile from Niagara River |
| 932031 | Olin - 102nd Street (56) | 2 | 1948-70 | 6.5 ac. | Benzenes, Chloro-benzenes, chlorophenols, hexachlorocyclohexanes, mercury, etc. | Adjacent to Niagara River |

**TABLE 5.4 (Continued)**
**HAZARDOUS WASTE SITE DESCRIPTIONS**
**NIAGARA RIVER WATERSHED**

| SITE NUMBER | SITE NAME MAP NUMBER | SITE CODE | YEARS IN OPERATION | SITE SIZE | CONTENTS | SURFACE WATER COURSE |
|---|---|---|---|---|---|---|
| 932022 | OCC - 102nd Street (40) | 2 | 1943-70 | 15.6 ac | Benzenes, Chloro-benzenes, chlorophenols, hexachlorocyclohexanes, mercury, phosphates, etc. | Adjacent to Niagara River |
| 932020 | Love Canal (38) | 2 | 1942-53 | 16 ac. | Chlorophenols, chloro-benzenes, benzyl chlorides, hexachlorocyclo hexanes | 1/4 mile from Niagara River |
| 932081 | Griffon Park (85) | D | 1930-50 | 4 ac. | Municipal/domestic wastes, mercury & organics from OCC 102nd St. site. | Adjacent to Niagara River |
| 932047 | Dupont - Necco Park (14) | 2 | 1930-77 | 25 ac. | Brine sludge, barium salts, chlorinated organic chemicals | 1.3 miles from Niagara River |
| 932040 | Reichhold Varcum (BTL) (Now OCC-Durez, Niagara) (66) | 2 | unk-present | 1 ac. | Phenolic wastes | 1.7 miles from the Niagara River |
| 932080B | Buffalo Avenue - PASNY (83) | 2a | 1930s-1963 | 25 ac. | Non combustibles, incinerator ash, PASNY project spoils | Less than 300 feet from Niagara River |

**TABLE 5.4 (Continued)**
**HAZARDOUS WASTE SITE DESCRIPTIONS**
**NIAGARA RIVER WATERSHED**

| SITE NUMBER | SITE NAME MAP NUMBER | SITE CODE | YEARS IN OPERATION | SITE SIZE | CONTENTS | SURFACE WATER COURSE |
|---|---|---|---|---|---|---|
| 932019A | OCC - "S" Area (41A) | 2 | 1947-1975 | 7 ac. | CaF2 sludge, organic phosphates, chlororganics, sulfides | 300 feet from Niagara River |
| 932019 | OCC - Niagara Plant (41B-49) | 2 | 1930-1975 | 130 ac. | Chlororganics, cell brine sludges, phosphorus sludges | 300 feet from Niagara River |
| 932096 | Solvent Chemical (251) | 2 | 1972-1978 | 6.5 ac. | Chlorobenzenes, zinc | 1500 feet from Niagara River |
| 932013 | Dupont - Niagara Plant (250) | 2 | 1898-1973 | 52 ac. | Metal cyanide sludge, chlorinated organic chemicals | Along the Niagara River |
| 932051 | Olin - Niagara Site (248) | 2 | 1957-1974 | 30 ac. | Mercury brine sludges, chlororganics, fly ash | 1500 feet from Niagara River |
| 932021 | OCC - Hyde Park (39) | 2 | 1953-1975 | 15 ac. | Brine sludge, organic phosphates, dechlorane, chlorotoluenes, TCP, benzoyl chloride, chlorobenzenes, acid chlorides | Adjacent to Bloody Run 1/4 mile from Niagara River |

**TABLE 5.4 (Continued)**
**HAZARDOUS WASTE SITE DESCRIPTIONS**
**NIAGARA RIVER WATERSHED**

| SITE NUMBER | SITE NAME MAP NUMBER | SITE CODE | YEARS IN OPERATION | SITE SIZE | CONTENTS | SURFACE WATER COURSE |
|---|---|---|---|---|---|---|
| CAYUGA CREEK | | | | | | |
| 932052 | Bell Aerospace (5) | 2 | 1940-1984 | 0.5 ac. | Chlorinated solvents, rocket fuel, misc. chemicals | 2000 feet from Cayuga Creek |
| 932063 | Charles Gibson Site (242) | 4 | 1955-57 | 4 ac. | Hexachlorobenzene, BHC Cake | Adjacent to Cayuga Creek, |

**TABLE 5.4 (CONTINUED)**
**HAZARDOUS WASTE SITE DESCRIPTIONS**
**NIAGARA RIVER WATERSHED**

**SITE CODES**

Classification 1 - causing or presenting an imminent danger of causing irreversible or irreparable damage to the public health or environment — immediate action required;

Classification 2 - significant threat to the public health or environment — action required;

Classification 2a - temporary classification assigned to sites for which there is inadequate data to assign them to the other classifications;

Classification 3 - does not present a significant threat to the public health or environment — action may be deferred;

Classification 4 - site properly closed — requires continued management;

Classification 5 - site properly closed, no evidence of present or potential adverse impact — no further action required;

Classification D - site delisted, no hazardous waste present on site.

The MacNaughton-Brooks site has been delisted due to the absence of hazardous waste, and the Mobil Oil site investigation indicates no significant contaminant migration.

Tonawanda-North Tonawanda Sub-Area. There are seven sites located in this sub-area. The potential for contaminant migration is confirmed at the INS Equipment, Niagara Mohawk Cherry Farm, Occidental Chemical - Durez, Gratwick - Riverside and Columbus McKinnon sites.

Confirmation of the potential for contaminant migration is required for the Allied Specialty Chemical and Tonawanda Coke sites.

Niagara Falls Sub-Area. There are 16 sites in this sub-area. Remediation has addressed the migration of contaminants at the Love Canal and the Charles Gibson sites. Contaminant migration was determined to be minimal at the Buffalo Avenue-PASNY site. Groundwater collection and treatment systems are in operation at the Bell Aerospace, DuPont-Necco Park, Reichold-Varcum (OCC-Durez, Niagara), DuPont-Niagara Plant and OCC-Hyde Park sites. The potential for contaminant migration is confirmed at the following sites: Niagara County Refuse Disposal, Olin - 102nd Street, Occidental Chemical - 102nd Street, Occidental Chemical-"S" Area, Occidental Chemical - Niagara Plant, Solvent Chemical, and Olin - Niagara Plant.

The Griffon Park site has been delisted with the exception of that portion to be remediated along with the adjacent 102nd Street sites.

Toxics Loading Characterization. Loadings from hazardous waste sites are difficult to quantify and are dependent upon the level of detailed information available relative to contaminant movement at each site. Where detailed data is not available hydrogeologic assumptions are required. The USEPA developed a preliminary estimate of toxics loading from hazardous waste sites to the Niagara River of approximately 690 pounds per day in 1988.

Category I (contribute more than 50 pounds per day) sites are: OCC-Niagara Plant, Niagara County Refuse Disposal, DuPont- Necco Park (including the adjacent CECOS International site) and OCC-Hyde Park.

Category II (contribute more than 1 pound per day but less than 50 pounds per day) sites include: Olin and OCC-102nd Street, Bell Aerospace, Reichold-Varcum (BTL), OCC-"S"-Area, Olin-Niagara Plant, DuPont-Niagara Plant, Buffalo Color, Bethlehem Steel, INS Equipment, OCC-Durez, Gratwick-Riverside Park and Mobil Oil.

Each of the remaining sites (Category III) were estimated to contribute less than 1 pound per day of toxics to the Niagara River. Category I and II sites represented 99% of this loading estimate. Improved loadings estimates are currently being developed by USEPA which will reflect additional data resulting from recent site investigations as well as remedial actions which have been completed since the above loading estimate was prepared.

Combined Sewer Overflows

Two combined sewer systems discharge untreated storm diluted overflows to the Niagara River during wet weather events: the Buffalo Sewer Authority (BSA) and the City of Niagara Falls.

Since the early 1980s, the BSA has been undertaking a sewer remediation program to upgrade the structural features of the system, a sewer cleaning program and an overflow structure backflow prevention program to improve system carrying capacity. A system modeling study to evaluate the frequency and extent of overflows along the main interceptors as well as assess options for their minimization has recently been completed. The modeling studies are currently being extended into sub-basins in the BSA collection system.

The City of Niagara Falls wastewater collection system is a partial combined sewer system which discharges diluted overflows to the Niagara River during storm events. In 1976, the City constructed the Southside Interceptor to convey flow from the main industrial area along the Niagara River directly to the wastewater treatment plant. The flow from this industrial area was conveyed in the past by the Falls Street Tunnel, which previously was a main component of the combined sewer system. This tunnel was constructed in bedrock. The City has recently undertaken an extensive program to minimize infiltration into the tunnel at various locations. This program has resulted in a substantial reduction of groundwater inflow to the Falls Street Tunnel. All residual dry weather groundwater inflow to the Falls Street Tunnel has been directed to the wastewater treatment plant with the completion of a rehabilitation of a conveyance pump station. The City conducts a sewer cleaning program and an overflow regulator maintenance program to maximize the flow carrying capacity of the combined system for treatment.

Bottom Sediments

Sediments accumulate contaminants by attraction of chemicals out of the dissolved phase and onto solids. The presence of sediments indicates that an area is a deposition zone but not all deposition zones are stable. Unusually intense storms or other rare hydrologic events can remobilize riverine sediments and send them off to other places. Bottom feeding organisms may ingest contaminants in sediments which may cause toxic effects or bioaccumulate to the point of threatening higher food chain consumers. While these effects are real and a subject of concern, there are problems in evaluating sediment contaminant concentrations. Where the sources of toxic discharge are curtailed and sediment stability is high, sedimentation itself will gradually bury noxious substances so they will not be bioavailable. Where dredging or other expected disturbances are likely or surface concentrations are high enough to have adverse effects, remedial action becomes necessary.

Depositional areas do not exist in the main channel of the Niagara River. Fine grained sediments have been found along nearshore areas and downstream of islands in the river. The analytical results of sediment samples collected by U.S. and Canadian agencies have been summarized.

Significant levels of contaminants have been found in three areas along the river. The first is at the outlet of the Pettit Flume in the Tonawanda-North Tonawanda Sub-area. The second is at the 102nd Street embayment located in the Wheatfield-Upper River segment of the Niagara Falls Sub-area. The third is the mouth of Gill Creek which is also located in the Wheatfield-Upper River segment of the Niagara Falls Sub-area.

In each case, the source of the contamination is known. Remedial measures are being undertaken in each instance to address the problem. The Pettit Flume carried contaminants from the Occidental Chemical - Durez hazardous waste site. Organic contaminants identified at the site include PCBs, dioxins, dibenzofurans, PAHs, BHCs and hexachlorobenzene. A site remediation program is currently being implemented for the facility. The remediation will include the removal of sediments within the Pettit Flume and address of the contaminants in the embayment at the flume outlet.

The 102nd Street embayment is adjacent to the Olin and Occidental Chemical - 102nd Street Landfills. Organic contaminants identified at these landfills include: PCBs, dioxins, dibenzofurans, PAHs, BHCs and hexachlorobenzene. Remedial plans for the 102nd Street Landfill sites include the address of contaminated sediments in the embayment.

Lower Gill Creek flows past the Olin and DuPont Niagara Plant sites. In 1981, Olin and DuPont voluntarily undertook a remediation project to remove contaminated sediments in Gill Creek. The project included a reach of Gill Creek from the Robert Moses Parkway, adjacent to the Niagara River, upstream through the industrial complex properties. Subsequent investigations of Gill Creek bottom sediments showed significant organic and mercury contamination of sediments in the unremediated stream segment (250 feet in length) from the Robert Moses Parkway downstream to the Niagara River. A project to remove the contaminated sediments in this stream section and other selected areas in lower Gill Creek was completed in 1992. The organic contaminants at this site included: PCBs, dioxins, dibenzofurans, PAHs, BHCs and hexachlorobenzene.

Groundwater

Groundwater may be a source of contaminant entry into the Niagara River. Groundwater investigations were conducted by the U. S. Geological Survey in 1982-83 to assess groundwater in each of the adjacent Niagara River sub-areas. The 1982-83 data is currently being updated in the Niagara Falls Sub-area by the U.S. Geological Survey to allow improved groundwater flow estimates by the USEPA at inactive hazardous waste sites.

To define the hydrogeology of each sub-area, test holes were drilled down to the top of the bedrock layer. The cores were used to describe the local geology. Monitoring wells were installed and a water sample collected and tested for EPA priority pollutants. A series of shallow and deep wells were installed at a number of sites along the Falls Street Tunnel. Groundwater samples were collected and analyzed for EPA priority pollutants.

Disposal sites located in the fill areas along the river, in general, are the sites having the greatest potential for contaminant migration due to the nature of the geologic materials and the short contaminant travel distance to the river.

The sub-area with the greatest potential for contaminant migration to the Niagara River is the Niagara Falls Sub-area due to the number of sites along the river, the nature of the materials disposed and the levels of contaminants observed in the groundwater at the sites.

Wells drilled in the unconsolidated deposits along the Wheatfield-Upper River segment of the Niagara Falls Sub-area reflected high levels of organic contaminants associated with the significant sites in this segment. Groundwater movement in the bedrock is northeast (away from the Niagara River) along the lower reach of this segment.

Contamination exists in the groundwater along the river. Chemical analyses from exploratory wells indicate that there is some contamination of the groundwater by both metals and synthetic organic contaminants. Comparison of concentrations of several parameters indicates that the groundwater in the upper portion of the Niagara Falls Sub-area is more highly contaminated than the two areas upstream. To some extent, this reflects the relative densities of known landfill sites in this sub-area and the proximity of the exploratory wells to these sites.

The horizontal direction of groundwater movement in the unconsolidated deposits is generally toward major surface water bodies: Lake Erie, the Niagara River and the Buffalo River in the Buffalo-Lackawanna Sub-area; the Niagara River, Ellicott Creek and Tonawanda Creeks in the Tonawanda-North Tonawanda Sub-area; and the Niagara River, Cayuga Creek and Gill Creek in the Niagara Falls Sub-area. In the Niagara Falls Sub-area, significant vertical movement of groundwater also occurs in the next two geologic layers through joints in the rock adjacent to the Niagara River. The joints are believed to be significant avenues for groundwater to flow downward into the Niagara River.

SOURCES OF POLLUTANTS AND DISTURBANCES

Based on the use impairment assessment of the Niagara River presented in Chapter 4, the following pollutants: polychlorinated biphenyls, mirex, chlordane, dioxin, dibenzofuran, polynuclear aromatic hydrocarbons, BHC (hexachlorocyclohexane), hexachlorobenzene, DDT, DDE, dieldrin, metals and cyanides plus physical disturbances, have been identified or are suspected of causing or contributing to one or more use impairments. The following discussion assesses the clearly identifiable or known sources and the potential sources of these causes of impairment. Clearly identifiable sources are those where the pollutant or disturbance is present, there is a direct connection with the impairment, and there is evidence to suggest that the pollutant or disturbance from that particular source could cause or is causing the impairment. Potential sources are those where the pollutant or disturbance is present but a link with the the impairment has not been established. Where information is available that suggests certain sources are not likely to be contributing to the impairment, these are also listed.

Polychlorinated Biphenyls

a. impairment observation:

The presence of polychlorinated biphenyls (PCBs) in fish flesh is a cause of the fish consumption advisory for carp and smallmouth bass in the upper Niagara River. In the lower Niagara River, exceedances occurred in American eel, smallmouth bass, rock bass and carp. Lake Ontario fish contaminant data indicated elevated levels of PCBs in lake trout six years of age and older.

Young-of-the-year spottail shiners indicated PCBs in excess of the DEC criteria for the protection of fish eating wildlife at several sites in the upper and lower rivers. This indicates that PCBs may lead to bird or animal deformities or reproductive problems although there is no direct evidence that this is occurring.

b. sources:

Embayment and tributary sediments are known sources of PCBs which have caused impacts on the biota of the Niagara River, including sportfish and benthic organisms. Due to the detection of PCBs, inactive hazardous waste sites are also known sources. River bottom sediments are a potential source of PCBs which may impact fish eating wildlife and cause restrictions on fish and wildlife consumption by humans. Bottom sediment criterion applicable to the Niagara River are required to classify river bottom sediments as a source that would cause impact. PCBs have been detected in the inflow to the Niagara River. Periodic combined sewer overflows are a potential source although DEC monitoring of the influent to the Buffalo Sewer Authority wastewater treatment plant and the Falls Street Tunnel in Niagara Falls did not indicate the presence of PCBs.

Mirex

a. impairment observation:

Mirex, a chlorinated insecticide, has been banned for use in New York State since 1974. Mirex has been identified by DEC as exceeding the FDA action level in American eel in the lower Niagara River and has been reported at elevated levels in several species of fish in Lake Ontario. Mirex may be considered a likely cause of restrictions on fish and wildlife consumption.

b. sources:

Inactive hazardous waste sites and adjacent embayment sediment deposition areas are known sources of mirex to the Niagara River. Mirex was detected in bottom sediments along the Niagara River in and downstream of the Tonawanda-North Tonawanda segment. Bottom sediment criteria are required to assess the levels observed. As such, bottom sediments are considered potential sources. Detection of mirex in

groundwater in Niagara Falls identifies it as a potential source. Mirex has not been detected in combined sewer system sampling. Also, mirex was not detected in the inflow to the Niagara River.

Chlordane

a. impairment observations:

Chlordane is a pesticide that has been banned in New York State since 1985. Chlordane was found in American eel in the lower Niagara River in excess of the FDA tolerance level. Chlordane was also identified as exceeding the FDA action level in carp in the Buffalo River.

b. sources:

Potential sources of chlordane include the inflow to the Niagara River where it was detected, but at a level well below the DEC water quality criteria. Chlordane was also detected in bottom sediments along the Niagara River. Bottom sediment criteria are required to assess the levels observed. Chlordane was also detected in groundwater in each of the three sub-areas along the river. Chlordane levels in the outlet from the Niagara River, however, did not increase from those measured at the inlet. Sampling has not indicated the presence of chlordane at inactive hazardous waste sites, municipal and industrial treatment facility discharges or combined sewer overflows.

Dioxin (2,3,7,8-TCDD) and Dibenzofuran (2,3,7,8-TCDF)

a. impairment observation:

Fish collected in Lake Ontario indicated exceedances of the 2,3,7,8-TCDD criterion in lake trout, brown trout and white perch. The equivalent criterion for 2,3,7,8-TCDF has also been exceeded for lake trout. Fish from Lake Ontario can migrate into the lower Niagara River. Young-of-the-year rock bass collected from Cayuga Island Little River exceeded the human health criterion for 2,3,7,8-TCDD. The observed levels are a cause of restrictions in fish and wildlife consumption in the river.

Several species of minnow and shiner collected in Cayuga Creek and the Cayuga Island Little River meet the New York State human health criterion but exceed the DEC wildlife criterion for 2,3,7,8-TCDD. This would indicate that dioxin may contribute to bird or animal deformities or reproductive problems.

b. sources:

Dioxins and dibenzofurans have been detected at inactive hazardous waste sites and associated adjacent sediment deposition areas. These sites are known sources of these contaminants to the Niagara River. None of the other categories of sources are known to be contributing these compounds.

Polynuclear Aromatic Hydrocarbons

a. impairment observation:

Polynuclear Aromatic Hydrocarbons (PAHs), which are byproducts of coke manufacturing and combustion, are believed to play a role in the formation of tumors in bottom dwelling/feeding fish. The specific substances involved, however, are not known.

b. sources:

PAHs have been detected in the inflow to the Niagara River and increase along the river. Some of the PAH compounds exceed the DEC human health guidelines in the inflow to the river which is considered a known source. Bottom sediments along the river also contain PAHs. Criteria are required to assess the levels observed in bottom sediments. PAHs were detected at inactive hazardous waste sites which are known sources of contaminants to the Niagara River. Groundwater in the Buffalo - Lackawanna and the Niagara Falls Sub-areas, as well as combined sewer overflows, are potential sources of PAHs to the river.

Hexachlorocyclohexane

a. impairment observations:

Hexachlorocyclohexane (BHC) exceeded the DEC wildlife criterion in spottail shiners in Gill Creek during a single sampling in 1985. This was the only location along the Niagara River where the criterion was exceeded.

b. sources:

BHC isomers were detected in the inflow to the Niagara River with little or no increase along the river. The levels observed did not exceed the DEC water quality standard. Bottom sediments along the river contain BHCs. Bottom sediment criteria are required to assess the levels observed. BHCs have been detected at inactive hazardous waste sites which are known sources of contaminants to the Niagara River. Groundwater in the Niagara Falls Sub-area, as well as combined sewer overflows, are potential sources of BHCs to the river.

Hexachlorobenzene

a. impairment observations:

Hexachlorobenzene exceeded the DEC wildlife criterion in spottail shiners at the Pettit Flume embayment and in Gill Creek.

b. sources:

Hexachlorobenzene was detected in the Niagara River at Niagara-on-the-Lake but well below the DEC water quality criterion. Bottom sediments along the Niagara River contain hexachlorobenzene. Bottom sediment criteria are required to assess the levels observed. Hexachlorobenzene has been detected at inactive hazardous sites and associated adjacent sediment deposition areas which are known sources of contaminants to the Niagara River. Groundwater in the Niagara Falls Sub-area is a potential source of hexachlorobenzene to the Niagara River.

DDT and DDE

a. impairment observations:

Total DDT (including its metabolites DDD and DDE) exceeded the DEC wildlife criterion in carp, smallmouth bass and American eel collected from the Niagara River. Total DDT concentrations exceeded the criterion for brown trout, chinook salmon, coho salmon, lake trout and rainbow trout taken from Lake Ontario. Fish from Lake Ontario can migrate into the lower Niagara River. The exceedance of the DEC wildlife criterion implies that bird or animal deformities or reproductive problems may occur.

b. sources:

DDT and DDE, a pesticide banned in New York State since 1971, were detected in the inflow to the Niagara River with a measured decrease along the river. The levels observed did not exceed the DEC water quality standard. Bottom sediments along the river contain DDT and DDE. Bottom sediment criteria are required to assess the levels observed. DDT and DDE have been detected at inactive hazardous waste sites along the Niagara River. Groundwater in the Buffalo-Lackawanna Sub-area is also a potential source of DDT to the river.

Dieldrin

a. impairment observations:

Dieldrin exceeded the DEC wildlife criterion in carp along the upper Niagara River and in American eel from the lower Niagara River. Dieldrin concentrations exceeded the criterion for brown trout and lake trout taken from Lake Ontario. Fish from Lake Ontario can migrate into the lower Niagara River. The exceedance of the DEC wildlife criterion implies that bird or animal deformities or reproductive problems may occur in wildlife that rely on these species as a food source.

b. sources:

Dieldrin was detected in the inflow to the Niagara River but did not

exceed the DEC water quality standard. While dieldrin has been detected at inactive hazardous waste sites along the Niagara River, dieldrin levels at the outlet from the Niagara River are essentially the same as those measured at the inlet.

Metals and Cyanides

a. impairment observations:

The median values of the following metals and cyanides exceed the criteria for open lake disposal in bottom sediments subject to dredging in the Buffalo Harbor and Black Rock Canal segments of the Niagara River: arsenic, barium, cadmium, chromium, copper, iron, lead, manganese, mercury, nickel, zinc and cyanide. Bottom sediments from the Bird Island-Riverside and Tonawanda-North Tonawanda segments also exceed open lake disposal criteria; however, these segments are not dredged.

b. sources:

In four segments of the Niagara River, bottom sediments exceed open lake disposal criteria and if dredged would require containment. Potential sources are combined sewer overflows, inactive hazardous waste sites, and other nonpoint sources such as groundwater, urban runoff and soil erosion Metals were detected in the inflow to the Niagara River, however only iron consistently exceeded the water quality standard.

Physical Disturbances

a. impairment observations:

Loss of fish and wildlife habitat has been observed within the Niagara River Area of Concern. The majority of this loss has been along the upper Niagara River, including the Buffalo Harbor. Most noticeable along the upper Niagara River has been the loss of wetlands which are an integral part of the ecosystem since they provide spawning and rearing habitat for fish as well as feeding, breeding and resting areas for river associated wildlife. Shallow water areas and shoreline habitat, including areas of beach, mudflat, cobble shore and forested shoreline, have been extensively altered. This alteration has eliminated much of the resting and feeding areas for migrating shorebirds and resting areas for waterfowl.

b. sources:

Historic loss of wetland habitat was caused by filling associated with industrial, residential and marine development. Water level alteration resulting from the diversion of river water for power production has also contributed to wetland degradation. Future wetland degradation may be caused as the result of the invasion of the alien plant purple loosestrife.

Bay and shallow water habitat has been lost due to filling and dredging associated with marine development and the maintenance of commercial navigation. Bulkheading and filling associated primarily with residential and recreational development has extensively altered shoreline habitats on the upper river. Clearing of forested shoreline is nearly complete along the upper river. The majority of the remaining forested shoreline is in public ownership which should provide for future protection. All of the above impact fish and wildlife populations.

## SUMMARY OF IMPAIRMENTS, CAUSES AND SOURCES

A summary of impairments, causes and sources is contained in Table 5.5. Sediments in noted embayments and tributaries and inactive hazardous waste sites are known sources of contaminants which cause impairments. Inflow to the Niagara River monitored at Fort Erie, river bottom sediments, combined sewer overflows and nonpoint sources such as groundwater, urban runoff and soil erosion are possible additional sources which may in aggregate produce contaminant levels that cause impairment. Physical disturbances are the known source of impact resulting in habitat loss.

TABLE 5.5
SUMMARY OF IMPAIRMENTS,
CAUSES AND SOURCES

| No. | Impairment Indicators | Impairment | Likely Causes | Known Sources | Potential Sources 1/ |
|---|---|---|---|---|---|
| 1. | Restrictions on fish and wildlife consumption | Yes | Polychlorinated biphenyls | Embayment and tributary sediments<br>Inactive hazardous waste sites | Inflow to Niagara River<br>Bottom sediments |
| | | | Mirex | Embayment sediments<br>Inactive hazardous waste sites | Bottom sediments<br>Groundwater |
| | | | Chlordane | | Inflow to Niagara River 1/<br>Bottom sediments<br>Groundwater |
| | | | Dioxin and dibenzofuran | Embayment and tributary sediments<br>Inactive hazardous waste sites | |
| 2. | Tainting of fish and wildlife flavor | No | Not applicable | Not applicable | Not applicable |
| 3. | Degradation of fish and wildlife populations | Likely | None identified | Not applicable | Not applicable |

TABLE 5.5 (CONTINUED)
SUMMARY OF IMPAIRMENTS,
CAUSES AND SOURCES

| No. | Impairment Indicators | Impairment | Likely Causes | Known Sources | Potential Sources |
|---|---|---|---|---|---|
| 4. | Fish tumors and other deformities | Yes | Polynuclear aromatic hydrocarbons | Inflow to Niagara River [1/]<br>Inactive hazardous waste sites | Bottom sediments<br>Combined sewer overflows<br>Groundwater |
| 5. | Bird or animal deformities or reproduction problems | Likely | Polychlorinated biphenyls | Embayment and tributary sediments<br>Inactive hazardous waste sites | Inflow to Niagara River [1/]<br>Bottom sediments |
| | | | Hexachlorocyclo-hexane (BHC) | Embayment and tributary sediments<br>Inactive hazardous waste sites | Inflow to Niagara River [1/]<br>Bottom sediments<br>Combined sewer overflows<br>Groundwater |
| | | | Hexachlorobenzene | Embayment and tributary sediments<br>Inactive hazardous waste sites | Bottom sediments<br>Groundwater |
| | | | Dioxin | Embayment and tributary sediments<br>Inactive hazardous waste sites | |
| | | | DDT & DDE | Inactive hazardous waste sites | Inflow to Niagara River [1/]<br>Bottom sediments<br>Groundwater |

TABLE 5.5 (CONTINUED)
SUMMARY OF IMPAIRMENTS,
CAUSES AND SOURCES

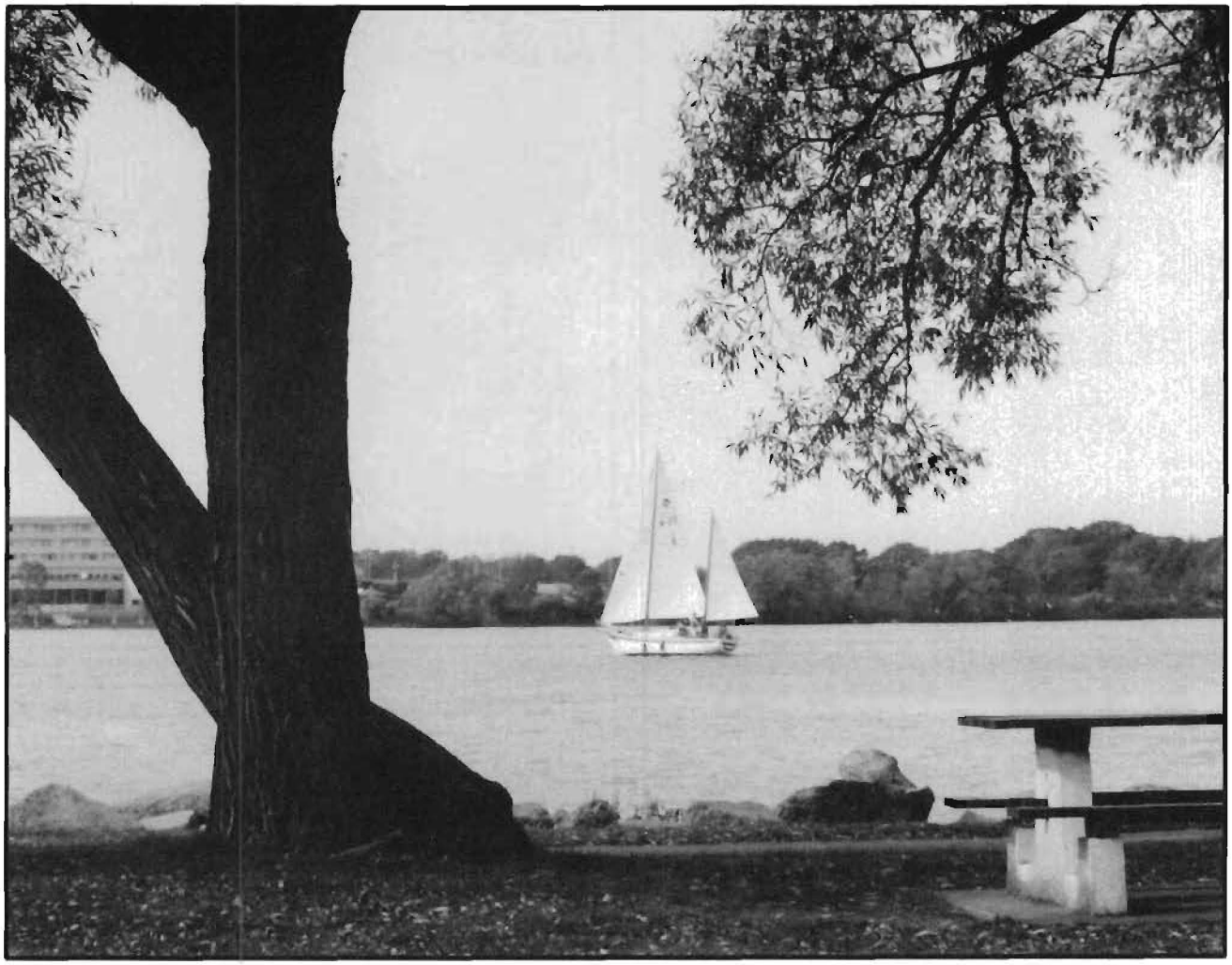
| No. | Impairment Indicators | Impairment | Likely Causes | Known Sources | Potential Sources |
|---|---|---|---|---|---|
| 5. | Bird or animal deformities or reproduction problems | Likely | Dieldrin | Inactive hazardous waste sites | Inflow to Niagara River [1/] |
| | | | Chlordane | | Inflow to Niagara River [1/]<br>Bottom sediments<br>Groundwater |
| 6. | Degradation of benthos | Yes | Polychlorinated biphenyls | Embayment and tributary sediments<br>Inactive hazardous waste sites | Inflow to Niagara River [1/]<br>Bottom sediments |
| | | Yes | Hexachlorocyclo-hexane (BHC) | Embayment and tributary sediments<br>Inactive hazardous waste sites | Inflow to Niagara River [1/]<br>Bottom Sediments<br>Combined sewer overflows<br>Groundwater |
| 7. | Restrictions on dredging activities | Yes | Metals and Cyanide | Bottom sediments | Inflow to Niagara River [1/]<br>Inactive hazardous waste sites<br>Combined sewer overflows<br>Groundwater<br>Urban runoff<br>Soil erosion |
| 8. | Eutrophication or undesirable algae | No | Not applicable | Not applicable | Not applicable |

TABLE 5.5 (CONTINUED)
SUMMARY OF IMPAIRMENTS,
CAUSES AND SOURCES

| No. | Impairment Indicators | Impairment | Likely Causes | Known Sources | Potential Sources |
|---|---|---|---|---|---|
| 9. | Restrictions on drinking water consumption or taste and odor problems | No 2/ | Not applicable | Not applicable | Not applicable |
| 10. | Beach closings | No | Not applicable | Not applicable | Not applicable |
| 11. | Degradation of aesthetics | No | Not applicable | Not applicable | Not applicable |
| 12. | Added costs to agriculture or industry | No 2/ | Not applicable | Not applicable | Not applicable |
| 13. | Degradation of phytoplankton and zooplankton populations | No 2/ | Not applicable | Not applicable | Not applicable |
| 14. | Loss of fish and wildlife habitat | Yes | Physical disturbance | Bulkheading<br>Filling<br>Marine development<br>Water diversion<br>Tributary migration barriers<br>Loss of shoreline forest cover | |

1/ Contaminant detected in water column at head of Niagara River.

2/ Except for the impact of zebra mussels



East Branch Niagara River at Tonawanda

*Jacqueline Letke*

# CHAPTER SIX: REMEDIAL PROGRAMS

## INTRODUCTION

A number of remedial programs have been or are being developed and implemented to address sources of contaminant entry into the Niagara River. These remedial programs are described below and options that could apply to known or potential causes of impairment are discussed.

## THE FOUR PARTY AGREEMENT

In February 1981, the New York State Department of Environmental Conservation (DEC) along with the U.S. Environmental Protection Agency (EPA) joined with the Ontario Ministry of Environment (MOE) and Environment Canada (EC) to form the Niagara River Toxics Committee (NRTC). The purpose of the NRTC was to conduct a bi-national investigation of toxic chemicals entering the Niagara River. After completing its work the NRTC issued a report and recommendations in October 1984. Soon thereafter, each of the four agencies developed specific action plans in response to the NRTC report and its recommendations. To continue coordinated actions including river monitoring activities, a four party work plan was completed in October 1986. In February 1987, the Four Parties agreed to pursue the reduction by 50% of Niagara River loadings of persistent toxic chemicals of concern by 1996. This agreement is known as the "Declaration of Intent".

The activities of the Four Parties along the Niagara River are incorporated in the Niagara River Toxics Management Plan which is updated regularly. The activities of the Four Parties focus on the following: sorting chemicals as a basis for action, implementing programs to reduce the loadings of toxics entering the Niagara River, assessing the success of programs to reduce the loadings of toxics and coordinating activities with Remedial Action Plan (RAP) activities.

## REMEDIAL PROGRAMS

The major programs which affect contaminant entry into water bodies are those which address municipal and industrial discharges, combined sewer overflows, inactive hazardous waste sites and other nonpoint sources. Program development is required for contaminants in river bottom sediments.

### Municipal and Industrial Discharges

New York State has chosen the "Substance Specific" approach as the primary method of water-quality-based toxic substance management and control for point sources. Water quality standards and guidance values have been adopted for over 200 toxic substances in both fresh and marine waters for the protection of human health and aquatic life. These are in addition to federally mandated technology-based treatment standards, and best professional judgment where such standards are lacking. This approach was consistent with the federal Water Pollution Control Act of 1972.

Control of toxic discharges was an important new feature of the 1972 Water Pollution Control Act. It included the legal requirement to establish national industrial wastewater treatment technology standards in the form of "Best Available Treatment Economically Achievable".

DEC reviews the self-monitoring reports from dischargers for violations of permit limits. In addition, DEC inspects facilities in operation and independently samples effluent to check the validity of self-monitoring data. Inspections often detect small operational problems before they grow into permit violations, and are focused on facilities with a history of problems and on dischargers to sensitive receiving waters.

Significant violations of permit conditions trigger compliance or enforcement measures. In extreme cases, DEC may impose summary abatement or closure to end an immediate or very serious health or environmental threat. The department can also pursue criminal or civil penalties for illegal discharge. The common initial approach, however, is establishment of an "integrated compliance strategy" to abate the discharge as quickly as possible. The violator is obligated to follow the compliance strategy, which may include construction, corrective maintenance or changes in operation. DEC surveillance of the discharger is increased until permit limits are achieved.

A requirement of industrial dischargers in the State Pollutant Discharge Elimination System permits administered by the DEC Division of Water is the development and implementation of Best Management Practices (BMP) Plans to deal with the prevention of releases of significant amounts of toxics or hazardous materials from plant site runoff, accidental spills and leakage, waste disposal or drainage from raw material storage.

The DEC Division of Water has proposed a Water Quality Enhancement and Protection Policy to supplement existing regulatory programs. This initiative will incorporate pollution prevention techniques as an additional means of moving toward the established goal of the elimination of discharge of pollutants. Pollution prevention emphasizes actions to eliminate, reduce or recycle pollutants, thereby lessening the need for treatment and disposal. The policy includes the following three aspects:

- Amending the classification regulations to add discharge restriction categories that prohibit some or all discharges.

- Refining the State's antidegradation policy by establishing processes to review individual proposed actions that might affect water quality and ensuring that water quality is not degraded unless there is compelling social or economic need.

- Banning certain persistent toxic substances.

Through all of the measures described above, New York State has in place and exercises the elements of a comprehensive program to control the discharge of toxics to surface water from point sources.

Industrial pretreatment programs have been developed and are being implemented for the service areas of Erie County Sewer District No. 6 (City of Lackawanna), the Buffalo Sewer Authority, Town of Amherst, Town of Tonawanda, City of North Tonawanda, Niagara County Sewer District No. 1, and the City of Niagara Falls. These programs regulate the discharge of toxic substances from industries to the wastewater treatment plants. The primary objectives of the pretreatment regulations are to prevent the discharge of toxic pollutants which interfere with the operation of municipal wastewater treatment facilities and which may either pass through these facilities untreated, or severely limit disposal options for large volumes of municipal sludge.

The municipal authorities implement the industrial pretreatment programs through a system of inspections, sampling and enforcement for cases of non-compliance. The legal authority necessary to implement the compliance and enforcement portions of the program was established during program development. Enforcement action in response to non-compliance may include civil or criminal penalties and termination of service.

Inactive Hazardous Waste Sites

The New York State Abandoned Sites Act of 1979 marks the formal beginning of New York State's Inactive Hazardous Waste Site Remedial Program. The Abandoned Site Act mandated a statewide inventory of inactive hazardous waste sites, established the New York Registry of Inactive Hazardous Waste Sites, and provided DEC and the Department of Health the authority to order responsible parties to clean up their waste sites, or to initiate cleanup activities in the event that no responsible party could be identified.

The Abandoned Sites Act spotlighted New York State as a leader in the hazardous waste remedial cleanup arena. Federal regulation came about somewhat later with the passage of the Comprehensive Environmental Response Compensation and Liability Act of 1980 (CERCLA ).

As more sites were discovered and the need for additional funding became evident, New York enacted the State Superfund Law of 1982. This law established the Hazardous Waste Remedial Fund (State Superfund) from fees assessed against wastes generated in or transported into New York State. These monies were dedicated to pay for site investigation, remedial programs at sites where there was no responsible party, financing the non-federal share of remediation activities carried out under federal Superfund, and emergency response actions for spills involving hazardous waste.

The State Superfund Law was ammended in 1985. The 1985 Amendments authorized a significant increase in revenue. However, it was estimated that it would take at least 40 years to fund the State's share of remediating an estimated 500 hazardous waste sites. For this reason, New York proposed issuance of the Environmental Quality Bond Act of 1986 to raise $1.45 billion. The Bond Act was approved overwhelmingly by voters of New York State providing adequate funding for the remedial effort.

Once a hazardous waste site is listed in the Registry, the State must (1) determine whether hazardous waste at the site constitutes an imminent or significant threat to the environment or public health, and (2) identify potentially responsible parties. Priority for action is dependent upon the type of waste deposited at the site, the potential for contaminant migration and the presence of groundwater or surface water contamination from the site. A Phase I and Phase II site assessment is performed to identify these concerns.

A Remedial Investigation (RI)/Feasibility Study (FS) is undertaken when a site is determined to pose a significant threat to public health or the environment. The Remedial Investigation is designed to determine the extent of contamination whereas the Feasibility Study provides the analysis and recommended solution to the particular site problem. An RI/FS may require up to two years to complete.

Once a remedy is selected, a remedial design is prepared and the remedial construction is carried out. Remedial designs typically require one year while remedial construction may take several years to complete depending on the complexity of the site.

A summary of remedial action techniques for inactive hazardous waste sites is presented in Table 6.1.

Bottom Sediments

No formal programs to address contaminated bottom sediment currently exist at the federal or state level. In the Great Lakes Amendment to the U.S. Clean Water Act, the EPA Great Lakes National Program Office is authorized to "carry out a five year study with demonstration projects relating to the control and removal of toxic pollutants in the Great Lakes, with emphasis on the removal of toxic pollutants from bottom sediments." Five areas were suggested as ones that should receive priority consideration as sites for the demonstration projects. All five are Areas of Concern as identified by IJC for RAP development. The Buffalo River is in this group. The Amendment authorizes the expenditure of $4.4 million per year for Federal Fiscal Years 1987-1991 for the demonstration projects. In 1990, the program was extended and scheduled for completion by the end of calendar year 1993.

Remedial options for sediments include excavation (spot or entire) or retention-in-place through natural or man-made armoring and discontinuation or modification of dredging for navigational purposes.

To assess excavation feasibility and costs, bottom sediment criteria have to be established, investigations would have to be conducted of the horizontal and vertical distribution of contaminants, volume estimates would have to be prepared, treatment/disposal site capacity would have to be established and dredging mechanisms would have to be evaluated to determine the least disruptive method of bottom sediment removal. Analytical chemical, physical and biological data would be compared with sediment quality criteria to determine the degree to which excavation would be required to effectively remove the contaminants.

TABLE 6.1
SUMMARY OF AVAILABLE REMEDIAL ACTION TECHNIQUES FOR HAZARDOUS WASTES

| Technique | Functions | Applications/Restrictions | Estimated Cost |
|---|---|---|---|
| Land disposal | Disposes of waste materials in landfills. | Most widely used method for waste disposal; improper disposal can result in air pollution, groundwater and surface water contamination; RCRA requirements will markedly increase the cost but will provide for more sound disposal methods. | $100-300 per ton |
| Incineration | Thermally oxidizes waste material in controlled environment. | Most effective for all organic wastes, especially those with low flash points and containing relatively low ash contents. Applicable to wastes that are oxidizable at temperatures below 2500 °F. | $400-1,000 per ton |
| Solidification | Incorporates waste material into immobile matrix such as cement or resin. | Most economical for small quantities of waste. Waste material must be compatible with solidification agent. Not well demonstrated for nonradioactive wastes; may leach from some matrices over time. | $100-150 per ton |
| Encapsulation | Surrounds waste material with impermeable coating. | Most applicable to containerized waste materials or dewatered sludges; not fully demonstrated; costly. | $100-150 per ton |

TABLE 6.1 (Continued)
SUMMARY OF AVAILABLE REMEDIAL ACTION TECHNIQUES FOR HAZARDOUS WASTES

| Technique | Functions | Applications/Restrictions | Estimated Cost |
|---|---|---|---|
| In-situ solidification | Injects waste solidification agents directly into waste site, or immobilizes waste by vitrification. | Applicable to liquid wastes from surface impoundments and well defined landfill sections. Not applicable to containerized wastes. | $150-200 per ton |
| In-situ neutralization/ detoxification | Neutralizes or immobilizes wastes by application of a neutralization agent such as lime to the waste material, or detoxifies waste by chemical reaction. | Most applicable to surface impoundments and disposal sites with permeable surfaces for metal-bearing wastes. Degree of effectiveness may be difficult to determine. | $50-150 per ton |
| Bioremediation | Biodegrades organic wastes. | Most effective for landfarms and surface impoundments; can degrade a wide range of organics when acclimated; degradation process is slow and requires adequate aeration. | $75-100 per ton |

TABLE 6.1 (Continued)
SUMMARY OF AVAILABLE REMEDIAL ACTION TECHNIQUES FOR HAZARDOUS WASTES

References for Cost Estimates 1/


- "Remedial Action Technology for Waste Disposal Sites"
  P. Rogoshewski, H. Bryson, K. Wagner, 1983

- "Wide Beach Superfund Site Pilot Testing of Chemical Treatment"
  Glason Research Corporation, March 1988

- "RI/FS for the 93rd Street School Site"
  Loureiro Engineering Associates, March 1988

- "Remedial Action at Waste Disposal Sites"
  USEPA, October 1985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1/ Cost estimates updated by Division of Hazardous Waste Remediation staff.

The potential exists for the retention-in-place of contaminated bottom sediments through natural or man-made armoring and the discontinuance or modification of current dredging practice.

Prior to undertaking any remedial actions relative to the bottom sediments it will be necessary to demonstrate that there are no continuing sources of unacceptable levels of sediment contaminating constituents in the system.

Specific remedial projects are to be undertaken at three areas along the river where significant levels of contaminants have been found. The sites are the Pettit Flume embayment, 102nd Street embayment, and the mouth of Gill Creek. At each site, the source of the contamination is known. Remedial plans for each source will include the address of contaminated sediments associated with the particular site. Remediation of the Gill Creek site was completed in 1992.

Combined Sewer Overflows

Combined sewer overflows are included in municipal State Pollutant Discharge Elimination System permits as separate discharge points. EPA and DEC, through the Construction Grants Program, have awarded grants to CSO abatement projects designed to restore uses of the receiving waters in priority water quality areas which have been impaired by the impact of CSOs. A revolving loan program has replaced the construction grants program as a source of continuing financial support for remedial activity.

Remedial options for combined sewer systems include enhanced conveyance capability (removal of any system restrictions), increased treatment capability, flow segregation, development of in-system storage through operational modification and use of off-system storage for post storm conveyance and treatment.

Other Nonpoint Sources

A nonpoint source (NPS) of pollution is usually considered an areawide source or many small sources of pollution distributed diffusely over an area, which cumulatively make a significant contribution to water quality degradation. Toxics may enter surface waters either dissolved in runoff or attached to sediment and may enter groundwater through soil infiltration.

Nonpoint sources of water pollution within the scope of the State's management strategy which may include substances of a toxic nature are: diffuse urban runoff; household on-lot wastewater disposal; chemical and petroleum bulk storage; pesticide and fertilizer use in agricultural and silvicultural operations by commercial turf grass, yard care, and vegetation control operations, and by homeowners; small spills, accidents and leaks of hazardous substances associated with poor housekeeping at industrial and commercial facilities; and storage and use of road salt and other deicing chemicals and abrasives.

As the major point sources of water pollution were brought under control in New York, the water quality impacts of NPS become relatively more apparent. In recognition of these impacts, the Water Quality Act of 1987 provided new direction and authorized federal assistance for the preparation and implementation of state NPS programs.

Under the Water Quality Act, the State was required to submit an assessment report identifying those waters that cannot reasonably be expected to attain water quality standards due to NPS pollution. The State was also required to submit a NPS management program. While the assessment report identified the overall dimensions of the NPS problem, the management plan targeted a subset of these waters on a watershed-by-watershed basis. Statewide approaches to problems such as urban stormwater runoff from developing areas were also established.

DEC is now in the implementation phase of the program. NPS program implementation is being accomplished through a cooperative arrangement between DEC and the New York State Soil and Water Conservation Committee. Working with DEC, the county soil and water conservation district managers have formed water quality committees which will develop county water quality strategies for NPS control. The strategies will will prioritize NPS problems within each county and will result in a county being eligible to apply to DEC for monies for implementation of specific NPS abatement projects.

Spill Prevention

While a major spill event has not occurred, ship traffic in the Area of Concern includes tankers and barges which deliver petroleum and chemical products to land based facilities containing large storage tanks in the Tonawanda area along the Niagara River as well as the Buffalo River. The U.S. Coast Guard inspects these vessels and issues certificates of inspection. The Coast Guard also inspects waterfront facilities which are utilized to transfer such cargoes. The Coast Guard contingency plan includes the provision of spill containment and cleanup gear which would be rushed to the area in the event of a major spill.

The DEC regulates both aboveground and belowground storage facilities. Large facilities require annual licensing and inspection of facilities. Smaller facilities are subject to tank registration and periodic leakage testing. A parallel Chemical Bulk Storage Program is in place to regulate the storage of hazardous substances.

The DEC maintains a spill response unit and has standby contractors that can mobilize equipment, manpower and analytical services for response, assessment and cleanup of significant spills. The DEC maintains communications with the United States Coast Guard relative to the Niagara River and both participate in periodic joint response exercises with the Canadian Coast Guard and Canadian environmental agencies.

Fish and Wildlife Habitat

The physical alteration of natural shoreline, wetlands and shallow water areas along the Niagara River Area of Concern resulting from industrial, commercial and residential development contributes to the loss and degradation of fish and wildlife populations associated with the river. Much of this alteration is irreversible. However, New York State now has in place regulatory programs which are used to protect the remaining shoreline, wetland and shallow water habitats.

Protection of Waters Program. The policy of New York State is to preserve and protect lakes, rivers, streams and ponds. The resultant Protection of Waters Program regulates two different categories of activities which pertain directly to the Niagara River:

1. Disturbance of the bed or banks of a "protected stream" or other watercourse. The Niagara River is considered to be a protected stream by virtue of its class A-Special designation.

2. Excavation and/or filling in "navigable waters". The Niagara River is considered to be a navigable water.

Projects involving these activities are reviewed with emphasis on minimizing adverse impacts to aquatic resources and habitats.

Freshwater Wetlands Program. The New York State Freshwater Wetlands Act was passed in 1975. The Act declares that the policy of the State is to preserve, protect and conserve freshwater wetlands. Wetlands provide benefits such as wildlife habitat and nursery grounds and sanctuaries for freshwater fish. They also provide a source of nutrients in freshwater food cycles.

Under the Wetlands Regulatory Program, activities are regulated that may occur in wetlands and their adjacent areas. Protection is given to fish and wildlife habitats when permit applications are reviewed by department staff. Permits for activities which could potentially harm fish and wildlife resources are either modified to be made more compatible or denied. Mitigation is required for wetland losses.

Presently, there are 11 State regulated wetlands within the Niagara River Area of Concern.

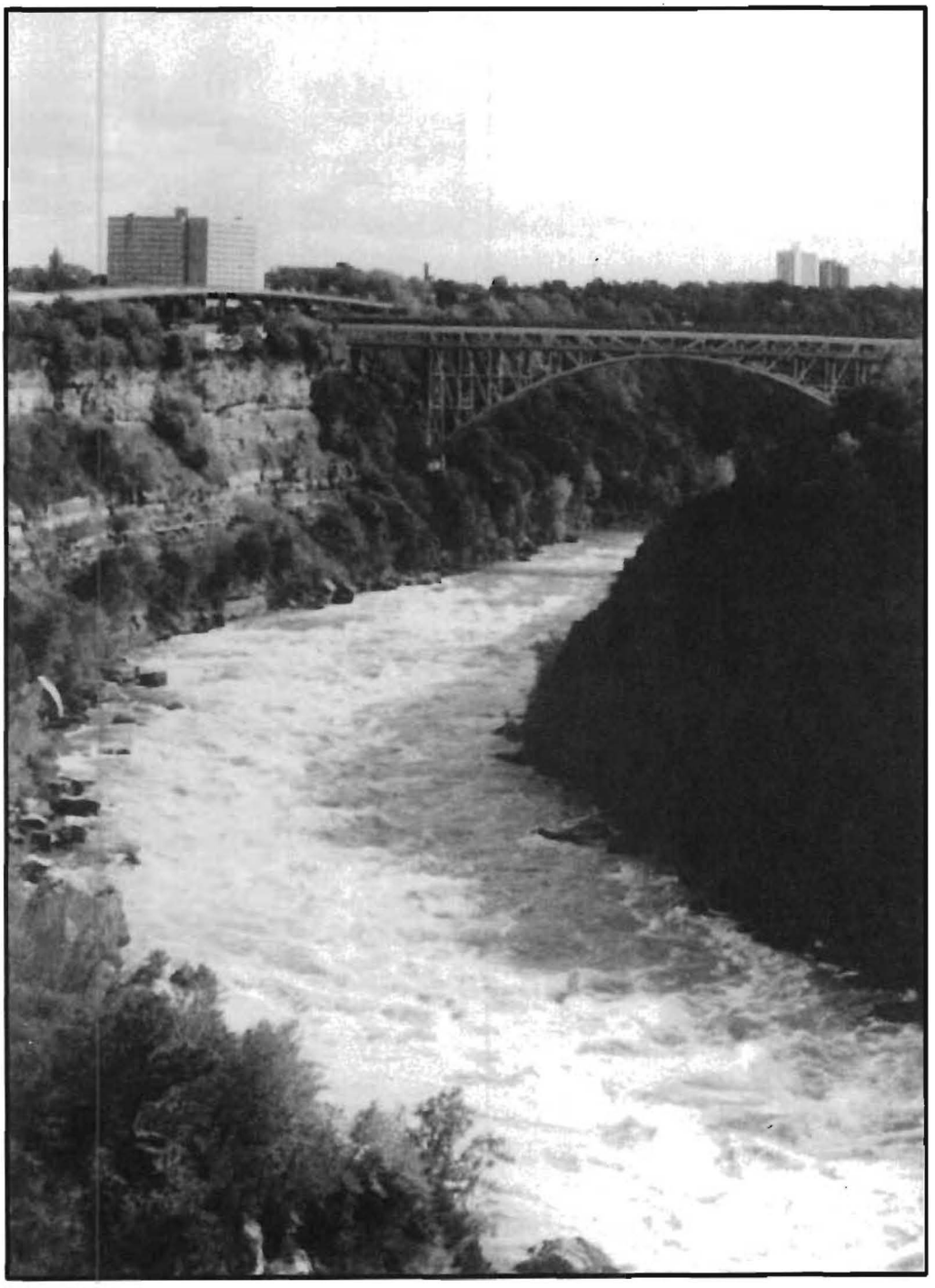
Along the upper Niagara River and the Buffalo Harbor, many former shallow water areas, wetlands and areas of natural shoreline have become disposal sites for hazardous and solid wastes. At many of these sites, remnant portions of the original wetlands and shallow water areas remain immediately adjacent to banks of waste material. In most cases these adjacent shallow water areas and wetlands are being utilized by fish and wildlife as habitat. Because of the extensive disturbance and loss of these habitats in the Area of Concern these remnant habitats are of significant importance to fish and wildlife associated with the river. At the present time, Division of Fish and Wildlife staff review proposed

remedial designs for inactive hazardous waste sites and where necessary suggest modifications to provide adequate protection and remediation of adjacent or on site fish and wildlife habitat.

Natural Heritage Program. The New York Natural Heritage Program was established in 1984 as a cooperative effort of the New York State Department of Environmental Conservation (DEC) and The Nature Conservancy (a nonprofit conservation organization). The Program's goal is to establish and maintain an up-to-date inventory on the location and status of New York's rarest animal and plant species and the highest quality examples of all our natural communities. The inventory may then be used as a planning tool to protect and maintain these valuable areas.

Significant Coastal Fish and Wildlife Habitats. The Federal Coastal Zone Management Act of 1972 (CZMA) established a voluntary participation program to encourage coastal states to develop rational, comprehensive processes to coordinate various levels of government agencies and to resolve conflicts between coastal development demands and coastal resource protection. New York uses the Coastal Management Program (CMP) as a mechanism to assist in protecting its most valuable coastal fish and wildlife resources. The CMP is administered in New York State by the Department of State. The objective of the program is to protect the diversity of fish and wildlife species in the coastal zone by protecting the habitats and communities supporting vulnerable animal species, significant animal populations and rare coastal ecosystems.

In the Niagara River Area of Concern, eleven areas have been designated as Significant Coastal Fish and Wildlife Habitats. From a regulatory viewpoint, this authority provides that a federal permit (including those required for private development) cannot be issued unless the state has determined that the proposed activity is consistent with state coastal policies.



Lower Niagara River Gorge

*Kevin Myers*

# CHAPTER SEVEN: RECOMMENDED REMEDIAL STRATEGY

## INTRODUCTION

The remedial strategy for the Niagara River is described in this Chapter. It is intended that this strategy, with the availability of sufficient funds, be implemented and completed over the next 10-20 year time period. A schematic illustrating the remedial strategy is presented in Figure 7.1. The strategy identifies the assessment, remediation and verification activities required for each remedial action and the interrelationship among them.

Remedial action activities are aligned by contaminant sources or physical disturbances in the schematic. This alignment identifies each major remedial action activity and the sequence of each activity. The first elements to be undertaken in each alignment are noted as initial remedial activities. The schematic identifies the activities required for decision making in the remedial process. The interdependence of the various remedial actions is illustrated and linked vertically. Upon completion of a remedial option for a particular source category, the remedial activity undertaken is then monitored to assess its effectiveness.

## REMEDIAL ACTIONS

### Stream Water Quality Monitoring

Stream water quality monitoring is required to continue the assessment of water quality standards attainment. The exceedance of water quality standards would require the address of specific contaminant entry sources.

An upstream/downstream water quality monitoring program has been undertaken by Canada, the United States, New York State, and the Province of Ontario in accordance with the Niagara River Toxics Management Plan. The purpose of the program is to estimate input loadings of specific chemicals to the Niagara River from Lake Erie and output loadings to Lake Ontario. Upstream and downstream monitoring allows estimations to be made of loadings from the upper basin and from within the Area of Concern itself. Continued participation in the activities of the monitoring committee for the Niagara River is considered an initial remedial activity.

### Bottom Sediments

Embayment and bottom sediments in the Niagara River are known to be contributing causes to four impairments and are a potentially contributing cause to one other impairment (Table 5.5).

At three locations along the Niagara River, sediment contamination in embayment areas is a source of contaminants associated with impairments in the river. The three embayment locations are: at the mouth of the Pettit Flume, 102nd Street embayment and the mouth of Gill Creek. Remediation of Gill Creek was completed in 1992. Remediation of the two remaining embayment areas is being undertaken as an initial remedial activity.

Sediment criteria are required to determine the extent, both horizontally and vertically, of bottom sediment remediation necessary. The USEPA has been working to develop criteria over the past several years. The completion of this work and the application of these criteria to the Niagara River are essential for the accomplishment of bottom sediment remediation. The development of bottom sediment criteria is being undertaken as an initial remedial activity.

Additional remediation of Niagara River bottom sediments would be dependent upon current contamination levels exceeding the established bottom sediment criteria.

Inactive Hazardous Waste Sites

An ongoing program for remediation of inactive hazardous waste sites is being implemented by DEC and EPA.

The initial steps in the program consist of Phase I and Phase II preliminary site assessments. Based on the data obtained by these investigations, sites are ranked and determinations are made relative to the need to proceed with Remedial Investigation/Feasibility Studies.

Remedial Investigation/Feasibility Studies define contaminant pathways and assess alternative remedial measures. They are undertaken by the parties responsible for disposal of the waste at the site under Consent Orders issued by DEC/EPA or directly by DEC/EPA in the absence of known responsible parties.

Site remediation status is presented in Table 7.1. The Phase I investigation stage has been completed for all of the significant sites along the Niagara River. Phase II investigations have also been completed for all of the significant sites along the river. Remedial Investigation/ Feasibility Studies are underway at six sites as shown in Table 7.1. Upon completion of the evaluation of alternatives, the recommended remedial option can be designed and constructed.

Remedial design is underway at nine sites and remedial construction is currently underway at two locations, Columbus-McKinnon and the Occidental Chemical Corporation-Hyde Park site. Remediation is complete or not required at ten sites. Remediation to address contaminant migration is complete at the OCC-Durez, Bell Aerospace, Love Canal, DuPont-Niagara Plant and the Charles Gibson sites. Times Beach, Squaw Island, MacNaughton-Brooks and the Griffon Park sites have been delisted, as hazardous wastes were not found to be present at the sites. Investigations conducted at Mobil Oil identified no contaminant migration to be occurring.

Other Nonpoint Sources

While programs to address other nonpoint sources of pollution are ongoing, if specific entry points do not account for potential continuing exceedance of water quality standards, a focused nonpoint source assessment would be required. Under the Niagara River Toxics Management Plan an overall nonpoint source assessment is currently being undertaken. This

**TABLE 7.1**
**INACTIVE HAZARDOUS WASTE SITE**
**REMEDIATION PROGRAM PROGRESS**
**NIAGARA RIVER BASIN**

| | Phase I | Phase II | Remedial Invest. Feasibil. Study | Remedial Design | Remedial Constr. | Remediation Complete or Not Required |
|---|---|---|---|---|---|---|
| **BUFFALO-LACKAWANNA SUB AREA** | | | | | | |
| **NIAGARA RIVER** | | | | | | |
| Bethlehem Steel 1/ | ——— | ——— | ——> | | | |
| Alltift | ——— | ——— | ——> | | | |
| Times Beach | ——— | ——— | ——— | ——— | ——— | ———> |
| Squaw Island | ——— | ——— | ——— | ——— | ——— | ———> |
| **BUFFALO RIVER** | | | | | | |
| Mobil Oil | ——— | ——— | ——— | ——— | ——— | ———> |
| MacNaughton-Brooks | ——— | ——— | ——— | ——— | ——— | ———> |
| Buffalo Color 1/ 1/ | ——— | ——— | ——— | ——> | | |
| Allied Chemical 1/ | ——— | ———> | | | | |
| **TONAWANDA - N. TONAWANDA SUB AREA** | | | | | | |
| **NIAGARA RIVER** | | | | | | |
| Allied Specialty Chemical | ——— | ———> | | | | |
| Tonawanda Coke | ——— | ———> | | | | |
| INS Equipment | ——— | ——— | ——— | ——> | | |
| Niagara Mohawk-Cherry Farm | ——— | ——— | ——— | ——> | | |
| OCC-Durez 2,3/ | ——— | ——— | ——— | ——— | ——— | ———> |
| Gratwick-Riverside | ——— | ——— | ——— | ——> | | |
| **ELLICOTT CREEK** | | | | | | |
| Columbus-McKinnon | ——— | ——— | ——— | ——— | ——> | |

**TABLE 7.1 (Continued)**
**INACTIVE HAZARDOUS WASTE SITE**
**REMEDIATION PROGRAM PROGRESS**
**NIAGARA RIVER BASIN**

| | Phase I | Phase II | Remedial Invest. Feasibil. Study | Remedial Design | Remedial Constr. | Remediation Complete or Not Required |
|---|---|---|---|---|---|---|
| **NIAGARA FALLS SUB AREA** | | | | | | |
| **NIAGARA RIVER** | | | | | | |
| Niagara Co. Refuse Disposal | ——— | ——— | ——— | ——> | | |
| Olin-102nd Street | ——— | ——— | ——— | ——> | | |
| OCC-102nd Street | ——— | ——— | ——— | ——> | | |
| Love Canal | ——— | ——— | ——— | ——— | ——— | ——> |
| Griffon Park | ——— | ——— | ——— | ——— | ——— | ——> |
| DuPont-Necco Park | ——— | ——— | ——> | | | |
| Reichold Varcum (Durez-Nia) 1/ | ——— | ——— | ——— | ——> | | |
| Buffalo Avenue-PASNY | ——— | ———> | | | | |
| OCC-"S" Area | ——— | ——— | ——— | ——> | | |
| OCC-Niagara Plant 1/ | ——— | ——— | ——> | | | |
| Solvent Chemical | ——— | ——— | ——> | | | |
| DuPont-Niagara Plant 1/2/ | ——— | ——— | ——— | ——— | ——— | ——> |
| Olin-Niagara Plant 1/ | ——— | ——— | ——> | | | |
| OCC-Hyde Park 3/ | ——— | ——— | ——— | ——— | ——> | |
| **CAYUGA CREEK** | | | | | | |
| Bell Aerospace 1/ | ——— | ——— | ——— | ——— | ——— | ——> |
| Charles Gibson Site | ——— | ——— | ——— | ——— | ——— | ——> |

1/ Corrective action program being undertaken in whole or in part under the Resource, Conservation and Recovery Act.
2/ Excludes embayment remediation.
3/ Applies to remedial actions other than containment and treatment systems which are complete and in operation.

assessment is considered an initial remedial activity. If it is determined that a nonpoint source category is contributing a significant loading to the Niagara River, the controllable sources of specific contaminants could be identified and control methods assessed, designed, implemented and monitored to demonstrate effectiveness.

Municipal and Industrial Wastewater Facilities

Existing municipal and industrial wastewater facility discharges are in general compliance with their State Pollutant Discharge Elimination System permits. These facilities will continue to be monitored to assure compliance with water quality standards and updated through the provision of best available technology and best management practices.

A DEC Water Quality Enhancement and Protection Policy is being developed. This initiative will incorporate pollution prevention/waste minimization techniques as an additional means of further reducing the discharge of toxic chemicals. The policy includes the establishment of discharge restriction categories and substance bans to protect waterbodies. The third portion of the new policy is antidegredation. Maintaining the high quality of waters that are cleaner than standards require is the goal of antidegradation.

Continuation of the existing point source regulatory program and implementation of the enhancement and protection policy will provide effective control of point sources. Monitoring data from municipal and industrial facility discharges will provide a database for the assessment of toxics reduction and the potential for exceedance of water quality standards from this source category.

Combined Sewer Overflows

Combined sewer overflows are potential sources of contaminants. Two combined sewer systems discharge untreated storm diluted overflows to the Niagara River during wet weather events, the Buffalo Sewer Authority and the City of Niagara Falls.

The Buffalo Sewer Authority (BSA) is currently developing a combined sewer system model to evaluate system capacity and possible improvements to maximize flow to and treatment by the wastewater treatment facility. Completion of this modeling will allow the identification of physical or operational system improvements that would minimize overflow occurrence.

The City of Niagara Falls constructed the Southside Interceptor to convey flow from the main industrial area along the Niagara River directly to the wastewater treatment plant. The flow from this industrial area was conveyed in the past by the Falls Street Tunnel, which previously was a main component of the combined sewer system. The City then undertook an extensive program to minimize infiltration into the tunnel at various locations. This program has resulted in a substantial reduction of groundwater inflow to the Falls Street Tunnel. All residual dry weather groundwater inflow to the Falls Street Tunnel has been directed to the

wastewater treatment plant with the completion of a rehabilitation of a conveyance pump station. The City will continue to conduct a sewer cleaning program and an overflow regulator maintenance program to maximize the flow carrying capacity of the combined system for treatment.

Other Point Sources

Existing water quality programs consider other point sources. A focused investigation of other point sources (e.g. storm sewers) would be initiated if all other source categories cannot account for a future sediment or water quality criteria exceedance. Remedial design, implementation and monitoring would follow for those specific entry points identified as sources of contaminants.

Fish and Wildlife Habitat

The initial remedial activity for fish and wildlife habitats within the Niagara River Area of Concern will be a comprehensive inventory of fish and wildlife and their habitats. Although some information is available concerning critical habitats for common tern, waterfowl and muskellunge, site specific information for all remaining habitats is lacking. A complete listing of all species utilizing the Area of Concern has not been developed. In addition, information on contaminants in Niagara River fish and wildlife should be updated.

From this inventory, a plan for protection and improvement of fish and wildlife habitats will be developed. The plan may recommend changes in current regulatory programs or identify site acquisition to protect and enhance fish and wildlife habitat.

Additional information on contaminant levels in fish and waterflow would allow an appraisal of ongoing remediation activities in the Area of Concern as well as review of current human health advisories.

The introduction of non-native species of plants and animals to the Great Lakes ecosystem has occurred sporadically over time. The zebra mussel is the most recent in the series of non- indigenous species to inhabit the area. In response to this issue, the federal Aquatic Nuisance Management Act of 1990 was enacted which requires states to develop management plans for non- indigenous aquatic species. The management plan is under development in New York State and is considered an initial remedial activity. The plan will recommend activities such as monitoring programs to assess the impact of non-indigenous species on the aquatic ecosystem and to establish cause and effect linkages between different life forms. The plan will also address preventative measures to control the introduction of additional species.

A better understanding of population interrelationships, the extent of habitation by non-indigenous species and their impact on the habitat conditions of the area, will provide useful input for the preparation of the habitat improvement plan for the Niagara River.

Upon completion of the fish and wildlife habitat inventory and the non-indigenous aquatic species management plan, a habitat improvement plan would be developed. Based on the habitat improvement plan, necessary lands for plan implementation would be able to be acquired. Habitat improvement design would follow, along with implementation. Habitat improvements would then be monitored.

## MONITORING

In the context of a Remedial Action Plan, monitoring is carried out to determine whether the remedial actions that have been undertaken are achieving the expected environmental improvements. The details of such a monitoring exercise must be linked closely in time, place, and type with the specific remedial measures. They should be designed with the remedial program.

Table 7.2 shows, for each of the use impairments known or likely to be occurring in the Niagara River, a proposed sampling method, parameters to be measured, and indicators of recovery. For some of the use impairments there are no simple indicators of recovery. One could say that the system has recovered when the indicators have reached "normal" levels. However, there is no way to establish such normal levels except by expert judgment based on wide experience with relatively clean waters. In addition, the ultimate acceptable recovery will depend to a great extent on public opinion and the cost of remediation. A certain degree of fish tumor incidence above what experts would agree is characteristic of pristine areas, might be acceptable if the cost to obtain this ideal were large.

A particular caution should be noted with regard to measurements on fish and wildlife, particularly those ordinarily consumed by humans. These species travel outside the Niagara River and are likely to be affected by water quality existing outside of the Niagara River Area of Concern. To determine whether remediation within the Area of Concern has affected fish populations, the use of caged fish suspended in the river may be required.

Because of the difficulties noted above, there is a need for development of surrogate measurements that can be made directly on the water system, and that will allow estimations of environmental damage to be made. Water quality standards based on chemical analyses and Daphnia toxicity tests are examples of such surrogates. There is need for similar measures and associated acceptance criteria for sediments.

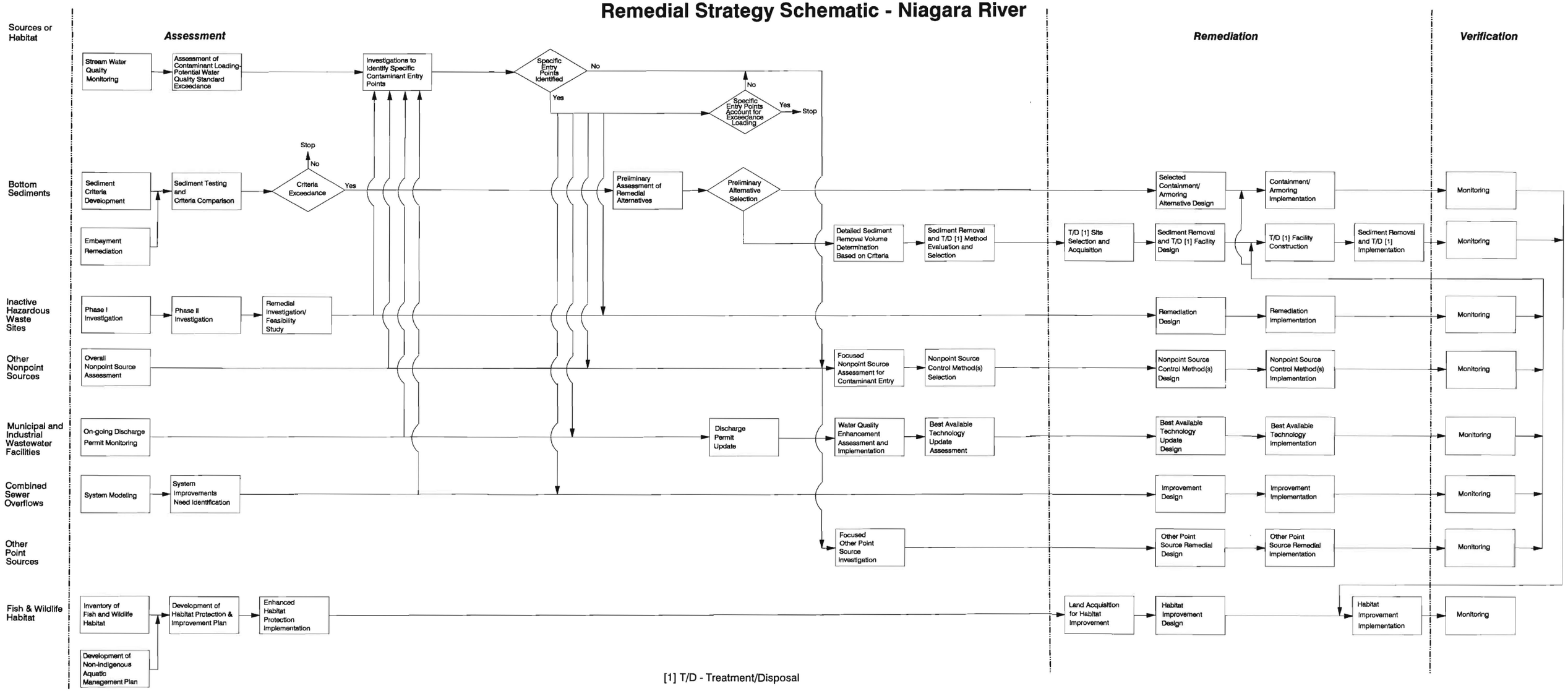
TABLE 7.2
MONITORING METHODS, PARAMETERS, AND INDICATORS FOR
USE IMPAIRMENTS DEFINED BY THE GREAT LAKES WATER QUALITY AGREEMENT

| Use Impairment | Sampling Method | Measured Parameter | Indicator of Recovery |
|---|---|---|---|
| 1. Restrictions on fish and wildlife consumption. | Collection of edible species. Possibly caged fish. | Chemical levels in flesh of fish. | Comparison of levels with guidelines. Removal of advisory by DOH. |
| 3. Degradation of fish and wildlife populations. | Collection of indicator species. | Population estimates. | Populations meet DEC plans for area. |
| 4. Fish tumors and deformities. | Fish collection. | Frequency of tumors and deformities. | 1/ |
| 5. Bird or animal deformities or reproduction. | Fish collection. | Chemical levels in fish. | Comparison of levels with guidelines. |
| 6. Degradation of benthos. | Bottom surveys. | Population/ community indices and species count. | 1/ |
| 7. Restrictions on dredging. | Cores of sediments in navigation channel. | Chemical levels, toxicity, and bio-accumulation. | Comparison with guide-lines. Decision by DEC and EPA to allow open lake disposal. |
| 14. Loss of fish and wildlife habitat. | Habitat survey. | Comparison with DEC management plans. | Habitat consistent with DEC management goals for area. |

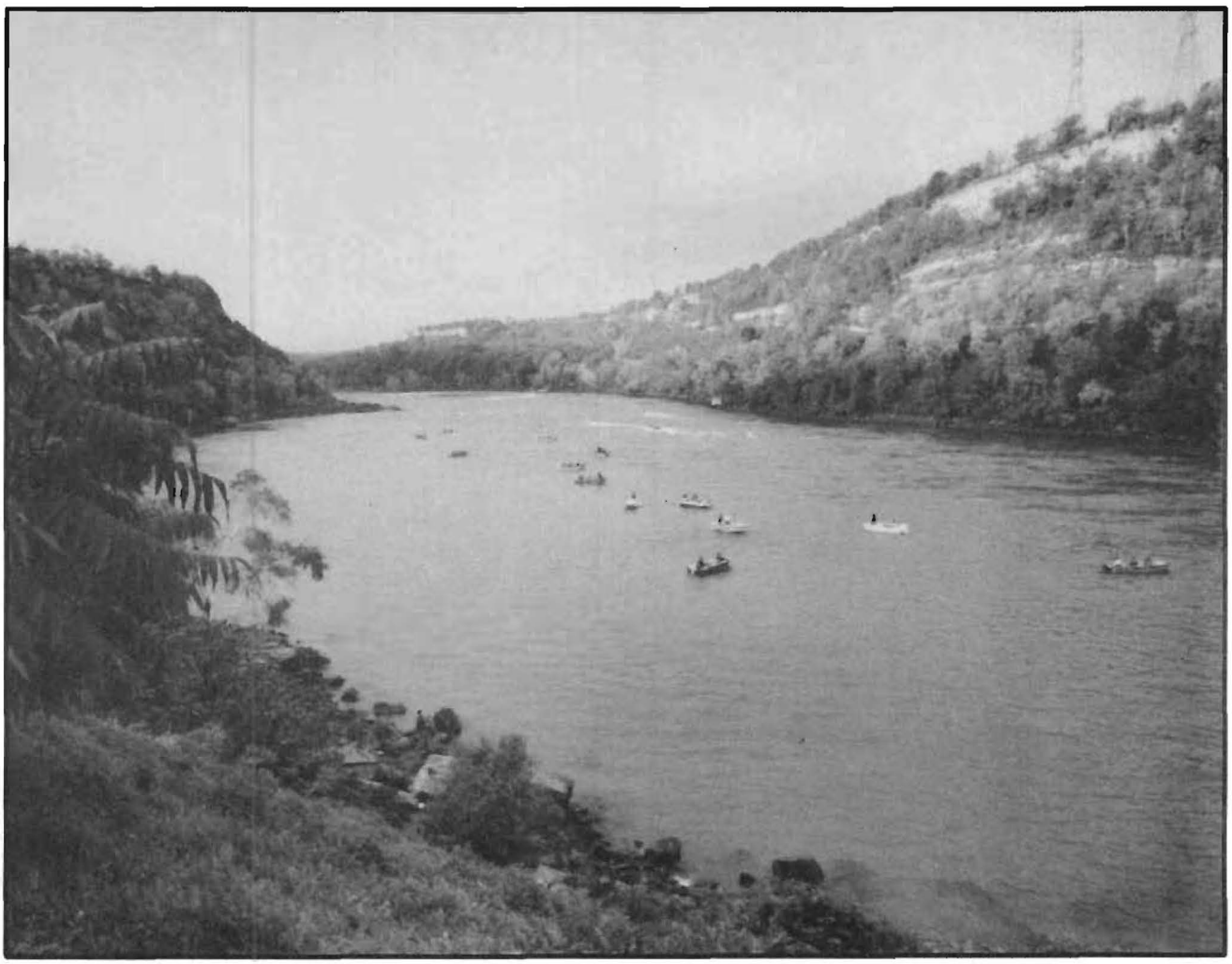
1/ Indicator of recovery under development

Figure 7.1

# Remedial Strategy Schematic - Niagara River




[1] T/D - Treatment/Disposal



Lower Niagara River Near Lewiston

*Bonnie Soley*

# CHAPTER EIGHT: COMMITMENTS

## INTRODUCTION

The remedial strategy outlined in Chapter 7 will require funding far in excess of what is currently available. Therefore, agencies cannot make commitments, at this time, to the complete implementation of this strategy. Such commitments will depend on the availability of funds, and these are likely to be made available only on a step-by-step basis as the investigation and decision process proceeds. It is anticipated that the strategy, with the availability of sufficient funds, would be accomplished over a 10 to 20 year time period.

DEC and other responsible agencies have been, and are currently carrying out remediation of environmental problems on the Niagara River. Since some funding is currently available, certain commitments can be made at this time.

DEC will provide the general coordination for implementation of the remedial strategy. However, participation of other agencies at the local, state, and federal levels is required.

## COMMITMENTS

Agency commitments are described in this section. Objectives, state fiscal year dates for completion, and responsible agencies are detailed. The "next step" denotes those activities needed to carry out the overall strategy after completion of the committed activities.

### A. Stream Water Quality Monitoring

#### 1. Continued participation in upstream/downstream water quality monitoring committee activities along the Niagara River.

An upstream/downstream water quality monitoring program is an ongoing program involving the collection of water and suspended solids samples at the head (Fort Erie) and the mouth (Niagara-on-the-Lake) of the Niagara River has been undertaken in accordance with the Niagara River Toxics Management Plan. The purpose of the program is to estimate input loadings of specific chemicals to the Niagara River from Lake Erie and output loadings to Lake Ontario. The monitoring program is the responsibility of the four parties participating in the Niagara River Toxics Management Plan: Environment Canada, Ontario Ministry of Environment, USEPA, NYSDEC. The next step will be to utilize the data for estimation of pollutant loadings from the upper basin and from within the area of concern itself. Assessment of the loadings will determine the need for further reductions. It is intended that participation in the activities of this monitoring committee be continued.

B. Bottom Sediments

1. Remediate embayment sediments along the Niagara River.

EPA and DEC will oversee remediation at three locations along the Niagara River where sediment contamination in embayment areas are sources of contaminants associated with impairments in the river. The three embayment locations are: at the mouth of the Pettit Flume, 102nd Street embayment and the mouth of Gill Creek. Remedial design and remedial action was completed at Gill Creek in 1992 and is to be completed at the Pettit Flume in 1995. The 102nd Street embayment remedial design is to be completed by March 1995. The next step will be to commence remedial action at the remaining embayment area.

2. Develop methods for determining sediment criteria that have scientific validity.

EPA has been working for several years on developing and validating tests and associated acceptance criteria that would allow decisions to be made relative to the likely environmental impacts of contaminated sediments. A completion date has not been set for this work. As a next step following the development of a criteria methodology, DEC will apply this methodology to the Niagara River sediments. This would include both the development of site specific criteria, and actual testing of the bottom sediments.

C. Inactive Hazardous Waste Sites

1. Conduct Phase I investigations involving existing data accumulation and assessment.

The accumulation and evaluation of existing data to assess contaminant conditions at each of the significant sites in the Niagara River basin has been completed by DEC. The next step is to conduct Phase II investigations, which include preliminary field studies to fill data gaps to complete the initial site assessment.

2. Conduct Phase II field investigations to fill data gaps to complete initial site assessments.

Phase II investigations have been completed at all of the significant sites in the Niagara River Basin. DEC has served as the responsible agency. The next step is ranking of the sites and the determination of need for Remedial Investigation/ Feasibility Studies (RI/FS). Once a RI/FS is determined to be required, implementation action can be initiated under a DEC Consent Order by the responsible party or directly by DEC in the absence of a known responsible party.

3. Conduct Remedial Investigation/Feasibility Studies to define contaminant pathways and assess alternative remedial measures.

Remedial Investigation/Feasibility Studies are underway at six sites (Bethlehem Steel, Alltift, DuPont-Necco Park, Occidental Chemical-Niagara Plant, Solvent Chemical and Olin-Niagara Plant). Oversight of these studies is a shared responsibility of EPA and DEC. All of the studies are scheduled to be completed by March 1996. Once Remedial Investigation/Feasibility Studies are complete, the next step in the process is the design of site remedial measures.

4. Conduct Remedial Design.

Remedial design is underway at nine sites (Buffalo Color, Niagara Mohawk-Cherry Farm, INS Equipment, Gratwick-Riverside Park, Niagara County Refuse Disposal, Olin-102nd Street, Occidental Chemical - 102nd Street, Reichold-Varcum (OCC-Durez, Niagara) and OCC-"S" Area). Design work for these sites is scheduled for completion by March 1996. EPA and DEC share responsibility for the oversight of these sites. The next step after design is the start of remedial action at these sites.

5. Conduct Remedial Action

Remedial construction action is currently underway at two sites (Columbus-McKinnon and Occidental Chemical-Hyde Park). At the OCC-Hyde Park site, remedial construction applies to remedial actions other than containment and treatment systems which are complete and operational. EPA and DEC have responsibility for oversight of these remedial projects. Construction is scheduled for completion by March 1995. Once remedial construction is completed the sites will be monitored.

D. Other Nonpoint Sources

1. Develop methodology for estimating the loading of persistent toxic chemicals from nonpoint source categories.

Nonpoint source loading estimating methodology is to be developed for three source categories: surface runoff, groundwater migration and atmospheric deposition. The projected completion date is March 1995. The responsible agencies are the four parties participating in the Niagara River Toxics Management Plan: Environment Canada, Ontario Ministry of Environment, USEPA, NYSDEC. The next step will be to utilize the methodology to estimate loadings to determine the significance of the contribution from the various nonpoint source categories.

E. Municipal and Industrial Wastewater Facilities

1. Continue discharge permit monitoring to achieve compliance with secondary treatment for municipal discharges and best available technology and best management practices for industrial discharges.

DEC reviews self-monitoring reports from dischargers, inspects facilities in operation and independently samples effluent to check on the validity of self- monitoring data. Significant violations of permit conditions trigger compliance or enforcement measures. These activities are an ongoing program responsibility of DEC. As new standards or technologies are developed, each permit will be reassessed to assure that updated water quality standards and technology requirements are applicable.

2. Develop water quality enhancement and protection policy to include discharge restriction categories, antidegradation and substance bans.

DEC will continue development of this policy initiative. Initial development was focused on the development of discharge restriction category regulations which has been completed. Antidegradation procedures are being developed in cooperation with EPA and other states as part of the Great Lakes Initiative. Antidegradation measures will maintain the high quality of waters that are cleaner than standards require. This action will incorporate pollution prevention/waste minimization techniques as an additional means of further reducing the discharge of toxic chemicals. This phase of the policy development is scheduled for completion by March 1997.

F. Combined Sewer Overflows

1. Apply the combined sewer system model developed by the Buffalo Sewer Authority to assess sub-basin flow conveyance capacity and the potential for enhanced in-system storage.

The Buffalo Sewer Authority (BSA) will continue the model development process for the system sub-basins. The model will then be used to assess system conditions and alternative operation schemes for the initial sub-basin. This phase of the project is scheduled for completion by March 1995. The next step, once the exact nature of potential system modifications is defined, is the planning of remedial measures including enhanced in- system storage.

G. Fish and Wildlife Habitat

1. Develop a plan for a comprehensive inventory of fish and wildlife and their habitats.

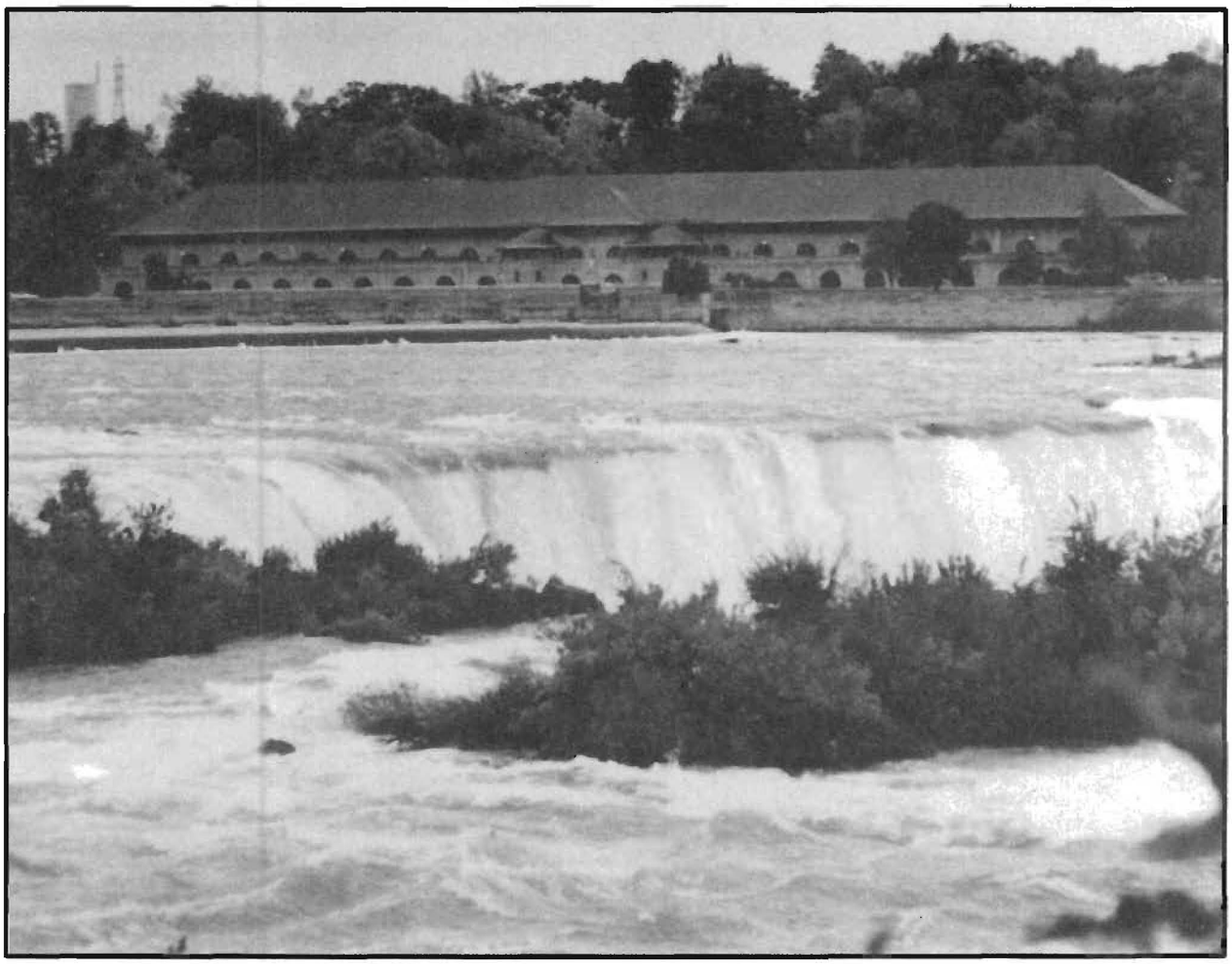
DEC will develop a plan for the inventory of fish and wildlife populations and habitat by March 1995. The plan will include the use of existing knowledge and data related to fish and wildlife and their habitats within the Niagara River Area of Concern. The existing data will be examined and surveys will be designed to fill informational gaps concerning fish and wildlife use of available habitats, unidentified critical habitats, habitats in need of remediation and sites where habitat creation or restoration are possible. Once the plan for the inventory is completed, the next step will be to obtain the necessary resources to complete the inventory activities.

2. Develop a plan for contaminant monitoring in fish.

DEC has developed a plan for contaminant monitoring in fish. This plan describes fish collections and analyses necessary to determine current levels of organochlorine contaminants in Niagara River adult and young-of-the-year fish. With completion of the plan, fish collections and analyses will commence.

3. Develop a management plan for non-indigenous aquatic species.

The zebra mussel is the most recent in the series of non-indigenous species to inhabit the Great Lakes ecosystem. DEC has developed a plan to assess the impact of non-indigenous species on the aquatic ecosystem and to establish cause and effect linkages between species. A better understanding of population interrelationships, the extent of habitation by non-indigenous species and their impact on the habitat conditions of the area will provide useful information for the preparation of a habitat improvement plan. With completion of the plan, assistance will be sought to undertake the non-indigenous species assessment activities.



Ontario Power Station at Niagara Falls

*Keith Kirkland*

# CHAPTER NINE: TRACKING NIAGARA RIVER RAP IMPLEMENTATION

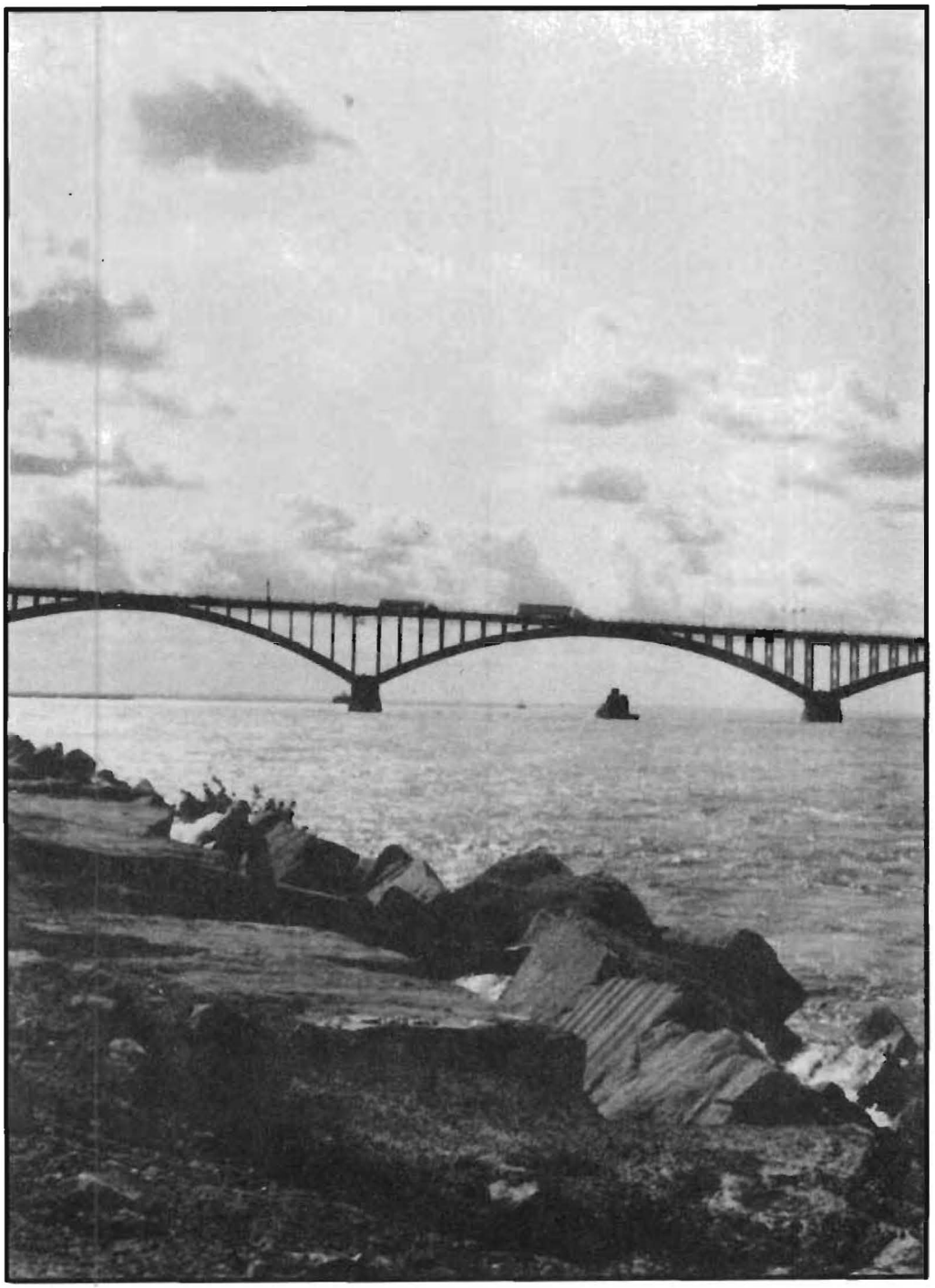
Tracking progress in implementing the RAP will have three components: (1) public participation, primarily through an advisory committee; (2) annual progress reports and workplans for the coming year; and (3) periodic plan revisions and updates.

DEC will appoint a twelve-member committee in 1993 to advise and assist it in implementing the RAP and producing the annual reports and plan updates. The Remedial Advisory Committee (RAC) members will represent elected and appointed government officials, public and economic interest groups, and private citizens interested in the Niagara River. In addition to RAC members, agencies at all levels of government will be asked to participate and provide input in RAP implementation as needed.

The RAC will meet with DEC at least three times a year to advise on RAP amendments, recommend RAP revisions where needed, and discuss topics relevant to the RAP including agency commitments, availability of federal funds, input for the annual report, and future RAC involvement in building support for the remedial process.

As part of tracking implementation of the Niagara River RAP, DEC will produce a progress report and workplan each May. The report will respond to public priorities and incorporate the discovery of new information.

As new information becomes available during investigation and changes occur in land use and in uses of the river itself, there will be a need to update the RAP. DEC will consult with the RAC on the need for updating. DEC will work with the RAC to prepare revisions, review them with the public, and submit the revisions to the IJC as required.



Head of Niagara River at Lake Erie

*Rebecca Condon*

# CHAPTER TEN: LAND USE RECOMMENDATIONS

Chapter 10 of the RAP was prepared by the Niagara River Action Committee (NRAC). It addresses the impacts of land use on the environment, and lays out some recommendations for a land use decision-making process which minimizes environmental impairment while maximizing environmental and aesthetic improvement.

The chapter subsections deal with land use guidelines, history of land use along the Niagara River, fish and wildlife habitat, past and present planning efforts, shoreline aesthetics, and recommendations for ways to incorporate concerns for environmental protection and remediation into regional land use planning efforts.

## LAND USE GUIDELINES

1. There shall be no net loss of environmentally higher forms of land use within the Coastal Zone. The hierarchy of desirability is based on water dependency, with water-dependent uses that must be located along the water's edge, such as fish and wildlife habitat or a water- dependent transportation facility, taking precedence over uses that are merely water-enhanced or non-water-dependent.

2. Ever-more benign use of land must occur within the Coastal Zone. A goal should be to create new projects with less environmental impact than the uses that preceded them.

3. Each given piece of land must conform to siting regulations based on environmental desirability. Ever-greater sensitivity to the environment is required the closer one gets to the water. Lands along the water should approximate the original, natural habitat to the maximum extent possible. The near-shoreline may be park-like, with restrooms and other buildings set farther back. Housing, commercial structures, parking lots, etc. should be set back from the river as far as possible.

4. Remedial action related to land use changes should require more detailed environmental assessment, and more public involvement in the decision-making process. Federal and state laws exempt clean-up actions at hazardous waste sites from environmental impact studies, based on the rationale that lengthy environmental analysis and evaluation may prevent expeditious action. However, major clean-ups take years to accomplish and are often preceded by long remedial investigations. The public good might be better served if full environmental impact statements were prepared.

5. Remedial action on hazardous waste landfills along the Niagara River should favor excavation over containment, but if containment is the chosen option, any settlements or court-

ordered remedial actions should provide for public access to the shoreline, when the remediation has been completed. Settlements should stipulate a 50-foot setback wherever possible.

6. A regional planning and coordinating agency must be established. It is recommended that the jurisdiction of the New York State Urban Development Corporation-sponsored Horizons Waterfront Commission be extended northward from Erie County to include the shoreline of Niagara County, much of which is on the Niagara River.

## LAND USE HISTORY AND STATUS

Current land use along the Niagara River is related to patterns established during European settlement and industrial expansion in the 19th century. Early residents made use of the river for transportation, water power, waste disposal, and as a source of fish and game. The construction of the Erie Canal early in the 19th century made Buffalo a major transshipment point for goods moving between the Atlantic seaboard and the developing Midwest and upper Great Lakes. The development of railroad systems enhanced Buffalo's role as a transportation hub. By the end of the 19th century, cheap and abundant hydroelectric power from Niagara Falls, combined with the availability of the Niagara River as a source of fresh water for cooling and as a medium for waste disposal, led to development of the water-dependent electrochemical industry. The same factors combined with the relative proximity of coal and iron ore in the Great Lakes region gave birth to huge steel works. As a result of these broad factors, large areas of the Niagara River shoreline, particularly in Niagara Falls, the Tonawandas, and Buffalo, became occupied by highly water-dependent industries.

In 1885 the creation of the Niagara Reservation, a park area around Niagara Falls, introduced a new public use which was entirely water-dependent, and it was followed by the establishment of additional parks.

The urban riverfront was dominated by transportation, industrial, and relatively minor public uses, with residential areas close by. Between urban centers the towns were small and rural in nature, and the waterfronts were lightly developed, agricultural, or brush land.

During the early 20th century urban areas grew rapidly and existing industrial uses, many of them still water-dependent, continued and expanded. Public health regulations began to play a role in both municipal and industrial waste disposal practices. The development of the automobile and good road networks started urban sprawl and began to affect the commercial importance of railroads.

In the second part of the 20th century, transportation patterns changed with the building of the St. Lawrence Seaway, which meant the end of Buffalo's role as a marine transshipment center, and the construction of the national Interstate Highway System, which contributed to the growth of

trucking and the decline of the railroads. Unused railroad and canal paths were often chosen as sites of new expressways, which preempted other reuse of waterfront land.

The decline of the local steel, automobile and chemical industries severely weakened the economy, while new residential construction intensified in rural and suburban areas, leaving the older urban areas with stagnant or declining tax bases. There has been little reuse of former industrial areas, many of which require expensive environmental clean-up. Some of the remaining local industry has lost much of its water dependency, due in part to waste treatment regulations which have put an end to waterfront dumping practices.

Redevelopment of urban waterfronts became a major planning priority in the 1970s. Under the tutelage of the New York State Department of State, many communities developed Local Waterfront Revitalization Programs (LWRPs), which identified the need for greater public access, open space, and residential, recreational, and commercial development.

While environmental consciousness grew in the public at large, much of the river's natural environment had been permanently altered or destroyed. In many respects, the present Niagara should be considered a man-altered ecosystem. This is nowhere better illustrated than in the activities of the giant hydroelectric facilities on both sides of the river. They have created an enormous diversion structure to control water levels above Niagara Falls, dug channels deep into the river bottom, and created miles of new shore. They install an ice boom each winter at the head of the Niagara River to reduce ice accumulation in the river. At times 75% and more of the flow that would normally pass over the Falls is diverted through underground conduits. These operations influence surface and ground water levels in the area. The industry has environmental impacts regularly and over a wide area, but escaped environmental assessment because the current facilities were built before environmental impact statements were required.

The growth of water-dependent recreational activity, the public's increasingly high valuation of fish and wildlife habitat, historic and scenic preservation, and the demand for public access are now considerations of local planners, in addition to the ever-present desire for economic growth.

## FISH AND WILDLIFE HABITAT

### History and Present Status

Perhaps no aspect of the Niagara River has changed more drastically or irreversibly than the shoreline that served as habitat for fish and wildlife. Loss of fish and wildlife habitat is a major impairment resulting directly from past and current land use practices.

Before the incursions of Western Europeans, the great inland wilderness forest probably extended to much of the water's edge or to the fairly extensive marsh areas which existed upstream of the Falls, at the

mouths of creeks, and along the northeast Lake Erie shore from the mouth of the Buffalo River southward. The shoreline probably teemed with reptiles, amphibians, and mammals of many species, and there were thousands of birds, both resident and migratory.

None of the pristine wilderness habitat remains due to transitions in land use along the river's edge. Even the Niagara River itself has been changed by control of upper river levels and diversion of about 50 to 75% of the flow to power plants, drastically affecting the lower river flow and to some extent, the character of the shoreline. Virtually all the marshes and mud flats directly along the shorelines have been filled with excavated rock, steel-mill slag, or even refuse, and paved or covered with factories, commercial enterprises, or residences with breakwalls, manicured lawns and scattered (often non-native) trees and shrubs. The very few remaining marshes in the NRRAP area are either separated from the river or lake proper or changed in character by manipulation of river level, construction, sedimentation, and incursion of non-native plants. Many plant and animal species have been extirpated from, or reduced to rare occurrence in, the NRRAP area over the years. Dredging and filling of wetlands and shallows, alteration and diversion of flow, bulkheading of shorelines, destruction of riparian habitat, and alteration of tributary habitat undoubtedly contributed to changes in abundance, distribution, and type of fish populations.

A number of the remaining habitats are in some way important to fish and wildlife, including 11 state-regulated wetlands (each greater than 12.4 acres), the 11 areas designated as Significant Coastal Fish and Wildlife Habitats under the federal Coastal Zone Management Act of 1972, and many other smaller wetland areas.

Fish and Wildlife Habitat Recommendations

The following partial list of specific actions exemplifies the preservation and enhancement of habitat that should become part of the Niagara River Action Plan:

- Ensure that fish spawning and waterfowl feeding areas (whether specifically identified or not) are maintained, such as the Buffalo South Harbor area south of the Small Boat Harbor.

- Preserve riparian habitats such as Grand Island tributaries identified as significant coastal fish and wildlife habitats.

- Take measures to preserve Strawberry Island and downstream shallow areas of the river, which provide nesting and feeding areas for ducks, gulls, and terns, and are known to be major muskellunge spawning and nursery areas.

- Purchase or otherwise preserve the thorn thicket and shore areas adjacent to East River Road on Grand Island as wildlife preserve.

- Strictly maintain Buckhorn Island State Park as the wild area for which it was originally dedicated.

- Maintain at least the center woodland area and river bank of Goat Island on the Niagara Reservation, the wooded sections along the north and east areas of Fort Niagara State Park, and the wooded, bushy and long grass areas of Joseph Davis State Park in as nearly wild or natural condition as possible.

- Obtain a long range commitment or conservation easement to preserve the woodland located on Niagara University's DeVeaux Campus.

- Resist "improvement" of the entire Niagara River gorge and lower river bank areas to the point wildlife habitat is further impaired, while accommodating safe use for fishing and hiking in the gorge area.

LAND USE IMPACTS

Past unregulated growth in municipalities along the Niagara River, particularly Niagara Falls, North Tonawanda, the Town of Tonawanda, and Buffalo, has usurped some of the most physically unique shoreline for exclusively industrial purposes. One impact is large acreages of waste sites on and near the river shore. Another is the exclusion of public access. In addition, the shoreline of industrial sites is usually protected by various unnatural means including sheet piling and blocks of used concrete.

Commercial uses of riverfront lands are limited mostly to private marinas and a few restaurants. Private ownership of other portions coupled with transportation uses (expressways and rail lines) further limits opportunity for the general public to have access to the riverfront, except at state and local parks, and along the Buffalo Riverwalk.

Power generation land uses offer varying public access. The Niagara Mohawk Huntley Station coal-fired power plant in the Town of Tonawanda offers none. The New York Power Authority in Niagara Falls and Lewiston provides limited access for fishermen to the Niagara River and has also provided other recreation opportunities near their reservoir in the Town of Lewiston.

Other land uses such as water treatment plants and intakes and waste water treatment plants absorb other acreages of prime riverfront land offering no access for the general public.

The impacts of industry, power generation, and commercial land uses on the Niagara River have been positive in providing economic opportunity to the region, while also being negative in denying the public access to the river, in destroying the natural environment, and in providing a legacy of residual impacts on the environment for generations to come.

AESTHETICS OF NIAGARA RIVER SHORE

Even as the increasingly clean appearance of Lake Erie and the Niagara River has led to a boom in recreation along those bodies of water, the landscape may move from industrial degradation directly to recreational despoliation. Existing billboards, private structures, and utility poles alongside roadways bordering the shore area are a consistent problem. Design controls can prevent much of this while still allowing maximal public usage.

Major aesthetic problem areas include the degraded industrialized shoreline along the Bethlehem Steel site in Lackawanna and the large billboards and overly complex road system along the Buffalo Outer Harbor. New residential development at Erie Basin blocks views of the river and lake from the city proper. The Niagara Thruway is an eyesore on the Buffalo and Tonawanda shoreline for miles. Heavily-laden utility poles mar the view along River Road in the City of Tonawanda. Boat launch areas in Tonawanda are dominated by unbroken expanses of asphalt. Landscaping is poor in Gratwick Park in North Tonawanda. There has been degradation of the Olmsted Plan for the Niagara Reservation, accompanied by commercial exploitation surrounding state lands. The Robert Moses Parkway obtrudes along most of the shoreline from the North Grand Island Bridges to Lewiston. Intrusive structures, tree clearing, and bank erosion may be found along the lower river from Lewiston to Youngstown.

LWRPs AND THE RAP PROCESS

Common Ground

The Local Waterfront Revitalization Plans (LWRPs) typically do not deal at length with the full range of potential obstacles to development posed by water quality impairments. The RAP process, on the other hand, is specifically designed to remediate water-related environmental problems.

Treatment of water quality issues, while an important part of the LWRP, is necessarily more general than found in RAPs. LWRPs deal with a wide range of issues. Also, the State has more responsibility than local governments for enforcing water quality regulations.

The LWRP process attempts to elaborate on the State's 44 coastal management policies, which deal in a most forthright manner with environmental problems, trying to prevent repetition of past mistakes. However, experience is that the translation of these policies into local policies leaves much to be desired, due in part the the lack of local resources for dealing with major environmental problems and in part to an imperfect local awareness of the need to be consistent with state and federal coastal management policies.

LWRPs

The LWRPs outline development strategies which are submitted to the public for comment at public hearings and through surveys. Focusing on a small strip of land along the river's edge, the LWRPs all propose similar

activities such as boat slips, beaches, improved fishing areas, and increased public access. A strong need remains to incorporate LWRPs into a comprehensive plan for the river as a whole, and to designate a local coordinating body to oversee the plan. A body similar to Erie County's Horizons Waterfront Commission to coordinate both Erie and Niagara Counties should be a high priority for local governments along the river.

The LWRPs emphasize activities that could be implemented fairly quickly and easily to improve the quality of life for present residents. Few of the plans consider in any detail whether new beaches will be safe to use, fish from new fishing areas safe to eat, or newly accessible recreational areas safe to play in.

RAPs

RAPs perform a more specific function and operate under a different time frame than LWRPs. The Niagara River RAP prescribes actions necessary before LWRP dreams can be implemented: clean the land and water and designate areas to be protected from development. The RAP process may encourage or restrict certain land uses depending on the "health" of the land and the projected impacts on the river's ecosystem.

The State Coastal Policy Recommendations connect the LWRPs and the RAP by addressing short-term development and long-term environmental integrity. Municipalities are required to consider the environmental recommendations in preparing their LWRPs. As most of the

LWRPs have not advanced to the actual development stage, whether they will be followed remains to be seen.

## REGIONAL PLANNING AND THE RAP

The Erie and Niagara Counties Regional Planning Board (ENCRPB) was formed by the legislatures of Erie and Niagara counties in 1966 to respond to urgent water pollution problems. After preparing regional wastewater and water supply plans, in concert with a conceptual land use plan, the ENCRPB focused on refining recreation and open space recommendations for the Niagara River shoreline and local tributaries. Some recommendations from the ENCRPB studies have been implemented, such as the "Riverwalk" hike/bikeway, but many have not. Other recommendations became part of various Local Waterfront Revitalization Plans.

### The Horizons Waterfront Commission

The Horizons Waterfront Commission (HWC) was created as a subsidiary to the New York State Urban Development Corporation (UDC) to prepare a comprehensive county-wide "Action Plan" for its 92-mile Lake Erie and Niagara River shoreline in Erie County and guide implementation of its plan recommendations.

An Intermunicipal Cooperation Agreement between the cities and towns of Erie County's waterfront, Erie County, and the Niagara Frontier Transportation Authority laid the groundwork for the creation of the

commission alongside the powers and purposes stated in its bylaws. Created as a public benefit corporation, the powers of the HWC include: development of a regional waterfront master plan; receipt of state and federal funds to implement projects; coordination of public and private investment in the waterfront area; and to act as a developer of last resort, where a particular project cannot be carried out by a local entity.

The HWC's Board of Directors serves as a model for regional planning activity. The Board is comprised of 16 voting members from local elected officials and governing bodies and 18 non-voting members representing key planning and regulatory agencies concerned with waterfront development. The Board's vision is "to create a clean, prosperous and accessible waterfront."

The HWC Action Plan consists of a conceptual regional land use plan for the waterfront comprised of recreation, development and transportation components wherein key projects are identified to achieve this vision. Since the Action Plan's adoption by both HWC and UDC in January 1992, plans for key projects have been advanced. Two of these projects, located in Tonawanda and Buffalo, are related to the RAP. The Town of Tonawanda Waterfront Master Plan proposes to redevelop Tonawanda's industrial waterfront to maximize public access to the river, locating water-dependent and water-enhanced recreational, housing, and commercial uses along the riverfront and relocating roads and other non-water dependent uses inland. The plan includes development of a 55-acre regional park, Cherry Farm, on a remediated inactive hazardous waste site, and redevelopment of the former Roblin Steel site as a mixed use area. The Buffalo Harbor Center/Nowak project, a major recreational complex proposed by retired Congressman Henry Nowak to revive the Buffalo waterfront, is envisioned as a themed attraction which would showcase the interrelationships of water, land, animals, and man in the Great Lakes ecosystem.

The HWC Action Plan will largely be implemented by local government working cooperatively with the State of New York. Several LWRPs will need to be revised to reflect the Action Plan. Municipal plans and development controls will be reviewed and updated as needed to incorporate key projects as they develop, update zoning ordinances to create special waterfront zones and development districts, refine and integrate performance standards and design guidelines developed in the Action Plan into existing site plan review regulations, and adopt a procedure for referring proposed changes in waterfront planning, zoning, permitting and site plan review to HWC for review.

Land Use Recommendations

The purpose of this section is to evaluate the goals and methods of remedial action against the values and planning principles expressed over the last 20 years, and to recommend guidelines for their implementation. Recommendations are organized according to the basic planning issues facing the Niagara River area: intensity and type of development; access to the waterfront and recreational open space; economic impact of environmental problems; and enhancement of quality of life.

- Intensity and Type of Development

Niagara River waterfront planning should aim to stabilize existing patterns of growth, strengthen existing urban centers, make more efficient use of existing infrastructure, increase amenities, economic growth, and environmental quality, and promote complementary uses not only along the New York side of the waterway but between both U.S. and Canadian waterfronts. No development should take place where adverse impacts have not been mitigated. To achieve these goals, a single set of land use controls should be established for the entire waterfront along both sides of the river, with the cooperation of all levels of government. The ideal might be the creation of a single, international superagency to coordinate development, although a river commission limited to the U.S. shore might be more practical, particularly if it can be established as an expansion of an existing organization such as the Horizons Waterfront Commission. Controls should favor water-dependent uses along the riverfront and expand public access.

Constraints to developing unified land use controls include differing government structures and lack of consensus on appropriate land use. Remediation strategies for inactive hazardous waste sites may conflict directly with new development.

- Access to the Waterfront and Open Space

Access to the waterfront has become an increasingly important issue to residents. The local waterfront revitalization programs highlight the potential for enhanced recreational activities along the waterfront.

Specific access-related goals include increased public use, increased tourism, complementary development on U.S. and Canadian banks, open space development and preservation, and buffer zones and suburban sprawl.

To achieve these goals, public awareness of the opportunities for riverfront recreational development must be heightened; public commitment and citizen involvement and support are needed. Again, unified public control is needed. Conditions limiting access, such as the riverfront transportation network, should be eliminated or modified as much as possible. Mechanisms must be developed to facilitate the acquisition and maintenance of land and historic properties in ways that will minimize hardships to owners, avoid litigation, and maintain as much private ownership as possible.

Constraints include strong traditions of private ownership and low funding priority for acquisition and conversion of land to public uses that will pay no taxes. Existing hazardous waste sites and treatment facilities have become barriers to access and excuses for no action alternatives.

- Economic Impact of Environmental Problems

The goal of the RAP is a clean, safe environment. If this can be

achieved, the region can take full advantage of its Niagara River assets. The image of the area will be improved, and tourism could be expanded. Environmental cleanup can open new land for recreation or open space use. Enforcement of existing laws and regulations will remove causes of conflict between the U.S. and Canada. Increased awareness and improved information will generate public support for a cleaner environment. And prevention of future contamination will avoid future remedial efforts.

To realize these goals, commitment to a cleaner environment must be given much higher priority. Political pressure for remediation and pollution prevention must increase. Funding for monitoring, investigation, environmental assessment, and remedial planning and cleanup must be provided on a regular basis. Increased public recognition of toxics problems must be generated.

Constraints include political differences between municipalities and between countries which contribute to the lack of legislation to mandate actions. There are not enough incentives to produce pollution-free technologies, existing remediation technologies are limited, and all these projects are in competition for limited funding.

- Enhancing the Quality of Life

The primary goal is to seek a balance between quality of life and economic growth. If this can be achieved, the region will see cleaner industry, revival of water-based activities for residents and tourists, balanced growth on both sides of the river, improved fish and wildlife habitat, and an enhanced quality of life for all.

For this to happen there must be the adoption of the point of view that the river unifies a natural region, rather than separates two political entities. There must be a commitment to a cleaner environment on both sides of the river through stronger joint agreements backed by adequate joint funding for monitoring and enforcement. Planning efforts should be regional and should recognize that fish and wildlife habitats play a crucial role in the quality of life.

Constraints include the lack of adequate linkages between governments at all levels, but especially those involving Erie and Niagara Counties. Further constraints are the differences in legislation and enforcement procedures at the local level.

## CONCLUSIONS

No one will deny that how the shores of the Niagara River are used will affect the success of present and future remedial efforts, and the health of the ecosystem. The manner in which the remedial efforts are carried out may be just as important, as they are limited by existing technology and constrained by economic considerations that depend on the political will. The remedial efforts themselves may conflict directly with current and future land uses.

Existing land use planning efforts in the Niagara River coastal zone must be strengthened to include long term environmental goals such as elimination of water quality impairments, and environmental regulation must include environmental assessment procedures that have direct reference to local goals and plans.

# CHAPTER ELEVEN: PUBLIC PARTICIPATION

The Niagara River RAP public participation program was designed to involve all interested parties in developing the RAP as well as to build support for the RAP and its implementation. Communication was maintained with the parallel Canadian remedial action planning process throughout RAP development via an International Advisory Committee consisting of citizens from both countries. DEC's commitment to public involvement in environmental policymaking, together with the Niagara River Action Committee's (NRAC) efforts to build a constituency for the river, resulted in an innovative partnership for developing the RAP.

## BACKGROUND AND HISTORY

During the Summer of 1989, DEC surveyed members of the public in both Erie and Niagara Counties who had been identified as active participants in the "Niagara River Community" to determine their interest in working with DEC to develop the Niagara River RAP. In October 1989 DEC established a 21-member Citizens' Advisory Committee providing a balanced representation of various segments of the community along the river, including environmental organizations, sportsmen's groups, local government, regulated dischargers, and academic institutions. The members named the group the Niagara River Action Committee, developed a charter, selected a logo, adopted a mission statement, and established subcommittees to focus on water quality, public outreach, and land use. Upon their recommendation, five additional members were appointed to the committee by DEC Commissioner Thomas Jorling. DEC hired a staff person to coordinate the public participation process and assist in the preparation of the RAP report.

An Executive Committee consisting of NRAC co-chairs and subcommittee chairs met regularly with DEC staff members to discuss the RAP. NRAC representatives and DEC worked cooperatively to organize technical information about the river, build public awareness and support, and develop and review drafts of the RAP document and related materials.

## THE PUBLIC PARTICIPATION PROCESS

Early in the RAP development, a plan to conduct public participation was developed. This plan identified the communication objectives, individuals and groups that DEC and NRAC should contact, information to be exchanged, and the activities needed to carry out the plan.

The public groups contacted included the following categories: government agencies and elected officials, public groups and organizations, academicians and researchers, business and industry in the AOC, other RAP groups, and the general community.

DEC and NRAC kept these groups involved and informed about the RAP project, its development, and how to participate in the RAP process. They sent meeting announcements, newsletters, surveys, brochures and flyers;

held public meetings; organized educational presentations and tours; and made an informal repository of documents pertaining to the Niagara River available for public use. Other public outreach activities included seedling distribution on Earth Day 1990; a tree planting ceremony along the City of Tonawanda waterfront during Water Week 1990; a widely presented slide-tape show; update reports at the Greater Buffalo Environmental Conference in 1990, 1991, 1992, and 1993; and an environmental photography contest.

NRAC's Water Quality Subcommittee worked with DEC to identify, obtain, and review numerous documents containing information relevant to the Niagara River AOC. These documents formed the core of an informal repository at the DEC office. The Land Use Subcommittee produced Chapter 10 of the RAP, "Land Use Recommendations", which included guidelines for future land use. The Public Outreach Subcommittee worked with DEC to design the public participation plan and conduct public outreach activities. They expanded their community network by reaching out to groups outside the NRAC membership for help in preparing the slide show and carrying out the photo contest. The list of interested individuals and groups grew through slide show presentations and other events.

The public provided DEC and NRAC with their opinions and concerns regarding the river's problems, the desired uses they felt were impaired, and possible solutions. The public also provided support for the RAP project. Individuals contributed important information to DEC and NRAC through survey responses, public meetings, and participation in NRAC's subcommittees.

DEC and NRAC held five public meetings in May and June of 1990 to describe the RAP process and hear comments regarding the problems and the desired future uses of the river. NRAC members developed a survey to stimulate discussion at the public meetings and slide show presentations. Although not designed to be a scientific survey amenable to statistical analysis, it has provided insight into a cross-section of the public's concerns about the river. Public workshops to review the draft RAP and a public meeting to receive comments on the draft RAP were held in May 1993.

Through monthly meetings of the International Advisory Committee, NRAC and its Ontario counterpart shared information and concerns about the river, as well as ideas for promoting public participation and education.

Future public participation will focus through the Remedial Advisory Committee (RAC) and the annual public meeting as described in Chapter 9.