Rochester Embayment

Remedial Action Plan
Stage I

August 1993

New York State Department of Environmental Conservation

MARIO M. CUOMO, *Governor* THOMAS C. JORLING, *Commissioner*

and

Monroe County Department of Planning and Development

ROBERT L. KING, *County Executive*

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ROCHESTER EMBAYMENT

REMEDIAL ACTION PLAN

STAGE 1

AUGUST 1993

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Members of the Genesee Basin Subcommittee of the WQMAC: chaired by Betty Lou Brett, Ph.D., and Mr. Ronald Pretzer.

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ACRONYMS and ABBREVIATIONS

AOC	Area of Concern
AROI	Atmospheric Region of Influence
ASCS	Agricultural Stabilization & Conservation Service
BTX	Benzene Toluene & Xylene
CCIW	Canada Center for Inland Waters
CFS	Cubic Feet per Second
CFR	Code of Federal Regulations
CGR	Center for Governmental Research
COD	Chemical Oxygen Demand
COE	Corps of Engineers (US Army)
CSO	Combined Sewer Overflow
CSOAP	Combined Sewer Overflow Abatement Program
CWA	Clean Water Act
DDE	Dichlorodiphenyl dichloroethylene (banned pesticide)
DDT	Dichlorodiphenyl trichlorethane (banned pesticide)
DEC	Department of Environmental Conservation (New York State)
DEIS	Draft Environmental Impact Statement
DOH	Department of Health (New York State)
DOT	Department of Transportation (New York State)
ECL	Environmental Conservation Law
EDR	Environmental Design and Research
EMC	Environmental Management Council (Monroe County unless specified)
EPA	Environmental Protection Agency (U.S.)
ESLO	Empire State Lake Ontario (Trout and Salmon Derby)
FDA	Food and Drug Administration
GBS	Genesee Basin Subcommittee
GCO	Gates-Chili-Ogden Wastewater Treatment Plant
GPG	Government Policy Group
GLWQA	Great Lakes Water Quality Agreement
IFYGL	International Field Year on the Great Lakes
IJC	International Joint Commission
LOCBIBS	Lake Ontario Central Basin/Irondequoit Basin Subcommittee
LOWBS	Lake Ontario West Basin Subcommittee
LWRP	Local Waterfront Revitalization Plan
MCDOH	Monroe County Department of Health
MCL	Maximum Contaminant Level
MCWA	Monroe County Water Authority
MDL	Minimum Detection Limit
MGD	Million Gallons per Day
NOAA	National Oceanic and Atmospheric Administration
NTU	Nephelometric Turbidity Unit
NURP	Nationwide Urban Runoff Program
NYCRR	New York Code of Rules and Regulations

NYSDEC	New York State Department of Environmental Conservation
NYSDOH	New York State Department of Health
NYSDOT	New York State Department of Transportation
PAH	Polynuclear Aromatic Hydrocarbons
PCB	Polychlorinated Biphenyl
PETE	Preserving the Earth Through Education
RAP	Remedial Action Plan
RFP	Request for Proposal
RG&E	Rochester Gas & Electric
RIBS	Rotating Intensive Basin Studies
SAB	Science Advisory Board (International Joint Commission)
SAIC	Science Applications International Corp.
SARA	Superfund Amendments Reauthorization Act
SCS	Soil Conservation Service
SPDES	State Pollutant Discharge Elimination System
SUNY	State University of New York
TRI	Toxic Release Inventory
TSS	Total Suspended Solids
USDA	United States Department of Agriculture
USEPA	United States Environmental Protection Agency (EPA)
USGS	United States Geological Survey
WQB	Water Quality Board (International Joint Commission)
WQMAC	Water Quality Management Advisory Committee
WROS	Waterfront Recreation Opportunities Study
WWTP	Wastewater Treatment Plant

GLOSSARY

Aesthetic	Relating to or dealing with beauty.
Assimilation	The capacity of natural water courses to receive pollutants without adverse affects.
Atmospheric Deposition	Deposition of pollutants from the air onto the ground
Bioaccumulation Bioconcentration Biomagnification	Related processes where chemical substances increase in concentratin as they are accumulated by aquatic organisms from water directly or through consumption of food containing the chemicals.
Biological Oxygen Demand	Dissolved oxygen required by organisms for the decomposition of organic matter present in water.
Biota	The plants and animals of a region.
Carcinogenic	Producing or inciting cancer.
Cladophora	A genus of green algae commonly known as "maidens hair" which provides shelter and breeding habitat to many aquatic invertebrates and in excessive quantities cause unsanitary beach conditions.
Concentration	The proportion of a material dissolved in water, e.g., 20 mg/L= 20 parts material per million parts of water.
Concentration units:	mg/L=ppm=parts per million µg/L=ppb=parts per billion ng/L=pptr=parts per trillion
Degrees Celsius	0 degrees C = 32 degrees F and 100 degrees C=212 degrees F. Therefore, degrees F =9/5 (degrees C) + 32.
Emergent Vegetation	In the case of aquatic habitats, this refers to vegatation that is rooted under water but emerges above the water line such as cattails.
Erie Canal	The part of the New York State Canal System that traverses Monroe County and portions of the watershed of the Rochester Embayment.

Eutrophication	Acceleration of the amount of nutrients (particularly the nutrient phosphorus) to a water body by natural or human induced causes. The increased rate of delivery of nutrients results in increasesd production of algae. Natural sources include leaves. Human induced sources include domestic sewage, stormwater runoff, and fertilizers.
Fauna	Animals or animal life.
Flora	Plants or plant life.
Genus (sing.), Genera(pl.)	A closely related kind, or group of plants or animals that have one or more common characteristics. For example, smallmouth and largemouth bass are different species of the same genus.
Hydrology	The study of the movements and other properties of water in the environment.
Littoral	Of, relating to, or situated or growing on or near a shore.
Loading	The amount of a matrerial that enters a water body per unit of time, e.g., 1000 lbs./year, 2lbs./day, etc.
Oligochaetes	Aquatic worms that often indicate poor water quality.
Phenols	Caustic poisonous crystalline acidic compound present in coal tar and wood tar.
Phytoplankton	Microscopic aquatic plants often floating in the water.
Riparian	Relating to or living or located on the bank of a natural watercourse (as a stream or river)
Neoplasia	The formation of tumors.
Thermocline	A rapid change in temperature vertically or horizontally in a lake.
Trophic	Of or relating to nutrition. In the case of lake

systems, this refers to the nutrients (phosphorus and nitrogen) that feed the plant life.

Oligotrophic:	Refers to a lake with few nutrients.
Mesotrophic:	Refers to a lake with a moderate amount of nutrients.
Eutrophic:	Refers to a lake with a large amount of nutrients.
Zooplankton	Microscopic aquatic animals often floating in the water.

A. GOAL, PURPOSE AND APPROACH OF THE REMEDIAL ACTION PLAN

1. The Rochester Embayment and its Remedial Action Plan :

(a) The Rochester Embayment: The Rochester Embayment designation refers to a portion of Lake Ontario and a portion of the Genesee River near Rochester, New York. For a description of the embayment, and a map of the embayment, see page 2-1 and Figure 2-1 in Chapter 2.

(b) The Remedial Action Plan: The Remedial Action Plan (RAP) will identify water quality problems and specific actions that need to be taken by various parties to address the problems. The Remedial Action Plan effort has been undertaken due to an international agreement to improve the water quality of the Great Lakes water system. The International Agreement, known as the Great Lakes Water Quality Agreement, is described in more detail in other sections of this chapter. The preparation of the RAP is being coordinated by the Monroe County Department of Planning and Development through a contract with the New York State Department of Environmental Conservation (NYSDEC).

(1) The Stage I RAP: The RAP is being written in two parts. This document, which is referred to as the Stage I Rochester Embayment Remedial Action Plan outlines what is and is not known about Rochester Embayment water quality conditions. It describes the water quality conditions in the context of the total environment. Therefore, information on geography, population, land use and community organization and goals is also included. This Stage I RAP provides the information needed for decision-making to implement actions necessary to: 1. Remediate identified use impairments; 2. Prevent future water quality problems; and 3. Protect human health.

(2) The Stage II RAP: The Stage II RAP is expected to be complete in mid-1993. Information contained in the Stage I RAP will provide the basis for the Stage II RAP. The Stage II RAP will consist of an analysis of possible remedial measures, including who should conduct the remedial actions and possible sources of funding. In the Rochester Embayment, work has already begun on the Stage II RAP through analysis of several possible actions to achieve the goals outlined in Chapter 3 of this Stage I RAP. The Stage II RAP will also include a schedule for implementation of chosen actions, including monitoring actions, along with any commitments made by governments and private organizations to implement the actions. Upon completion of the Stage II RAP, a reporting mechanism will keep the public informed on progress in implementing the RAP and subsequent plan revisions. The exact

mechanism to inform the public will be developed as part of Stage II efforts.

(3) The Stage III RAP: The Stage III RAP is implementation. Stage III is deemed to be complete when all identified remedial measures to restore all beneficial uses have been implemented and surveillance and monitoring data confirm restoration of beneficial uses.

2. **Intended Goal and Use of the Remedial Action Plan:** The comprehensive goals of this Remedial Action Plan (RAP) are three-fold: 1. The first is to identify existing use impairments in the Rochester Embayment Area of Concern (AOC) and to identify actions that will be implemented to remediate the impairments. Fourteen possible use impairments have been identified by the International Joint Commission. The list of impairments, and those that are deemed to exist in the Rochester Embayment are explained in detail in Chapter 4 (Page 4-1). (Restricted human consumption of fish and wildlife due to elevated contamination levels is an example of a use impairment.) 2. The second overall goal is prevention of further pollution of our waters. 3. The third goal is protection of human health. A set of detailed goals of this RAP and related efforts are outlined in detail in Chapter 3.

3. **Rochester Embayment Remedial Action Plan: The International Perspective:** The International Joint Commission was created by the Boundary Waters Treaty in 1909 (Hartig & Zarull 1992). "This independent body, composed equally of United States and Canadian appointees, provides a quasi-judicial and investigative mechanism to cooperatively resolve problems (including water and air pollution, fluctuating lake levels and other issues) along the two countries' common border." (Hartig & Zarull 1992).

(a) The Great Lakes Water Quality Agreement (GLWQA): The United States and Canada initially signed the Great Lakes Water Quality Agreement on November 22, 1978, with a supplement on phosphorus load reduction signed on October 7, 1983. The purpose of the agreement is to "...restore and maintain the chemical, physical and biological integrity of the waters of the Great Lakes Basin Ecosystem."

(b) Areas of Concern : The GLWQA established both a Water Quality Board (WQB) and a Science Advisory Board (SAB) of the International Joint Commission. The SAB advises the IJC on scientific knowledge and disputes. The role of the WQB, among other things, is to make recommendations on the development and implementation of programs to achieve the purpose of the Great Lakes Water Quality Agreement. Since 1973, the WQB has annually reported specific areas with serious water pollution problems. From a history given in the 1985 WQB report, it appears that each WQB report since 1973 indicated that the Rochester Embayment had pollution problems. In its 1981 Report the WQB summarized their work to initiate a process to establish formal "Areas of Concern" based on environmental quality data and on GLWQA and of the involved government objectives. At that time, the AOC's had two kinds of designations: Class A AOC's exhibited significant environmental degradation where the impairment of beneficial uses was deemed to be severe, and Class B designations where environmental degradation exists and uses may be impaired. In the 1981 document, 39 total AOC's were identified and the Rochester Embayment of Lake Ontario was identified as a Class B AOC with "...moderate violations of water quality objectives and some indications of fish contamination in Rochester Harbor and Irondequoit Bay. Surveys of the harbor from 1967 to 1973 found some of the sediments to be heavily polluted with metals and phosphorus." (GLWQB 1981)

In its 1985 Report, the WQB, with the assistance of the jurisdictional governments, identified 42 areas of concern, and the A/B classification system was dropped in favor of a new categorization scheme to identify the status of the information base, programs under way to fill information gaps, and the status of remedial measures. Using the 1985 categorization procedure, the Rochester Embayment was deemed to be a Category 4 AOC. Category 4 means "Causative factors known, but Remedial Action Plan not developed and remedial measures not fully implemented." That report identified Rochester Embayment problems as being conventional pollutants, heavy metals, toxic organic substances, contaminated sediments and fish consumption advisories. The report also identified pollutant sources as municipal and industrial point sources, combined sewer overflows, and in-place pollutants.

As of January of 1993, there are now 43 Areas of Concern. Figure 1-1 shows the locations of the 43 AOC's.

(c) Remedial Action Plans: In the 1985 report, the WQB explained that the Great Lakes jurisdictions had agreed to prepare Remedial Action Plans for each AOC to "... describe programs and measures which, when implemented, should solve the identified problems" and indicated that the WQB would review and assess the adequacy of each Remedial Action Plan to address the identified problems. The 1985 WQB Report also made a formal recommendation that "The jurisdictions complete and submit Remedial Action Plans for the areas

FIGURE 1-1

FORTY-THREE AREAS OF CONCERN IDENTIFIED IN THE GREAT LAKES BASIN

Lake Superior

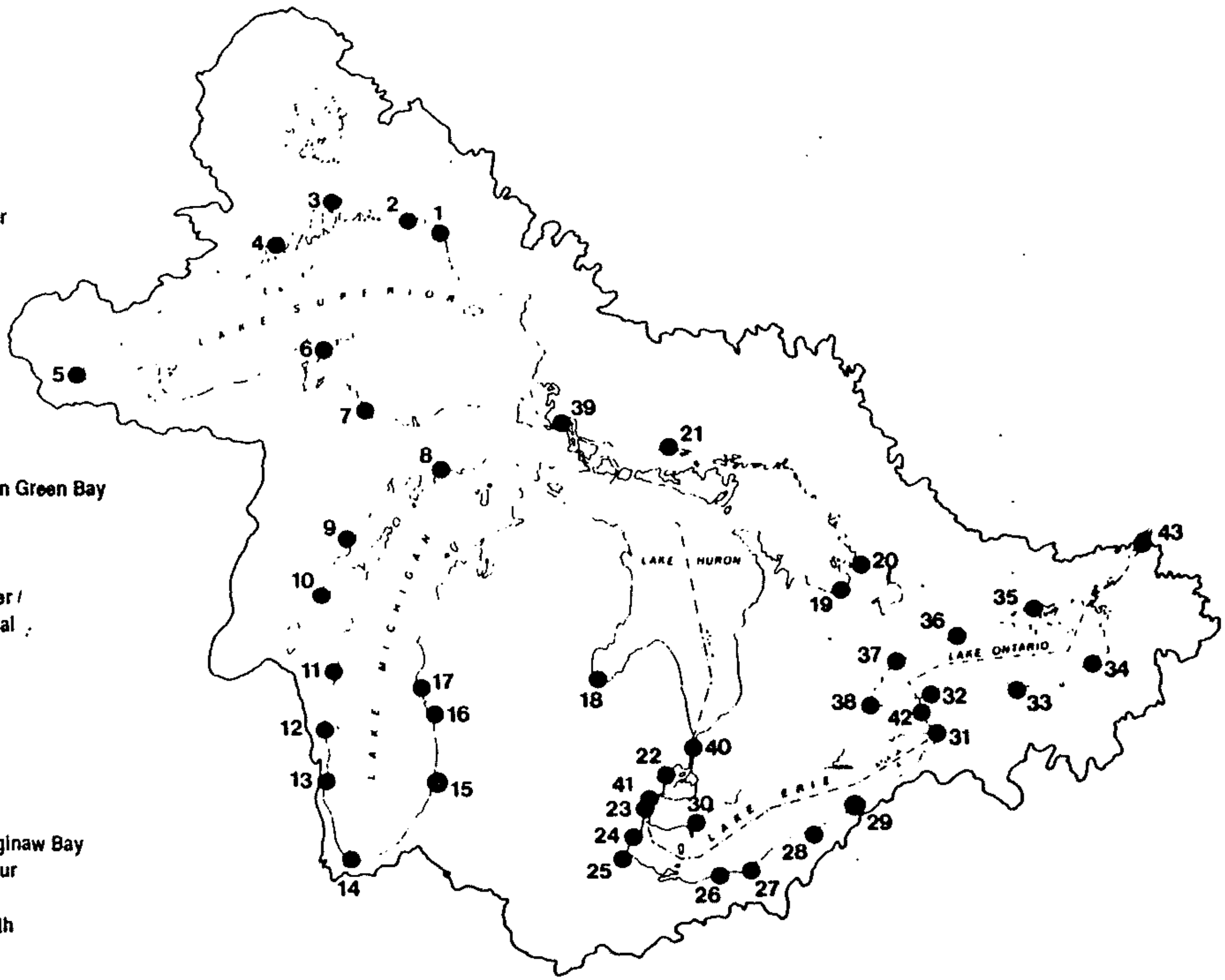
1 Peninsula Harbour
2 Jackfish Bay
3 Nipigon Bay
4 Thunder Bay
5 St. Louis Bay / River
6 Torch Lake
7 Deer Lake - Carp Creek / River

Lake Michigan

8 Manistique River
9 Menominee River
10 Fox River / Southern Green Bay
11 Sheboygan River
12 Milwaukee Estuary
13 Waukegan Harbor
14 Grand Calumet River / Indiana Harbor Canal
15 Kalamazoo River
16 Muskegon Lake
17 White Lake

Lake Huron

18 Saginaw River / Saginaw Bay
19 Collingwood Harbour
20 Severn Sound
21 Spanish River Mouth



Lake Erie

22 Clinton River
23 Rouge River
24 River Raisin
25 Maumee River
26 Black River
27 Cuyahoga River
28 Ashtabula River
29 Presque Isle Bay
30 Wheatley Harbour

Lake Ontario

31 Buffalo River
32 Eighteen Mile Creek
33 Rochester Embayment
34 Oswego River
35 Bay of Quinte
36 Port Hope
37 Metro Toronto
38 Hamilton Harbour

Connecting Channels

39 St. Marys River
40 St. Clair River
41 Detroit River
42 Niagara River
43 St. Lawrence River (Cornwall / Massena)

Source: Review and Evaluation of the Great Lakes Remedial Action Plan Program 1991, International Joint Commission. June 1991 of concern. The contents of each RAP would "describe environmental conditions, identify sources, detail what needs to be done to correct the problems, who will carry out the programs, how they will be implemented, the schedule for implementing the needed programs... {and} also describe surveillance and monitoring to be carried out to track the effectiveness of the program." (GLWQB 1985) The WQB also recognized that if it is not feasible to restore all uses, the Plan should identify the quality and uses which can be achieved.

(d) RAP Stages: The Great Lakes Water Quality Agreement was revised in

1987 to include remedial action plans. RAPs are to be submitted to the IJC for review and comment at three stages: problem definition (Stage I), selection of remedial actions (Stage II), and confirmation of use restoration (Stage III) (Hartig & Zarull 1992). More information on how the different stages of the RAP will be used is included at the end of this chapter.

4. **Rochester Embayment Area of Concern--U.S. Government Perspective:**

(a) The International Joint Commission: The President of the United States appoints the three U. S. Representatives to the International Joint Commission.

(b) The U. S. Environmental Protection Agency: The U. S. Environmental Protection Agency is the U.S. administrative agency that is most directly involved in the development of Remedial Action Plans. In 1985, an original "Guidance" document for the preparation of RAPs was prepared by a USEPA/Great Lakes National Program Office contractor Science Applications International Corporation (SAIC). In 1987 the guidance document was revised by SAIC as an aid to the Great Lakes states who were charged with the preparation of Remedial Action Plans for the Areas of Concern. The 1987 document, Guidance for Preparing an Area of Concern Remedial Action Plan was used in establishing the initial outline for the Rochester Embayment RAP.

In November of 1987, SAIC, under contract with the USEPA, also submitted an initial draft of a RAP for the Rochester Embayment. This initial draft summarized a great deal of information, and was one of many references used in the development of the Stage I RAP presented herein. The SAIC document was written after conducting research in the Rochester area which included interviews with many people who were active in conducting research and/or remedial actions. The SAIC report, however, did not include an extensive public involvement/stakeholder component.

(c) The Great Lakes Critical Programs Act and the Great Lakes Water

Quality Initiative: In 1990, the U. S. Congress passed the Critical Programs Act as an amendment to the Clean Water Act. Among other things, this Act sets timetables for RAP completion. The part of the Critical Programs Act which affects the Great Lakes is known as the Great Lakes Water Quality Initiative. This initiative describes "...the approach to be followed by EPA and the Great Lakes States for coordinating their activities under the Clean Water Act (CWA) in order to achieve the objectives of the Great Lakes Water Quality Agreement (GLWQA) and to provide a basis for negotiating Great Lakes water quality objectives and programs with Canada." (NYSDEC 1992). The U.S. EPA has made several commitments to achieve the purpose of the initiative.

5. Rochester Embayment Area of Concern--Statewide Perspective:

(a) New York Areas of Concern: There are six AOC's in New York State. They are the Rochester Embayment, the Buffalo River, the Niagara River, Eighteen Mile Creek, the Oswego River, and the St. Lawrence River at Massena. The New York State Department of Environmental Conservation has completed RAPs for the Buffalo River, the Oswego River, and the St. Lawrence River at Massena. A RAP for the Niagara River will be presented to the public in April 1993, and a RAP effort is expected to begin in 1993 at Eighteen Mile Creek (from R. Draper 12/92). See Figure 1-1 for the locations of these New York State RAPs.

(b) Contract with Monroe County for Development of Rochester Embayment RAP: In the Rochester Embayment AOC, the New York State Department of Environmental Conservation (NYSDEC) contracted with Monroe County to develop the Rochester Embayment RAP. This arrangement occurred after NYSDEC officials met with Monroe County staff to identify existing conditions, programs and potential stakeholders. As a result of this communication, and the finding that a substantial watershed planning, stakeholder organization, and water quality action effort had already begun, the State contracted with Monroe County to prepare the RAP. The contract was funded by a grant under section 205(j) of the federal Clean Water Act. As part of this effort, Monroe County has contributed 25% of the total cost through in-kind services and some water quality monitoring.

6. Rochester Embayment Area of Concern: Regional Perspective:

(a) Remedial and Preventative Actions Already Taken: Prior to the initiation of the formal Remedial Action Plan in 1988, several actions had already occurred to improve and protect water quality in the Rochester Embayment Area of Concern and its watershed. Soil and Water Conservation Districts in Allegany, Wyoming, Livingston, Genesee, Ontario, Wayne, Orleans, Steuben, and Monroe Counties had all worked with farmers to develop and implement conservation plans to prevent and/or reduce erosion, sedimentation and nutrient runoff. Agricultural runoff has been of special concern in the large Genesee River basin where farmland is plentiful. About the same time that the RAP was starting, most of these counties had already begun, or were about to embark on an effort to form County Water Quality Coordinating Committees to identify remaining water quality problems and develop actions. Efforts had also been taken in these counties to upgrade wastewater treatment facilities.

In Monroe County several actions had been taken to consolidate and upgrade municipal wastewater treatment facilities. An Industrial Pretreatment Program had also been developed and approved by the federal government for large municipal wastewater treatment systems. Eastman Kodak Company's Kodak Park facility, the largest industrial discharger in Monroe County, had significantly upgraded its wastewater treatment plant and the problem of combined sewer overflows in the City of Rochester was also well on its way to being remediated by means of a system of tunnels to store combined sewage until it could be conveyed to a wastewater treatment plant. Further, a watershed plan had been developed for the Irondequoit Bay watershed and implementation had already started. An outline of this watershed plan is below.

(b) <u>Watershed/Ecosystem Approach to the Remedial Action Plan:</u>

(1) Irondequoit Bay Watershed Plan: At the time that the need for the RAP was brought to the attention of Monroe County staff, the Irondequoit Bay watershed plan had recently been completed and implementation was under way. This was done after a great deal of research on the significance of non-point sources of pollution, primarily that which comes with stormwater runoff. In the Irondequoit Bay watershed, tributary to the Rochester Embayment, it was found that non-point sources of pollution, particularly from urban stormwater runoff, were the greatest remaining pollutant sources. The nature of non-point source pollution requires that the problem be addressed on a watershed basis.

(2) Ecosystem Approach: As part of the development of the Irondequoit Bay Watershed Plan, research conducted as part of the Nationwide Urban Runoff Program (NURP) indicated that atmospheric deposition (deposition of pollutants from the air onto the ground) plays a significant part in the amount of pollutants which are washed off of urban areas into waterways. This finding led local officials to recognize the need to manage its resources using

using an ecosystem approach. The ecosystem approach recognizes that all of our systems (air, water, land) are connected, and calls for consideration of all possible pollutant sources and transport methods in any plans to protect and/or improve water resources.

(3) The Four-Plan Approach: Because of the pollutant source knowledge gained from the NURP program and the watershed approach taken in the Irondequoit Bay watershed, Monroe County proposed that the Remedial Action Plan be developed with a watershed and ecosystem approach. The ecosystem approach and the watershed approach are both consistent with IJC, USEPA, and State ideals for water quality management. The specific method selected to achieve a watershed and ecosystem approach is to write a Remedial Action Plan for the Area of Concern and, in addition, write three Basin Plans--one for each of the three basins that flow to the Rochester Embayment. The key portions of the three basin plans that affect the embayment are incorporated into the RAP. The three basins that flow to the embayment are the Genesee River Basin, portions of the Lake Ontario West Basin (LOWB), and portions of the Lake Ontario Central Basin (LOCB). The Irondequoit Bay Watershed is part of the Lake Ontario Central Basin. For a map of the three basins, see Figure 2-1 in the next chapter.

B. THE ROCHESTER EMBAYMENT RAP PROCESS:

1. RAP and Basin Plan Writing:

(a) RAP Technical Group: A Technical Group was established in 1988 to guide the writing of the Rochester Embayment RAP. The Technical Group comprised of individuals with interest and knowledge in water quality issues, and included representatives of the advisory (stakeholder) groups. It was chaired by the RAP Project Manager, Ms. Margy Peet, in the Monroe County Planning Department. For a list of the people and agencies represented in the Technical Group, see Table 1-1. The Technical Group has met throughout the Stage I RAP preparation to guide the writing of the RAP and manage all technical issues. From time to time, short term task groups within the technical group have been formed to deal with specific subjects. These task groups are referenced in more detail in Chapter 5. Members of the RAP Technical Group worked extensively on three chapters of the RAP. Chapter 1 was written by RAP Technical Group members from the Monroe County Department of Planning and Development. The final version of RAP Chapter 4 was written primarily by the Monroe County Environmental Health Laboratory staff. Health Lab staff and Planning & Development Department staff also worked on

Table 1-1
Individuals Serving at one time or throughout on the
Remedial Action Plan Technical Group 1989 through 1992

Margy Peet	Monroe Co. Dept. of Planning & Development, Chair
Joe Albert	Monroe Co. Dept. of Health
Robert Barrows	City of Rochester Planning Department
Margit Brazda	Monroe Co. Dept. of Planning & Development
Betty Lou Brett, Ph.D.	Chair, Genesee Basin Subcommittee
Richard Burton	Monroe Co. Environmental Health Lab
Bruce Butler, P.E.	N.Y.S. Dept. of Env. Conservation, Avon
Cara Campbell	Monroe Co. Dept. of Planning
Tom Cullen, P.E.	N.Y.S. Dept. of Env. Conservation, Albany
Robert Collin	N.Y.S. Dept. of Env. Conservation, Albany
Richard Draper, P.E.	N.Y.S. Dept. of Env. Conservation, Albany
Richard Elliott, P.E.	Monroe Co. Dept. of Health
Michael Flanigan	Monroe Co. Environmental Management Council
Robert Gallucci, P.E.	Environmental Design & Research
Doug Gillette	N.Y.S. Dept. of Env. Conservation, Avon
Tom Goodwin	Monroe Co. Dept. of Planning & Development
Ken Gordon	Larsen Engineers
John Graham, P.E.	Monroe Co. Dept. of Env. Services, Pure Waters
Mark Gregor	City of Rochester Dept. of Environmental Services
Robert Hartrick	Soil Conservation Service
James Haynes, Ph.D.	Chairman, Water Quality Management Advisory Comm.
John Hecklau	Environmental Design & Research, Inc.
Robert Jonas	Chairman, Lake Ontario Central Basin/Irondequoit Basin Subcommittee
Tom Kipp	Monroe Co. Dept. of Parks
Scott Leathersich	Monroe Co. Dept. of Engineering
Ted McKay	Agricultural Stabilization and Conservation Service
Joseph Makarewicz, Ph.D.	State University of New York at Brockport, Biology Dept.
Patrick McGee	Monroe Co. Environmental Management Council
Gerald Mikol	N.Y.S. Dept. of Env. Conservation, Albany
Martin Minchella	Lake Ontario West Basin Subcommittee, Town of Greece
Tom Nally	Monroe County Cornell Cooperative Extension
Jane Naylon	Monroe Co. Dept. of Planning
Jim Nugent	Monroe County Water Authority
Ed Olinger	N.Y.S. Dept. of Transportation
Charles O'Neill	N.Y.S. Sea Grant Extension
David Rinaldo	Monroe Co. Dept. of Parks
Christine Robbins	Center for Governmental Research
Robin Salisbury	N.Y.S. Dept. of Transportation
Mike Schifano	Monroe County Environmental Services, Pure Waters
Paul Schmied, P.E.	N.Y. S. Dept. of Env. Conservation, Avon
Don Sherwood	U.S. Geological Survey, Ithaca
Scott Sherwood	Center for Governmental Research
Gary Skoog	Chair, Lake Ontario West Basin Subcommittee
Lisa Spittal	Monroe Co. Environmental Health Lab.
Phil Steinfeldt, P.E.	Monroe Co. Dept. of Engineering
Larry Stid	City of Rochester Planning Department
Andy Wheatcraft	Monroe Co. Dept. of Planning
John Wildeman	N.Y.S. Soil and Water Conservation Committee
Frank Winkler	Soil Conservation Service

sections of the final version of RAP Chapter 5.

(b) RAP Consultant Selection & Role: By February of 1989, the RAP Technical Group had prepared a Request for Proposals (RFP) to solicit proposals for the writing of the RAP and the three Basin Plans. After interviews and deliberation, a consulting team consisting of the Center for Governmental Research (CGR) and Environmental Design and Research (EDR), and Larsen Engineers was chosen. The primary responsibility for the Stage I RAP resided with CGR. A workplan for the consultant team was drafted by June of 1989.

The RAP consultant team prepared draft and final or near final chapters of the RAP chapters 2, 3, 5, and 6. The consultant team also prepared draft Chapters 4 and 7. Chapter 7, which deals with remedial measure analysis, will be included in the Stage II RAP. The RAP consultant team also prepared comparable chapters for the three Basin Plans.

Throughout the development of the Stage I RAP and Basin Plan, quarterly reports were prepared for the NYSDEC to document the progress of the RAP. Periodic project management meetings between County, consultant, and/or NYSDEC staff were also held.

(c) Stakeholders Group Involvement in Writing: While the bulk of the writing of the Stage I RAP and Basin Plans was done by the consultant team and the RAP Technical Group, the Water Quality Management Advisory Committee and its basin subcommittees (the stakeholders groups) played a major role in developing two portions of the Stage I RAP. In order to determine what use impairments existed, the WQMAC sponsored several workshop/educational sessions to insure a full understanding of the 14 use impairments listed by the IJC. Members of the basin subcommittees (described in more detail in the next section) also conducted volunteer stream surveys to identify water quality problems. Volunteers from the Lake Ontario West and Lake Ontario Central basins conducted stream surveys during the summer and fall of 1990 to identify water quality problems. Stream surveys were conducted in the Genesee Basin during the summer and fall of 1991. The educational effort conducted by the WQMAC and the information obtained through the stream surveys conducted by the basin subcommittees resulted in the stakeholder groups determining which of the 14 use impairments existed in the AOC and its three basins. The impairments, as determined by the stakeholders' groups, are outlined in Chapter 4.

The other area in which the stakeholders' groups played a major role was in the development of goals for the AOC and the basins. These goals were developed by the committees after lengthy deliberations that considered use impairments and other problems. The goals as developed by the committees can be seen in Chapter 3.

The stakeholders groups also reviewed and commented on all of the chapters written by the consultant and RAP Technical groups.

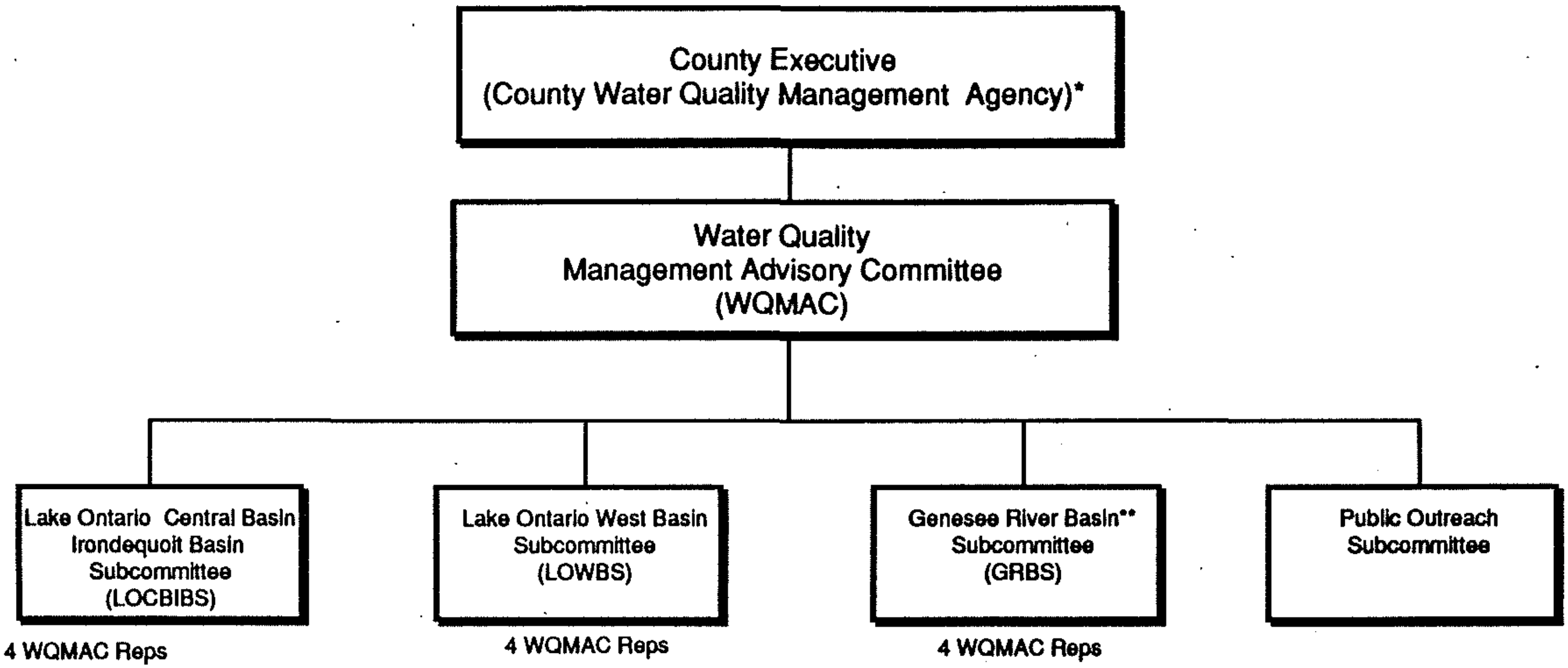
2. **Advisory (Stakeholder) Group Structure:** A total of six stakeholder groups were initially formed to advise and participate in the development of the RAP and the three Basin Plans. A chart showing the five groups is shown as Figure 1-2. The sixth group is the Government Policy Group. Each of the groups are described in this section.

   <u>(a) Water Quality Management Advisory Committee (WQMAC):</u> The primary advisory group is the Water Quality Management Advisory Committee (WQMAC). Monroe County has had such a committee in place for many years prior to the beginning of the RAP (at least since 1979). The committee was reorganized in 1989 for purposes of the RAP to consist of 27 voting members. The Committee was chaired from 1989 through 1992 by Dr. James Haynes, Professor of Biology at the State University of New York at Brockport. The 27 voting members changed somewhat during that time period due to resignations, but the voting members consisted of equal numbers of representatives from economic interests, elected officials, citizens, and public interest groups from the 3 basins. In order to insure coordination between the Basin Plans and the RAP, the basin subcommittees have representatives on the WQMAC. Several ex-officio non-voting members also serve on the WQMAC to provide expertise in special areas. A list of groups represented and individuals serving as voting members on the WQMAC during the development of the Stage I RAP are included in Table 1-2. The committee has met nearly every month since its reorganization in 1989.

   <u>(b) Lake Ontario Central / Irondequoit Basin Subcommittee:</u> This subcommittee was reorganized out of the original Irondequoit Basin Subcommittee which had existed since 1980 when work on Irondequoit Bay watershed research began in earnest. This subcommittee reorganized to help develop the Lake Ontario Central Basin Plan in May of 1989. Mr. Robert Jonas, a retired Soil

Figure 1 - 2

MONROE COUNTY WATER QUALITY MANAGEMENT
ORGANIZATION



* For purposes of the Remedial Action Plan (RAP), the WQMAC will also advise the N.Y.S. Dept. of Environmental Conservation
**Reorganized in late 1992 into 2 subcommittees: The Monroe County Genesee Basin Subcommittee and the Genesee Basin Coordinating Committee

December, 1992

Monroe County Department of Planning & Development

Table 1-2
Voting Members of the Water Quality Management Advisory Committee
during the time period 1989 through 1992*

CITIZENS:	
James Haynes, Ph.D., chair	Citizen
Betty Lou Brett, Ph.D.	Citizen
John Ernst	Citizen
Mike Mosehauer	Citizen
Robert Jonas	Citizen
Cassandra Jackson	Citizen
Bess Marino	Citizen
Janet Moffett	Citizen
Roy Hedman	Citizen
Matthew Perry	Citizen
John Colgan, M.D.	Citizen
Kenneth Goode	Citizen
Gerald Wahl, Esq.	Citizen
PUBLIC OFFICIALS:	
Irene Gossin	Monroe County Legislature
Willliam Richardsen	Town Supervisors Association
Roger Boily	Town Supervisors Association
Don Mack	Town Supervisors Association
Martin Minchella	Town of Greece
Margaret Freeman	Town of Pittsford
Edward Watson	City of Rochester
David Woods	Genesee Finger Lakes Regional Planning Council
Ellen Schnurr	City of Rochester Parks Department
ECONOMIC INTERESTS:	
Carl Ayers	Monroe Co. Charter Boat Association
Dan Miller	Marine Operators & Dealers
Charles Colby	Monroe County Farm Bureau
Bruce Boncke, P.E.	Rochester Homebuilders Association
Charles Costich, P.E.	Rochester Homebuilders Association
Dewayne Day, P.E.	Rochester Engineering Society
Paul Sawyko	Rochester Gas & Electric Corp.
Christopher Rau	Industrial Management Council
Grace Wever, Ph.D.	Industrial Management Council
Robert Brown	Laborers International Union of North America
David Stockmeister	Plumbers Union
PUBLIC INTERESTS:	
Carole Beal	Center for Environmental Information
John Ferraro	Charlotte Community Association
Christine Fredette	Rochester Committee for Scientific Information
Ray Nelson	Sierra Club
Mary Merner	Sierra Club
Ernest Mohr	Ad Hoc Odor Committee
Elmer Wagner	Monroe Co. Conservation Council
Ian Wellers	Monroe Co. League of Women Voters

*There were never more than 27 voting members at one time on the WQMAC.

Conservation Service employee has served as chairman of this subcommittee and as a member of the WQMAC throughout the development of the Stage I RAP. Membership on this committee is not limited. Anyone who has shown an interest in participating has been welcomed.

(c) Lake Ontario West Basin Subcommittee: This subcommittee was established in November of 1989 and has been chaired since its inception by a citizen member, Mr. Gary Skoog. Membership on this subcommittee is not limited. Anyone who has shown an interest in participating has been welcomed.

(d) Genesee Basin Subcommittees: The Genesee Basin Subcommittee was initially established in September of 1990 with citizen co-chairs, Dr. Betty Lou Brett, and Ronald Pretzer, who lives in Geneseo, Livingston County. This subcommittee covered a large geographic area (major portions of five counties) and was open to anyone who showed an interest in participating. Meetings were held in Avon, Livingston County. The attendance at this subcommittee was sparse with most regular attendance from representatives of the County Soil and Water Conservation Districts outside of Monroe County who were also involved in the development of County Water Quality Strategies. This group met regularly from September 1990 to May 1992 at which time it was reorganized. The reorganization resulted in the establishment of two committees, the Monroe County Genesee Basin Subcommittee chaired by Dr. Brett, and a Genesee Basin Coordinating Committee convened by Margit Brazda of the Monroe County Department of Planning & Development. The Monroe County Genesee Basin Subcommittee reactivated interested members, recruited some new members from within Monroe County, and began meeting in September 1992.

The Genesee Basin Coordinating Committee membership consists of one person from each county in the Genesee Basin. The size is small because each of these counties has its own Water Quality Coordinating Committee, each of which is preparing its own water quality strategy. Because County Water Quality Coordinating Committees developed at the same time that the RAP effort was under way, and because of the multi-county make-up of the Genesee River Basin, coordination was critially needed for efficient operation. The first meeting of the Coordinating Committee will be early in 1993. There has, however, been communication with the members of this group on the progress of the RAP during the Stage I RAP.

(e) Government Policy Group: The purpose of the Government Policy Group (GPG) is to provide information to policy makers, and to provide the RAP writers with local government feedback. From prior experience with water quality advisory groups, RAP staff had learned that public officials want to be involved in policy making but do not have time for frequent meetings where technical issues are discussed in detail. The WQMAC and its subcommittees included elected officials as representatives, but an additional forum was needed to meet on an ad hoc basis, which could include more elected officials who are likely to be affected by the RAP. This is important because the remaining significant water quality problems in the AOC are likely from non-point sources, and will require involvement of local governments and their land use decision making powers. The first meeting of the GPG was held in November 1988, at which time elected officials were asked to describe the water quality problems that exist in their jurisdictions. That information was used by the RAP Technical Group and the WQMAC to identify use impairments. The second meeting of the GPG was held in June 1992. At that meeting, the GPG learned about the use impairments, goals, and objectives as developed by the advisory groups. A list of the municipalities represented on the Government Policy Group are listed on Table 1-3.

(f) The Public Outreach Subcommittee of the WQMAC was formed in January of 1990 and has been chaired from its inception by Ms. Mary Merner. This Subcommittee was established to fulfill three roles: the first is to identify appropriate mechanisms to inform and involve county and regional residents of the RAP and basin plans; the second role is to develop, advise on, and implement ideas for general water quality education; the third role is to advise the WQMAC regarding appropriate long-term educational mechanisms that should be included in the RAP and Basin Plans. A list of the individuals who have served on this subcommittee since its inception is included in Table 1-4.

This subcommittee chose as its major project during the Stage I efforts development of a pamphlet about the New York State Department of Health (NYSDOH) fish consumption advisory. It was decided to focus the pamphlet on those socio-economic groups which eat locally caught fish for sustenance. The need for such information came from the concerns of Mr. Kenneth Goode, a member of the WQMAC in 1990. After some unsuccessful attempts to get funding from the Great Lakes Protection Fund for

Table 1-3
Government Representation on Government Policy Group

COUNTY REPRESENTATIVES
Allegany County Board of Legislators
Genesee County Legislature
Livingston County Board of Supervisors
Monroe County Legislature
Ontario County Board of Supervisors
Steuben County Legislature
Wyoming County Board of Supervisors

MONROE COUNTY TOWN REPRESENTATIVES
Town of Brighton Supervisor
Town of Chili Supervisor
Town of Clarkson Supervisor
Town of Gates Supervisor
Town of Greece Supervisor
Town of Hamlin Supervisor
Town of Henrietta Supervisor
Town of Irondequoit Supervisor
Town of Mendon Supervisor
Town of Ogden Supervisor
Town of Parma Supervisor
Town of Penfield Supervisor
Town of Perinton Supervisor
Town of Pittsford Supervisor
Town of Riga Supervisor
Town of Rush Supervisor
Town of Sweden Supervisor
Town of Webster Supervisor
Town of Wheatland Supervisor

MONROE COUNTY VILLAGE REPRESENTATIVES:
Village of Brockport Mayor
Village of Churchville Mayor
Village of East Rochester Mayor
Village of Fairport Mayor
Village of Hilton Mayor
Village of Honeoye Falls Mayor
Village of Pittsford Mayor
Village of Scottsville Mayor
Village of Spencerport Mayor
Village of Webster Mayor
CITY REPRESENTATIVE
City of Rochester

Table 1-4
Members of the Public Outreach Subcommittee of the Monroe County WaterQuality Management Advisory committee during the period 1990 through 1992*

Mary Merner, Chair	Sierra Club
Carole Beal	Center for Environmental Information
Tom Bouchard	Citizen
Margit Brazda	Monroe County Dept. of Planning & Development
Betty Lou Brett, Ph.D.	Nazareth College, Biology Dept.
Cara Campbell	Monroe County Dept. of Planning
Tony Capella	Citizen
Patricia DeJoy	Citizen
Chris Fredette	Environmental Management Council
Kenneth Goode	Citizen
James Haynes, Ph.D.	State Univ. of New York at Brockport, Biology
Roy Hedman	Monroe County Dept. of Planning & Development
Wayne Howard	Citizen
Meg Keefe	Monroe County Cornell Cooperative Extension
Dan Miller	Fishery Advisory Board
Janet Moffett	Citizen
Jane Naylon	Monroe County Dept. of Planning
Jim Nugent	Monroe County Water Authority
Cam Owens	Citizen
Margy Peet	Monroe County Dept. of Planning & Development
Susan Peterson	Citizen
Jan Wellers	League of Women Voters

Some of the people on this list were active on this subcommittee for a relatively short period of time.

development of the pamphlet, writing began by volunteers. A draft was distributed for review to local and New York State level groups and individuals in early 1991. In July 1991, the draft pamphlet was reviewed by the Monroe County Fishery Advisory Board which voiced strong objections to the development and distribution of such a pamphlet. Their concerns were echoed by some other fishery interests. As a result, a major effort was undertaken to modify the pamphlet to meet the variety of concerns raised. This effort culminated in a meeting in December 1991 with Dr. Andrew Doniger, the Monroe County Director of Health, and representatives of fishing interests and the Public Outreach subcommittee. Dr. Doniger heard the concerns of all parties and he took responsibility for choosing the final language of the pamphlet. A responsiveness summary which reflected all of the concerns raised and changes made in the draft was sent to all interested parties in April 1992. From April through December 1992, efforts have been under way, as staff time allows, to complete the pamphlet lay-out, and to test it in a sample of the target population. Publication is planned in 1993.

3. Public Outreach Activities:

(a) RAP Workshops: The Rochester Embayment RAP was first announced to the public at a meeting in November of 1988. Ideas were solicited from those in attendance about their perceptions of local water pollution problems. During the development of the Stage I RAP, several forums were held for stakeholder groups and for the public on subjects related to the RAP. The most widely attended meeting occurred on the issue of toxics in February of 1990 when 170 people from throughout the community attended a Saturday forum to hear experts from throughout New York State. Other special workshops have covered zebra mussels, atmospheric deposition, and work done at other AOCs in the Basin. Another workshop was held for all stakeholders to learn about the effects of various pollutants on aquatic systems.

(b) RAP Handouts and Displays: A RAP fact sheet was prepared and distributed to interested citizens and at public places. A separate written document which describes the RAP and the various groups involved in the RAP was prepared and made available to those who showed interest in learning more about the RAP. A RAP display board was developed and shown at many public events over the course of the Stage I RAP development, including an Environmental Summit in 1990, at environmental fairs, malls, boat shows, and other public events.

(c) Speaking/Educational Opportunities: Throughout the development of the Stage I RAP, staff members spoke with adults and children about the RAP and about water quality. School children learned about the RAP at annual environmental days sponsored by the Preserving the Earth Through Education (PETE) program, Conservation Field Days sponsored by the Cooperative Extension and Soil and Water Conservation District, and visits by the EPA research ship. Many classroom invitations were also accepted. Adult groups learned about the RAP at meetings where RAP staff were invited to speak including the Monroe County and New York State Environmental Management Council, the Monroe County Planning Board, a Coastal Erosion Conference, the American Society of Civil Engineers, Fishery Advisory Board, Sea Grant Extension Conference, International Association of Great Lakes Researchers, University of Rochester, Water Pollution Control Federation, conference of the Upstate Chapter of the American Planning Association.

(d) Articles: The Rochester Embayment RAP also was publicized in writing. Two newsletters were published and widely distributed at the beginning of the RAP. Since then, articles about the RAP have been published in local newspapers including the Times Union and Democrat and Chronicle, in newsletters of the Monroe County Department of Planning, the Center for Environmental Information, the International Joint Commission, and the New York Water Pollution Control Association. Local RAP staff also wrote a chapter on the Rochester Embayment RAP for inclusion in a book edited by John Hartig and Mike Zarull entitled "Under RAPs". The title of the chapter is "Rochester Embayment's Water Quality Management Process and Progress, 1887-1990."

(e) Public Meetings: Four public meetings were held during the week of January 25, 1993 to inform and get feedback on the Draft Stage I RAP which was published in early January. Over 100 people attended the meetings. A responsiveness summary has been prepared to address all of the comments that were made by individuals at the public meetings, or subsequent to the public meetings. The responsiveness summary is included in this Final Stage I RAP as Appendix A.

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Great Lakes Water Quality Board (1981). 1981 Report on Great Lakes Water Quality. November 1981, Cleveland, Ohio.

International Joint Commission. Revised Great Lakes Water Quality Agreement of 1978. January 1988

ROCHESTER EMBAYMENT REMEDIAL ACTION PLAN
CHAPTER 2: ENVIRONMENTAL SETTING
6-8-93

INTRODUCTION

The Rochester Embayment of Lake Ontario is a shallow triangular indentation midway along the southern shore of Lake Ontario at the mouth of the Genesee River (See Figure 2-1). It has been designated as one of 43 Areas of Concern (AOC) in the Great Lakes Basin.

at sets the embayment apart as a distinct geographical feature is its physical form (geology), in junction with natural forces impacting upon it (climate and current). The inflow to the Rochester bayment from tributary waterways has an effect on embayment and lake quality, and, at the same time, e lake modifies the water quality within the embayment.

This chapter describes the environmental setting of the embayment as a unique feature within the Lake Ontario ecosystem, as a part of the Great Lakes Basin, and as a composite of the waters that are influenced by human activity in each of three smaller drainage basins that contribute to the embayment. Since the waters from each of these three basins impact the water quality of the embayment, each basin is briefly described.

DEFINITION OF THE GEOGRAPHIC SCOPE OF THE ROCHESTER EMBAYMENT AREA OF CONCERN

The limits of the Rochester Embayment of Lake Ontario cannot be clearly seen. The accepted historic description of the embayment is an area of Lake Ontario formed by the indentation of the Monroe County shoreline between Bogus Point in Greece and Nine Mile Point in the Town of Webster, both in Monroe County. An appendix report for the Monroe County Comprehensive Sewage Study (Lozier, 1967) defines the northern boundary of the embayment as a straight line between the two points. It is recognized that describing the northern boundary is somewhat subjective since thermoclines and currents in the embayment and Lake Ontario change from day to day, thus changing the bounds of the embayment ecosystem that has different dynamics from the open Lake Ontario ecosystem.

Hydrologically, the southern boundary of the embayment can be described as those points from which water drains directly into the lake without first entering a stream. This fringe of land, that is exclusively within the embayment watershed, is quite narrow in places. For purposes of the RAP, the AOC also includes the approximately six miles of the Genesee River that are influenced by lake levels, from the river's mouth to the Lower Falls. This also includes the watershed that drains directly to this portion of the Genesee River from both sides of the river gorge.

LOCATION AND DRAINAGE AREA

From the lake side, the AOC comprises approximately 35 square miles of open water in Lake Ontario, the shoreline, and the watershed surrounding the six miles of the lower Genesee River. The mouth of the Genesee River is located at 43°16'N latitude and 77°36'W longitude, approximately seventy-five miles east of the mouth of the Niagara River, and six miles north of the City of Rochester.

The drainage area of the AOC is over 3000 square miles in area. It consists of the entire Genesee River Basin and parts of two other basins; the easternmost area of the Western Lake Ontario drainage basin (West Sub-basin) and the westernmost area of the Central Lake Ontario drainage basin (Central Sub-basin). (See Figure 2-1.)

The Genesee River Basin (shown in Figure 2-2) covers 2500 square miles and includes parts of ten counties. Its landscape steps down to the north in three major, fairly level plateau. Population and intensive development are concentrated at the north end, in and around the City of Rochester. Farmland and mixed forest dominate upstream, to the south. The Genesee River is the major waterbody in the basin. It collects water from 52 tributaries and six lakes as it flows 157 miles from headwaters in Pennsylvania. It flows through a steep rock gorge with three waterfalls in Letchworth State Park in Livingston County, and is controlled by a flood control dam at Mt. Morris. It then flows through a broad floodplain and into the City of Rochester, where it crosses the Erie Canal at grade before entering a steep rock gorge with three waterfalls and flowing into the embayment. The upper and lower falls in the City of Rochester each drop about 90 feet, and the middle falls drops about 30 feet.

The River is used for hydroelectric power generation (6 plants), receiving wastewater (from industrial, municipal and, other sources) and, at the Lake Ontario Port, limited commercial shipping. Recreational uses in the Basin are concentrated in three areas: boating near the mouth of the River; boating and trail use along the Erie Canal; and camping and sightseeing at Letchworth State Park. Public access is provided at other locations along the River and streams. The historic Erie Canal, which flows from west to east across the basin, both discharges water to and uses water from the Genesee River. A crucial role of canal water is augmenting the Genesee River flow during dry periods so that wastewater effluent in the lower Genesee River segment of the AOC can be adequately assimilated. The Genesee River Basin contains significant natural areas including Bergen-Byron Swamp, the Caledonia black duck wintering area and several streams with naturally reproducing populations of trout.

The Lake Ontario West Sub-basin (shown in Figure 2-3) includes 309 square miles and 25 miles of Lake Ontario shoreline in Monroe and Orleans County. It is part of the lake plain, sloping gradually toward the northeast. Population and intensive development are concentrated in the eastern area of the sub-basin, along the shoreline, and in five villages (Hilton, Spencerport, Brockport, Holley and Albion. The last four are located along the Erie Canal). By area, agriculture is the dominant land use. However the trend is toward expansion of residential, commercial and industrial development and reduction of farmland. The West Sub-basin contains a network of streams, many intermittent, flowing northeasterly into the embayment. The Erie Canal crosses the southern portion of the Sub-basin, and some of its water is used for irrigation and recreation. The streams are used for sport fishing and for wastewater discharge from a variety of sources. Recreational uses are concentrated on the shoreline (swimming and camping at Hamlin Beach State Park, and boating at Sandy Creek and Braddock Bay), and along the Erie Canal, with additional public access to some streams. The West Sub-basin contains one of the largest and most important coastal wetland ecosystems in the State at Braddock Bay. This 5000-acre area includes a 2500-acre State Wildlife Management Area that provides habitat and outdoor recreation opportunities as well as boat access to Lake Ontario. Significant habitats exist at Sandy Creek, Yanty Creek Marsh, and the Lake Ontario shoreline.

The Central Sub-basin (shown in Figure 2-4) includes 11 miles of shoreline in Monroe County and 224 square miles in Monroe and Wayne Counties. It has a rolling landscape with some steep shoreline areas. Population and intensive development are concentrated to the northwest, in and around the City of Rochester. The Sub-basin is predominantly and increasingly suburban in character, with diminishing areas of farmland in the northeast and southwest.

The dominant waterbody is Irondequoit Bay. It is significant due to its size (1700 acres), the extent of its watershed (over 70% of the Sub-basin area), and its scenic quality. The Bay water quality has benefitted due to remedial actions, including elimination of combined sewer overflows and the sealing of bottom sediments, which are intended to mitigate its eutrophication. It has very steep erodible slopes and significant shoreline ecosystems. It is an important recreational resource, and the only area in the sub-basin (except the Erie Canal) for launching or mooring motorboats.

In addition to Irondequoit Bay, the Sub-basin contains five smaller watersheds which drain to the embayment, and the Erie Canal which crosses through the middle of the Sub-basin. The streams in the

Sub-basin are used for sport fishing, some canoeing and receiving wastewater from a variety of sources. There are two major county parks along the lakeshore (Durand Eastman and Webster), swimming in two inland ponds, and public access to the Erie Canal and some streams in the sub-basin.

The sub-basin contains significant natural areas, (in addition to wetlands in Irondequoit Bay and the mouth of Irondequoit Creek), including: rare glacial landforms and ecosystems in Mendon Ponds Park; significant habitats in Shipbuilders Creek, Thousand Acre Swamp, Durand-Eastman Park, and the entire Lake Ontario Shoreline.

LAKE ONTARIO: THE BIG PICTURE

The RAP is primarily concerned with waters, sediments, and adjacent lands within the area of concern, and waters leaving the area of concern that may contribute to problems in Lake Ontario. The environmental setting focuses on the parts of the ecosystem that affect these areas.

Capacity and Physical Features of Lake Ontario

In surface area, Lake Ontario is the smallest of the Great Lakes, totalling 7340 square miles. It has a volume of approximately 393 cubic miles, which is more than three times that of Lake Erie. Lake Ontario has a maximum depth of 802 feet and a mean depth of 276 feet. Its deepest point occurs northeast of the mouth of the Genesee River. The Niagara River contributes about 85% of the water that flows into Lake Ontario.

Outflow from Lake Ontario is through the St. Lawrence River. If it were possible to displace all the water in the lake and replace it with the same amount of water currently feeding the Lake, the replacement time on the basis of the inflows, outflows and the volume of the lake would be about eight years (NYSDEC, 1977). So theoretically, if all of the inflow were clean, Lake Ontario could be cleansed in that time. However, the actual inflow is not clean. It contains contaminants that have been introduced upstream in other parts of the Great Lakes Basin, particularly the Niagara River. Many contaminants accumulate in lake sediments and can recycle back into the water.

Flow

The water that is stored in the lake circulates both vertically and horizontally, suspending particles in some areas and depositing them in others. Currents within the lake generally flow in a counter-clockwise direction. These currents are driven by the force of water entering the lake, changes in water temperature, wind, and the direction of the earth's rotation. Currents have the potential to resuspend contaminants in sediments.

The net surface flow of what can be considered Niagara River water is strongly developed toward the east along the southern shore. A lesser return flow moves west along the north shore. (See Figure 2-5)

Because of re-circulation and relatively low outflows compared to lake volume, a gradual dilution of pollutant concentration (depending on the quality of "new" water entering the system) takes place over a long period of time.

In its 1979 Annual Report to the IJC, the Science Advisory Board presented mapped data clearly showing that the Great Lakes become more stressed and polluted from west to east, as illustrated in Figure 2-6 showing concentrations of lead in Great Lakes sediments (Great Lakes Science Advisory Board, 1979). More information on pollutants can be found in Chapter 4.

Currents within the embayment itself depend on wind direction, and can respond to a change within hours. Based on prevailing wind patterns, it is estimated that water in the embayment flows toward the east 55 percent of the time and toward the west 35 percent of the time, and is in a process of reversal 10 percent of the time (U.S. Dept. of Interior, 1966).

Water Levels

The mean monthly water level in Lake Ontario varies seasonally with low levels in the winter and high levels in the summer. The range of this seasonal water level change is approximately two feet. The impacts of these fluctuations are intensified where streams and beaches are shallow.

The long term fluctuations of the water levels in all of the Great Lakes have been monitored since 1860. The Lake Ontario lake levels are monitored and somewhat controlled by international agreement through the International Joint Commission. Based on a 121 year data set, the lake has fluctuated from a high monthly mean of 248.06 feet to a low monthly mean of 241.45 feet. Levels in the last decade have been slightly higher than average (EDR, 1989). Since the last glacial period, a longer-term change has been taking place as a result of the earth's crust rebounding at differential rates in different locations within the basin. This tilting of the basin is expected to result in higher water levels on the southern and western shores of Lake Ontario relative to those on the north and east (Project Management Team, 1989).

Temperature and Wind

Seasonal variations in solar energy produce a seasonal heating and cooling cycle in Lake Ontario. Due to the lake's geographical location, westerly winds prevail during most of the year. During the winter and spring, the prevailing winds are from the west and northwest. During the summer, prevailing winds are from the west and southwest. The jet stream typically lies just north of the lake during the summer and just south of the lake during the winter. Because of the jet stream's influence on the movement of weather patterns, many of the main storm tracks in North America pass directly over Lake Ontario. Air temperature and wind have a major influence on lake levels by affecting the amount of runoff relative to precipitation, and evaporation from the lake's surface.

Temperature Stratification and Overturn

The heat content of the lake changes seasonally and causes vertical movements of water. These changes influence the long term distribution of contaminants once they have entered the lake system by resuspending contaminants that are stored in the bottom sediments.

Heat begins to be stored in the lake around mid-to-late March. The warming begins around the lake perimeter in the shallow waters. This ring of warm water is separated from the colder offshore water mass by a transition zone, known as a thermal bar, where lake water is at its maximum density temperature (4 degrees Celsius). Four degree C water and sinks from the lake surface to the lake bottom and is replaced by colder, less dense water upwelling from the bottom that may contain pollutants from the sediments. As lake warming continues through the spring, the thermal bar migrates lakeward and eventually disappears when the entire lake surface is at a temperature above 4 degrees C -- usually in mid-June. By the end of June, the lake is vertically stratified by temperature into an upper warmer layer (the epilimnion) and a lower colder layer (the hypolimnion), separated by a temperature transition zone called the metalimnion or thermocline, where the temperature gradient is steepest. The upper layer warms as summer heating progresses and thickens as a result of wind mixing. Characteristically, the mid-lake upper layer temperatures will reach 20 degrees Celsius and the thermocline (area of rapid temperature change) depth will reach 20 meters (67 feet) or more. During the period of stratification, the thermocline position changes in response to changing wind conditions at the lake surface, frequently resulting in the generation of internal waves. These vertical shifts in the position of the thermocline play a major role in the observed water temperature fluctuations in the near shore regions of Lake Ontario. Also, during the stratification period, wind effects are largely confined to the upper layer thereby limiting disturbance of bottom sediment.

The cooling phase of the lake begins by mid-September and continues throughout the winter period. The shallow regions of the lake cool first, resulting in a ring of cooler water around the lake perimeter, but without the formation of a thermal bar. Generally, around late October, an early winter wind event is sufficient to cause the vertical layers to mix. At this time, the lake becomes essentially one temperature throughout.

Throughout the winter, the lake continues to lose heat, but its great depth and large thermal inertia cause the main part of the lake to remain ice-free, although shore ice is a common feature. During the winter the lake may develop a weak stratification, with water at temperatures less than 4 degrees C overlying the dense bottom water which remains at 4 degrees C. This rarely persists in the near shore regions where wind keeps the water column well-mixed vertically (Matsumoto, Rumer and Argus, 1989.)

Seasonal stratification also affects what happens to runoff as it enters the lake. Temperature differentials and sediment loads affect the density of stream water relative to the lake, and may be a determining factor in how and where waters and pollutants become mixed within the embayment. For example, warm water from the Genesee River in the summer may flow many miles across the surface of colder Lake Ontario water before lake and river waters mix completely. In summary, in Lake Ontario there are two periods of stratification (Summer and Winter) and two periods of mixing (Spring and Fall).

Wave Action

Another major factor affecting the confluence of lake water and runoff is wave action, determined by the wind's strength, direction and duration, and the area over which it blows. While the moon has a generally negligible impact on the water levels of Lake Ontario, the water levels are fluctuating constantly due to a number of factors, primarily precipitation rates within the Great Lakes Basin. Shorter term fluctuations of a few hours or a day, at local points on the lake, are caused by local weather features, i.e., wind set up and barometric pressure differences. These fluctuations can range from a few inches to over two feet.

The Lake Ontario shoreline of Monroe County is exposed to storm waves generated by winds originating from the west-northwest to north-northeast. The exact exposure of any specific site varies somewhat due to the shape of the local shoreline and the offshore depth.

The movement of waves across any offshore shallow areas (shoaling) will greatly transform a wave's height and steepness and change its impact on the shoreline. The presence of a one- to two-mile-wide sand shelf offshore of the Monroe County shoreline serves both to limit many storm waves by shoaling and to provide a source of beach material.

Wave action is responsible for sediment transport characteristics of the shoreline areas. The present erosion west of the embayment at the western edge of Hamlin Beach State Park is replenishing sand beaches to the east. These processes are largely driven by the wave energy at the site and the site topography and geology, but they can also be greatly influenced by human development activities. The impact of humans on the process of sediment transport can be seen at the harbor structures for Rochester. These breakwater structures serve as a sediment transport barrier, which is causing the growth of sand beach fillets on both sides of the entrance. This buildup indicates that there is significant transport within the shore zone in both directions, depending on the prevailing wave direction and an adequate source of sand. It is likely that in the embayment area, the offshore sand bottom serves as a major source of beach sand during calmer periods, when waves are less steep, and receives back some of this same sand during the storm periods, when steep high waves are eroding the beaches (EDR, 1989).

The Rochester harbor (at the Genesee River) is largely protected from the wave action offshore by breakwalls, but significant water surge occurs in the Genesee River due to the funnelling of wave energy from the lake. The U.S. Army Corps of Engineers began a study on the water surge in 1990. The study, expected to be completed in 1992, will identify options to deal with this problem.

Lake Ontario is a complex and dynamic system. In addition to the physical activity described above, plant and animal life affects the chemistry of the water.

The Food Web and Bioaccumulation

An aquatic ecosystem is based on a complex food web made up of producers, consumers and decomposers. The producers are plants -- algae, phytoplankton and rooted vegetation (macrophytes) -- that use the sun's energy to produce carbohydrates from carbon dioxide and water. Those carbohydrates then become the food which sustains the rest of the ecosystem. Aquatic plants require over 20 chemical nutrients in order to survive; these nutrients are dissolved in the water, available from the air, and contained in sediments where rooted vegetation can extract them. During photosynthesis (the production of carbohydrates), aquatic plants give off oxygen that dissolves in the water and sustains life for other organisms.

Aquatic plants provide not only food and oxygen, but also shelter for many animals. Wetlands, which are filled with aquatic plants, are breeding grounds for fish, birds, amphibians and some mammals. Plants provide sites for egg-laying, concealment or hunting.

Because the producers depend on light, they are affected by turbidity that decreases the depth to which light penetrates. Because their growth depends on dissolved nutrients, they are sensitive to changes in nutrient concentrations. These primary producers increase greatly in number when a scarce nutrient becomes abundant. The macrophytes, because they grow along the shore, are affected by changes in shorelines and sediments (caused by development, for example) that alter or destroy their habitats.

Consumers do not produce their own food, but obtain it by eating other organisms. Microscopic zooplankton are the primary consumers, feeding on algae and phytoplankton. They in turn provide food for secondary consumers, or carnivores, such as alewives, gizzard shad and the young of other fish species. The community of carnivores is very diverse, ranging from benthic invertebrates (insects, crayfish, clams and organisms that live in or on the bottom sediments) to fish, waterfowl, raptors (hunting birds) and fish-eating mammals. Those at the top of the food web eat other carnivores, and are thus several levels removed from the original nutrient sources in the inorganic environment. These "top carnivores" in the Great Lakes basin normally include trout, salmon, mink, otter, gulls, terns, ducks, loons, bald eagles, ospreys and humans. Not all of these species are present in the Rochester Embayment.

At each step in the food web, some energy is lost; thus the numbers of top carnivores are small compared to the large numbers of plankton, minnows and others lower on the food web. These relatively small populations of top carnivores are also particularly affected by pollution, due to the process of bioaccumulation. Toxic substances that are not metabolized or excreted build up in each organism's body, becoming concentrated even further when that individual and others like it are eaten by a predator. Figure 2-7 shows how PCBs are concentrated hundreds of times through four levels of predation in Lake Ontario. Gulls and Lake Trout eat Smelt and Sculpin which eat Pontoporeia and Mysis which eat Plankton.

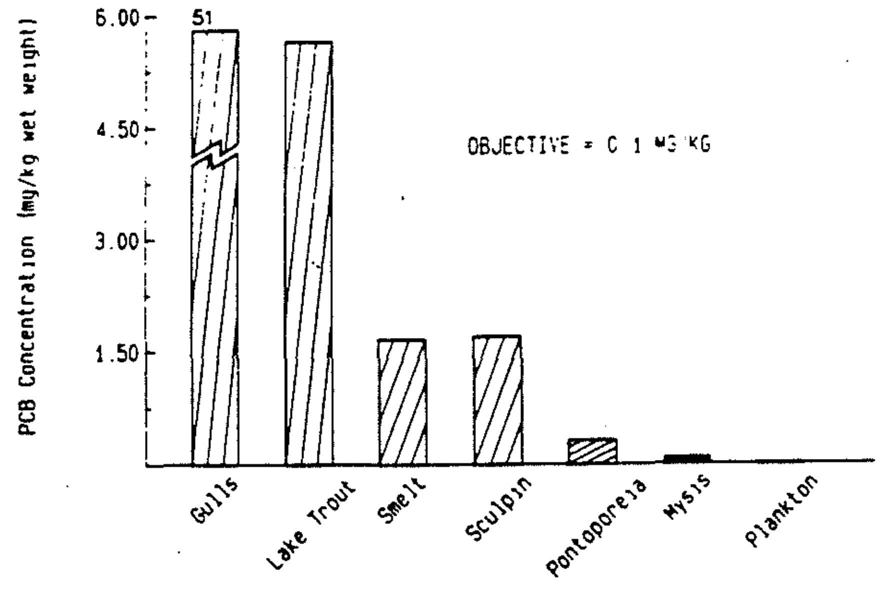

FIGURE 2-7. BIOMAGNIFICATION OF PCB THROUGH THE LAKE ONTARIO FOOD CHAIN

Source: Canada Dept. of Fisheries and Oceans. From Rathke and McRae (1989).

The populations of aquatic consumers in the embayment are sensitive to the physical and chemical qualities of the water such as temperature and oxygen levels, and to the presence or absence of other organisms that serve as food, as predators, or as competitors within the ecosystem.

The third category of organisms is the decomposers. These essential organisms recycle organic wastes and dead plants and animals by breaking them down into their chemical constituents, which are then released for use once again as nutrients by aquatic plants. Bacteria, fungi and yeasts commonly perform these functions. They not only break down dead matter, but transform nutrients from one form to another (e.g. ammonia to nitrite, nitrite to nitrate, etc.). They themselves may also be eaten by other organisms, forming another base for the food web. It is the decomposers that carry out waste treatment both in natural systems and in most wastewater treatment plants.

In areas heavily loaded with conventional pollutants, the populations of decomposers increase and they recycle more nutrients, providing added fertilizer for plants such as algae. Even with increasing populations, however, decomposers may not be able to process all the wastes entering the ecosystem.

Decomposers that require oxygen to break down organic matter can deplete the dissolved oxygen in the water when a great deal of waste is present. The lack of oxygen makes the water inhospitable to fish and many other organisms. Excess wastes then build up in the sediments, creating an oxygen debt so that depletion of oxygen continues whenever the sediments are disturbed. The problem is exacerbated because oxygen depletion causes the breakdown of a naturally-occurring chemical process that retains many pollutants in bottom sediments, and allows release of the wastes and toxins that are stored there.

In a healthy environment, the food web is normally complex and diverse -- composed of many different species. Inhabitants of the ecosystem include species that are tolerant of pollution or low oxygen conditions and those that are not. Polluted environments that can still support life often contain many individuals but few species, since only those especially tolerant of pollution survive there. This lack of diversity makes it more difficult for the ecosystem to maintain stability and respond to stresses.

In addition to pollution and habitat destruction, another important factor in determining the biological composition of the embayment has been the introduction of species from outside the area. When exotic organisms (those not native to an ecosystem) are introduced into the system, they can cause the disappearance of native species through predation or competition for the same resources, or they can undergo population explosions due to a lack of natural enemies. At times they can tolerate degraded conditions better than the native species, and assume an important place in the system. Lake Ontario has experienced the introduction of the alewife, white perch, carp, Pacific salmon, sea lamprey (a parasitic fish), and more recently the zebra mussel, which encrusts boats and water intakes and consumes large quantities of plankton. Many exotic species have been brought into the lake in the ballast water of ships.

Eutrophication

Eutrophication is a process that has caused use impairments in the Embayment, Irondequoit Bay, and several of the smaller lakes and ponds within the sub-basins. The trophic classification of a lake refers to its productivity, or the amount of food available in it. A lake can be oligotrophic, mesotrophic or eutrophic (Odum, 1971). Lake Ontario is primarily mesotrophic. (U.S. EPA and Environment Canada, 1988).

An oligotrophic (few foods) lake is normally clear, with little vegetation around its margin and little visible algae. In nature, such lakes are normally deep and/or geologically young. In contrast, a eutrophic lake has an abundant supply of available nutrients and produces a large crop of algae and aquatic plants. A mesotrophic lake is between the two in character. Over geologic time, many lakes naturally will become shallower and more eutrophic, eventually becoming marshes, then dry land.

There is more life in a eutrophic lake than in the other types, but the species composition and functioning are different. For example, cold-water fish such as trout and salmon are frequently able to live in the cold depths of an oligotrophic lake, but not in a eutrophic lake. In a eutrophic lake, algae and other organisms are produced in such abundance that when they die, their decomposition uses up the lake's oxygen supply faster than it can be replenished. The rain of dead matter to the depths of the lake creates anoxic conditions there, preventing these game fish from surviving.

Even through many natural lakes are eutrophic, it is considered undesirable when human actions result in the eutrophication of a naturally oligotrophic or mesotrophic lake. The algal blooms, vegetation-clogged shorelines, odors from decomposing organic matter, and loss of desirable fish species all detract from the enjoyment of the lake. The primary cause of eutrophication is the accelerated flow of nutrients from the watershed into the lake. Phosphorus is naturally the most limited nutrient in most cases, so it is the addition of phosphorus that permits the algal blooms and associated detrimental conditions to occur.

CLIMATE

The climate in the vicinity of the AOC and its drainage basin is humid continental. The prevailing wind movement is the same as for Lake Ontario -- predominantly from the west and northwest in winter and southwest and west in summer. Wind acquires moisture as it moves over the lakes, contributing to precipitation in the form of rain and snow (which is termed lake effect). Figures for the weather over the embayment and its drainage basins are based on data collected at the Greater Rochester International Airport southwest of Rochester, about ten miles inland from the lake.

Seasonal temperatures fluctuate between extremes of -25 degrees to 104 degrees F with an average annual temperature of 46-48 degrees. Lake Ontario plays a major role in the Rochester weather. Because the lake water warms and cools at a slower rate than the land, in the summer the lake has a cooling effect that inhibits the temperature from rising much above the low- to mid-90s F. In the winter the modifying temperature effect prevents temperatures from falling below minus 15 degrees F most of the time.

The lake also plays a major role in winter snowfall distribution. Inland from the lake and toward the airport, the seasonal snowfall is usually less than in the area north of the airport and toward the lakeshore where wide variations occur. Snowfalls of one to two feet or more in 24 hours are not uncommon near the lake in winter due to lake effect alone. The area is also prone to other heavy snowstorms and blizzards because of its proximity to the paths of low pressure systems coming up the east coast, out of the Ohio Valley, or to a lesser extent, from the Alberta area. Total annual snowfall ranges from 80 to 90 inches, and continuous snow cover is possible though not recently common, from December through March.

Precipitation is rather evenly distributed throughout the year (NOAA, 1989). Excessive rains occur infrequently, but may be caused by slowly moving thunderstorms, slowly moving or stalled major low pressure systems, or by hurricanes and tropical storms that move inland from the Atlantic Coast. Hail occurs occasionally. Heavy fog is rare on land but is common on the lake. Winds average 11 mph, and wind magnitude throughout the region tends to vary in inverse proportion to distance from the lake.

The growing season in the drainage basin averages 150 to 180 days near the lake, depending on microclimatic influences, and as little as 110 days in the southern uplands. The year's first frost usually occurs in late September and the last frost typically occurs in mid-May (NOAA, 1989).

Concerns for air quality have given rise to recent monitoring of long range air movement patterns. While atmospheric movement is somewhat constrained by local topography and meteorological events, there is no direct analogy between a watershed and an airshed. However, it can be said that a given area is within a certain Atmospheric Region of Influence (AROI). In contrast to its hydrological counterpart where all points within a river drainage basin are in the same watershed, the AROI is receptor site specific, meaning that every site has its own unique AROI. This data is not presently available for the Rochester area. However, Figure 2-8 shows the one to five day AROI for the entire Great Lakes Basin. The general pattern for individual points in the basin are similar and tend to correspond to the known dominant wind patterns. The probability of a particular windborne substance being deposited at a site depends, among other things, on travel distance and the substance's lifetime in the atmosphere. (International Air Quality Advisory Board, 1988-89)

TOPOGRAPHY/GEOLOGY

Topography

The land that drains to the Rochester Embayment has been raised in elevation through a long, intermittent, erratic and slow process of uplift since it formed the bottom of several inland seas. The region was later covered with glacial deposits and subsequently exposed to the erosional influences that have produced the physiographic features of today. Ridge Road (State Route 104, shown on Figures 2-9 and 2-10) follows the prominent shoreline of the former glacial Lake Iroquois (Monroe Co. EMC, 1976). Topography of the area is characterized by a fairly level lake plain to the north of Ridge Road with a gradual transition to rolling hilly features to the south. Elevations in the two Lake Ontario subbasins range from 245 feet at the lake shore to around 1100 ft. in the southeastern portion of the Lake Ontario Central sub-basin. The greatest elevation in the Genesee basin is 2500 ft. in Pennsylvania. There are very few areas within the Lake Ontario West sub-basin that have steep slopes. The specific areas of steep slope in the Lake Ontario Central sub-basin are concentrated around the Lake Ontario shoreline, Irondequoit Creek, Irondequoit Bay, and drumlin fields in the southeastern portion of the sub-basin. The Lake Ontario shoreline in the Central sub-basin generally consists of steep slopes with a gradient of over 10% adjacent to or a short distance from the water's edge. The Irondequoit Bay shoreline is composed of very steep slopes ranging from 15% to 60% grade. Steep slopes in the Genesee Basin are generally concentrated along the walls of the river valleys, particularly in the headwater areas and in the gorges through Letchworth State Park. (See the Genesee Basin Plan for a map of slopes in the basin).

The western portion of the embayment itself has a relatively gradual slope -- about half of what is typical along the rest of southern lakeshore including the eastern portion of the embayment (see Figure 2-10). As the easterly lake current rounds the tips of Devil's Nose and Bogus Point (Bogus Point shown on

Figure 2-9), a drop in velocity occurs as currents are deflected around the headlands. This slowing of the lake current prevents sedimentary particles carried into the embayment by the Genesee River from being scoured away. Instead, it appears that they build up over time (e.g. continual sand blockage of Braddock Bay). Sediment blocking bays is normal longshore transport related to all rivers and beaches providing sediment. This sediment is generally being reworked by long-shore drift (west to east) (see Figure 2-5).

The rising lake levels of Lake Ontario, since the last glaciation, have resulted in the flooding of lower reaches of streams as they approach the lake. The subsequent development of sand bars across the mouths of these streams has caused the development of shoreline ponds (e.g. Round Pond in Greece shown in Figure 2-10) which add to the diversity of the embayment area. (EDR, 1989)

Dredging of the Genesee River has occurred regularly over several decades. Dredge spoil is dumped in a designated one-half mile square area of the embayment, located about 1.5 miles northeast of the river jetties (see Figure 2-10). The volume of spoils deposited over this time totals more than a cubic mile, but there is no significant accumulation of sediments on the Lake bottom in the designated dumping area. What can be seen on the depth charts is an elongation of the shallows extending northeast of the river's mouth toward the deepest portion of the lake floor. It would appear that the long term impact of dredging on the bathymetry of the embayment does not vary substantially from the effects caused by the force of the river itself before the jetties were built.

Geology

Within the AOC drainage area, the bedrock is basically one of six types: shale, limestone, siltstone, evaporites (salt, gypsum, etc) , sandstone, or dolostone. The bedrock is thousands of feet thick and was formed by the deposition of clay, silt, sand and calcareous material at the bottom of seas that covered the area throughout much of geologic time. Several ancestral Genesee Rivers predated the latest glacial events. Prior to the arrival of the last glaciers, the river had an outlet to the lake through Irondequoit Bay (Kappel and Young, 1989). Glaciation eroded the hills and deepened and widened the valleys. When glaciers retreated they left behind massive deposits of clay, silt, sand, gravel and rock debris known as glacial drift. Glacial deposits are generally thin (less than 50 ft. deep) on upland sites, and thick (100-300 ft.) within the valleys of the Genesee River and its major tributaries. The principal exceptions to such thickness in the valleys are the postglacial Genesee River gorges where bedrock is at or close to the surface. The glacial and postglacial sediments in the old Irondogenesee Valley in the Lake Ontario Central sub-basin are 300-400 feet thick in many places near Irondequoit Bay. A detailed description of the glacial history of the basin is presented in Muller et. al., 1988.

Soils are diverse and variable with significant areas susceptible to erosion and/or considered poor for disposal of septic effluent (Landre, 1990).

Groundwater aquifers in the embayment drainage area in general are variable, with some good quality but some moderately hard water. Usual depths of wells range from 30 to 80 feet. Estimates of available groundwater reserves far exceed what is drawn for regular use. Ninety percent or more of drinking water within the drainage basin comes from surface sources, and well over half of that is drawn from Lake Ontario (Weston, 1987). All of the three basin plans prepared at the same time as the RAP have extensive information on groundwater included in their appendices. Please see these appendices for further information on groundwater. Additional information on water use and drinking water sources may also be found in the basin plans.

Major Waterways and Water Uses

The Genesee River discharge varies seasonally with maximum flows generally occurring in early spring (March-April) as a result of rain and snow melt runoff. Average annual river discharge as measured at Driving Park Avenue (near Lower Falls) over a 76 year record period was 2794 cubic feet per second. This represents a minor portion of the total water load to Lake Ontario (approximately 1% vs. over 4% from the

Oswego River and nearly 85% from the Niagara River). Sediment loadings in the Genesee River discharge are high and turbidity events are common. Stream bank erosion throughout the drainage system is thought to be the primary source of sediments.

After the river, the next largest channel in the drainage basin is the Erie Canal, which flows west to east beginning at Lake Erie. The canal receives water from local waterways, including the Genesee River, and discharges water into local waterways, including the Genesee River and Irondequoit Creek. Its use in recent years has been primarily recreational. The canal receives stormwater and treated wastewater and has an impact on the embayment via its discharges to the Genesee River and other waterways that flow to the embayment.

Several other major streams make their way to the embayment from both urban and agricultural watersheds. Irondequoit Bay is fed primarily by Irondequoit Creek, which has a 163 square mile watershed. Irondequoit Bay is heavily used for recreation, and is a harbor of refuge. Six creeks with a watershed area of 64,039 acres (approximately 100 square miles) feed Braddock Bay at the western end of the embayment.

Uses of the embayment by humans are described below briefly:

Water Use/Consumption:

The Monroe County Water Authority (MCWA) is the primary user of Lake Ontario water for drinking. The Monroe County Water Authority primarily serves people within Monroe County outside the City of Rochester. The MCWA has a maximum allowable withdrawal of 140 million gallons per day (mgd). Actual usage averages less than half of that to serve over 700,000 people. The water intakes for the MCWA's Shoremont Water Treatment facility lie approximately one mile west of the Genesee River mouth in the Rochester Embayment. The Village of Brockport, which serves some other communities in the Lake Ontario West sub-basin as well, also draws its water from Lake Ontario. The intake for the Brockport waterworks is located about one and a half miles west of the mouth of Sandy Creek (see Figure 2-3). The City of Rochester draws an average of 37 mgd from Hemlock and Canadice Lakes (see Figure 2-2). A conduit system conveys the water to the city and also supplies an amount less than 1/2 mgd to water districts in Livingston County. A reciprocal water sales purchase agreement between the city and the MCWA allows MCWA to draw an average of 13 mgd from the conduit system to serve their customers south of the city. The city in turn receives water from MCWA to offset the amount taken from the conduit and to supplement the city's water supply.

Eastman Kodak, the largest industrial user in the basin, draws water from the lake via an independent system. The Kodak intakes lie approximately one and a half miles west of the river mouth within the Rochester Embayment.

Wastewater Discharges:

Most of the wastewater from industry and homes throughout the drainage basin is discharged into the Genesee River, Lake Ontario, streams or the Erie Canal. Some is also discharged to the ground. Depending on the volume and velocity of discharge, extent of vegetation, evaporation, sunlight, etc., the biotic, chemical, and thermal wastes received by the streams and river will be altered, concentrated in sediments or other sinks, or carried downstream. Direct discharges of wastes to surface and groundwaters are regulated by the State Pollutant Discharge Elimination System (SPDES) overseen by the New York State Department of Environmental Conservation. As of June 1989, throughout the drainage basin, there were twenty-eight permits issued for discharges in excess of 0.5 mgd. In all, these total nearly 500 million gallons per day of permitted volume (NYSDEC, unpubl.a).

Several outfalls for municipal and industrial discharges are located in the lake and in the Lower Genesee River. The single largest discharger using the lake directly is Monroe County with its Frank E. VanLare sewage treatment plant designed to handle 135 mgd and the Northwest Quadrant Plant with a design flow of 22 mgd. The Town and Village of Webster systems handle an additional 10 mgd. All of these discharge pipes are located close to or beyond the limits of the Rochester Embayment.

The largest industrial treated wastewater discharges is Kodak which discharges to the lower Genesee River. Permitted municipal wastewater and industrial facilities which discharge to the river and lesser tributaries, are listed by design flow and receiving waters in the individual basin reports. Chapter 5 of this report estimates pollutant loadings from various sources.

Stormwater drainage in urbanized areas is a significant source of non-point pollution. Because a high percentage of the land surfaces are impervious (roofs, paving, compacted soils), the ratio of runoff to precipitation is high. Nutrients, sediment, particles and chemicals on impervious surfaces are more susceptible to being washed into the streams than would be the case in meadow or forest landsurfacesr. The quality of this discharge is only starting to be measured and regulated. In the Irondequoit Basin, which flows to the embayment, stormwater runoff was found to wash significant amounts of pollutants to Irondequoit Bay. Results are summarized in the final reports of the Nationwide Urban Runoff Program in 1983 and 1986 (O'Brien and Gere, 1983; Kappel, et al., 1986).

In addition, combined sanitary/storm sewers exist in the City of Rochester. The original system frequently discharged untreated combined sewage to the Genesee River and Irondequoit Bay. This problem has been alleviated by the construction of underground conveyance tunnels, built as part of the Combined Sewer Overflow Abatement Program (CSOAP) described further in Chapters Four and Five.

Transportation/Commercial Shipping/Commercial Fishing:

The lower Genesee River is dredged to maintain a 21-foot deep shipping channel two and a half miles upstream from the mouth in the harbor area. Although once used extensively for commercial shipping, as of 1992 the river has only one commercial user, Essroc Materials, Inc. (a cement company). The Lower Falls drops nearly 100 feet to the lower river, precluding the use of the river as a transportation route upstream.

Commercial fishing is no longer an industry for the embayment as it was in the earlier part of the century. In the last two decades, recreational fishing, primarily for trout and salmon stocked in the lake by federql and state fishing management agencies, has become an important social and economic activity in Lake Ontario and the Rochester Embayment..

POPULATION and LAND USES

Population Density

The 1990 Census puts the population within the drainage area at slightly over 1.2 million people. Monroe County accounts for 84% of the total population and about 15% of the total land area. (Based on CGR, Unpubl.).

A greatly simplified illustration of dominant land use patterns can be seen in Figure 2-11. Forest and agriculture account for approximately 90% of the land use within the combined drainage basins, but these uses are farthest from the Area of Concern. Population densities increase dramatically as one moves north toward the embayment. The fastest rates of population growth since 1920 have taken place in the towns immediately to the west and southeast of the City of Rochester in Monroe County.

Residential growth in the Monroe County villages has been more modest, but Monroe County far outpaces all the other basin counties in its rate of development and that trend is expected to continue.

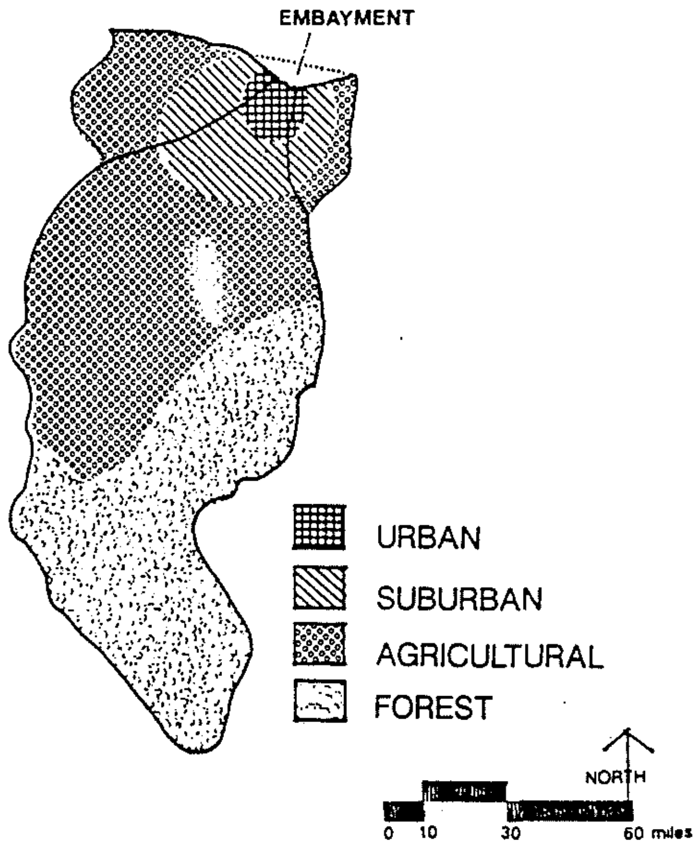

FIGURE 2-11. DOMINANT LAND USE PATTERNS IN THE ROCHESTER EMBAYMENT BASIN. Source: Landre (1990). (Note: generalized–in reality some ag. use in area designated as forest and vice versa)

There is a direct connection between the distribution of people within the land area of the basins and the amount of stormwater runoff that carries pollutants to the embayment. Unfortunately, features of the natural environment that are most likely to have a long term buffering effect on the impacts of human activity are least likely to remain undisturbed in an urban setting. The filtering effect of soils is negated when covered with impervious asphalt and concrete, which collect atmospheric pollutants that later wash off into waterways. In such urbanized areas, runoff speeds through straight stream channels devoid of vegetation that facilitate flow and do not impede the transport of sediment and other pollutants in the water.

Forest and Agriculture

Agricultural land use has experienced some decline in recent decades. What may be more significant for water quality is that the remaining agriculture has changed dramatically. There is a tendency toward consolidation and large-scale farming techniques. Compared to even ten years ago, there are fewer farms overall, with an increase in the average size per farm. In the southern part of the basin, farmland is predominantly used for dairy production. In the northern part of the basin, crop production is more significant. The moderating effect on air temperature caused by Lake Ontario enhances the climatic conditions for growing fruit near the lake.

Although there are no formal predictions for changes in agricultural production, the dairy industry has been dependent on government subsidy for some time, and surpluses have built up. The recent economic downturn could force notable changes upon that industry in the coming decade, similar to the national programs that reduced tilled acreage of grains in the 1960s. With less land being tilled, there has been a slight increase in the amount of wooded cover as old fields have reverted to secondary growth, especially in outlying suburban areas.

Commercial and Industrial Land Use

Manufacturing, retail and service industries are concentrated in the City of Rochester and Monroe County along major transportation routes. Rochester is a world leader in several industries including photography, xerography, telegraphy, telephone automation, optics and imaging (Great American Brokerage, Inc., 1989). The distribution and amount of industry within the basin is well established and is not expected to change dramatically in the foreseeable future. There are, however, efforts by many economic development agencies to attract new industries to the basin. There is some mining of gravel and sand, but it is not extensive.

Transportation

The drainage basin is well served by major state and interstate highway routes. The Lake Ontario Parkway and connecting roads are part of New York's Seaway Trail that promotes tourism along scenic waterfront areas. Not surprisingly, most transportation corridors are concentrated in and around the City of Rochester. The largest airport in the basin is adjacent to the Genesee River near the southwest portion of the city. One notable trend in transportation is renewed interest in promoting the use of the Erie Canal as an intrastate transportation/recreation route. See the basin reports for discussion of other transportation corridors.

Recreation

The drainage basin is rich in water resources that attract related recreational use. Recreation is proving to be a growth industry. Demand for waterfront recreation facilities and services currently exceeds supply and is growing. The Rochester Harbor in the lower Genesee River, Irondequoit Bay, and Braddock Bay are the primary access points to Lake Ontario. Boat launches and marinas are available in these areas as well as in several of the streams along the shore. There is public swimming at Ontario Beach Park (immediately west of the Genesee River) and Hamlin Beach State Park (west of the embayment). There has been substantial growth in sport fishing in recent years, despite consumption advisories for a number of fish species.

Lake Ontario and its shoreline areas are most suitable for power and sail boating, swimming, fishing, scenic access, and camping. There is some tourism related to fishing, other attractions in the Rochester area, and travel along New York's Seaway Trail. Current demand for facilities to support these activities generally exceeds the supply depending on the economy, and demand is expected to grow. There is potential for these demands to threaten aquatic habitat.

Aesthetics

The waterways are the major scenic resources in the drainage basins. Views to the water ways from public roads are typically screened or blocked by the interposition of landform, vegetation or shoreline development. Panoramic views from public roads such as those of Irondequoit Bay, Braddock Bay, and the lower Falls, are rare and of outstanding quality. Many notable scenic locations in the embayment area have been preserved as parkland and public access provided -- e.g. the Rochester gorge and waterfalls, Seneca and Maplewood Parks on either side of the gorge, Ontario Beach, and Durand Eastman Park.

Planning/ Regulating Jurisdictions

Governing bodies whose jurisdiction can potentially impact water quality within the embayment range from private owners of parcels that drain directly into the embayment or streams, to the International Joint Commission itself, which has called for this Remedial Action Plan and is coordinating policy review and implementation for the entire Great Lakes Basin. Intermediate governments and the areas which they oversee are discussed in detail in the basin reports. Briefly they include:

Local Government:

Villages, Towns, and Cities: These municipalities prepare land use master plans (including local waterfront revitalization plans) and develop and implement land use regulations based on State enabling legislation (this includes approving plans for stormwater drainage). The City of Rochester provides water to its population directly, as do many Villages. Some villages and many towns purchase water from other suppliers and deliver it to their population. The City of Rochester and many villages provide garbage and trash pick-up and disposal. Some Villages and Towns provide wastewater collection and/or treatment.

County: Some counties have their ownHealth Departments. Depending on the county, their roles include approval and inspection of water supply extensions, on-site wastewater treatment facilities, drinking water supply monitoring,beach, stream, and some ground water quality monitoring and response to stream pollution complaints, State Pollution Discharge Elimination System commercial sewage plan review, inspection, and enforcement, an inactive hazardous waste site program, and response to petroleum and hazardous material spills. The Monroe County Division of Pure Waters is responsible for municipal wastewater collection, wastewater treatment, operation and maintenance of the sewer system in many areas, and operation and administration of an industrial pretreatment program. The Counties provide overall solid waste management concentrating primarily on recycling and disposal. Counties operate and maintain roadside drainage on County roads, and in Monroe County, work with others to track road salt usage and discourage the excessive use of road salt. County Environmental Management Councils provide education in the area of water quality. County Planning Departments are involved in land use planning that impact water quality. County agencies also work together to conduct research and demonstration projects that lead to improved water quality.

Monroe County Water Authority (MCWA): This Authority provides drinking water to much of the population of Monroe County that lives outside the City of Rochester.

County Soil and Water Conservation Districts: Staff of the districts, together with staff from the federal USDA Soil Conservation Service provide planning and technical assistance to landowners in preventing soil erosion and water degradation in both urban and agricultural areas. District staff also encourage tree planting and helps landowners design ponds.

New York State:

Department of Environmental Conservation (NYSDEC): The State regulates actions that may have an impact on water quality. This includes issuing permits for discharges of wastewater to streams, groundwater, and lakes; issuing municipal water supply permits; issuing permits for emissions to the air (which can enter the water via stormwater runoff); managing and protecting fish and wildlife; issuing permits for development on or near certain wetlands; regulating of hazardous and solid waste disposal facilities and transportation; and undertaking some monitoring and research activities. The NYSDEC also is the lead Stage agency coordinating with the State Departments of Law and Health in implementing the Inactive Hazardous Waste Site Remediation Program.

Department of Transportation (DOT): This state agency builds and maintains many roads and bridges which include water issues such as stormwater drainage and winter deicing methods.

Department of State: This state agency is responsible for overseeing State coastal management programming such as the local development of Local Waterfront Revitalization Plans.

Department of Health: This state agency is responsible for insuring safe drinking water and safe food (including locally caught fish). In many cases, such as in Monroe County, the State regulations are actually enforced through the County Health Department. They annually issue fish consumption advisories in areas where they determine there may be concerns about the safety of consumption.

Regional Agencies:

Genesee/Finger Lakes Regional Planning Council: This group promotes economic development, including tourism and recreation as elements that attract and keep industry. This agency is also involved in assisting counties in its region in conducting research that will result in improved water quality. Counties covered by this agency are Genesee, Livingston, Monroe, Ontario, Orleans, Seneca, Wayne, Wyoming, and Yates.

Finger Lakes Water Resources Board: This multi-county group works together as a consortium to apply for State aid to localities to improve water quality. Funds obtained by the Counties that are members of this group are used for many different kinds of water quality and aquatic weed control projects. This group is also trying to coordinate water quality activities among the counties (Cayuga, Cortland, Genesee, Madison, Onondaga, Ontario, Oswego, Seneca, Wayne, Wyoming, and Yates).

Federal Agencies:

U.S. Environmental Protection Agency (EPA): This agency, with regional offices in New York City, has a Great Lakes section which oversees work ongoing in the Great Lakes Region. In addition, EPA is responsible for setting water quality criteria and ultimately enforcing Clean Air and Clean Water standards. There is also a Great Lakes Regional Program Office located in Chicago, Illinois. The EPA works closely with the NYSDEC in allocating funding for many water quality programs.

U.S. Army Corps of Engineers: The Corps, with a regional office located in Buffalo, is responsible for issuing permits for filling of wetlands under Section 404 of the federal Clean Water Act. They also perform maintenance dredging of federal navigation channels including the Genesee River and Irondequoit Bay and regulate dredging by others. The Corps also does feasibility studies on many projects that affect the water including flooding and surge, monitors Lake Levels in Lake Ontario and works with the International Joint Commission to regulate lake levels.

National Oceanic and Atmospheric Administration (NOAA): This federal agency is a source of information on the effects of human activities on environmental quality. One NOAA responsibility, together with the U.S. Envioronmental Protection Agency, is to guide and approve State Coastal Nonpoint pollution control programs.

U.S. Department of Agriculture Soil Conservation Service (SCS) and Agricultural Stabilization and Conservation Service (ASCS): These two agencies work together to prepare conservation plans for agricultural lands and to cost share the implementation of best management practices to protect soil and water quality.

International:

International Joint Commission(IJC): The IJC regulates Great lakes water levels and carries out the activities outlined in the Great lakes Water Quality Agreement by convening meetings and preparing reports. Under the auspices of the IJC, a declaration of intent between four parties (NYSDEC, USEPA, Environment Canada, and the Ontario Ministry of the Environment) has resulted in a toxic management plan for lake Ontario.

The planning jurisdictions with the most immediate effect on water quality in the embayment are local planning boards at the municipal level, because their actions affect the most proximate and intense land uses. The New York Department of State, Army Corps of Engineers and NYSDEC have some jurisdiction over coastal lands adjacent to the embayment.

NATURAL FEATURES

The natural features of the AOC relate most strongly to the dominant characteristics of the shoreline: extensive low lying wetlands west of the river and steep bluffs to the east. There are three distinct shoreline types: low-lying sand beaches; narrow, non-sand beaches; and wetlands.

The sand beaches are found along the western shore of the embayment and further west. They include:

1. Hamlin Beach State Park (west of the embayment) where sands are stabilized by jetties and replenished by erosion of the Devil's Nose headland, farther to the west.

2. Bogus Point, a largely low-lying littoral spit (small point of land or a narrow shoal projecting into a body of water from the shore) where the offshore bathymetry provides protection and permits an apparently stable beach.

3. Ontario Beach, on the west side of the river jetties, which has a public beach developed for swimming.

4. Durand Eastman beach, part of 10,000 feet of park lake frontage. Natural topography is rolling with several natural drainage ways extending across it carrying small stream flows to the lake. The shoreline has a narrow sand beach.

Non-sand beaches line the shore at the toe of steep slopes on the east:

1. Webster Park with a total lake frontage of about 2000 feet in length, has a high bluff section of shoreline with a ravine cut at its eastern edge by a small stream. The toe of the bluff is stabilized by rubble. The bluff deposits are mapped by the Surficial Geologic Map of New York as lacustrine deposits of silt and clay. There is no beach at the shoreline. The offshore area is relatively steep and rocky with no established offshore bar or beach.

2. Nine Mile Point has a single beach at the toe of an eroding high bluff. The foreshore is steep and there is no sign of any sand deposits either on the beach or immediately offshore of the toe and of the bluff. Bluff materials appear to be primarily lacustrine silts and clays which are sand and gravel deficient.

The major wetland areas include:

1. The Braddock Bay Area in the Lake Ontario West Basin (see Figure 2-3) is an extensive area of ponds and marshes that is actively managed for fish and wildlife production. Five thousand acres of wetlands, sections of which are designated wildlife refuges, provide critical spawning and nesting habitat for a wide variety of fish and birds, including several species listed as endangered or threatened. It is particularly noted as a viewing area for migrating birds. This is one of the largest and most significant coastal wetlands on Lake Ontario. In some areas, there is conflict between recreational boating use and use of the wetland for wildlife habitat. It should also be noted that the entire shoreline area from the Genesee River west to Hamlin Beach State Park is dotted with wetlands.

2. In the Lake Ontario Central Basin (Figure 2-4), Irondequoit Bay was originally formed as the entrance bay of the Genesee River into the ancestral Lake Iroquois. The river has redirected its flow to the present day channel through Rochester and the sand bar at the mouth of the bay has grown and moved bayward with subsequent rises in the level of the lake. The bay is eutrophic: rich in organic matter and nutrients. Near the center its depth exceeds 50 feet, but the northern and southern ends of the bay are quite shallow. Although its waters open to the lake, the opening is narrow and allows little mixing to occur. Along the shoreline and at the south end of the bay, (the mouth of Irondequoit Creek), are extensive wetlands, which serve as important fish spawning and waterfowl nesting areas. Irondequoit Creek and its tributaries provide unique spawning habitat in a suburban setting.

3. The Lower Genesee River has extensive areas of wetlands in and south of the Turning Basin (shown on Figure 2-10. It is a significant salmon movement area, and a productive warm water fishery. However, the species of fish are limited to those which tolerate high turbidity. The wooded gorge is an important wildlife habitat within this intensively developed urban area.

Fishery Resources:

Salmon stocking by the DEC has created an important recreational fishery in Lake Ontario and its major tributaries. In 1990, a total of 270,000 chinook salmon, 20,000 steelhead (lake-run rainbow trout) and 25,000 coho salmon were stocked in the Genesee River. An additional 32,000 brown trout were stocked directly to Lake Ontario in the vicinity of the Kodak Water Treatment Plant (NYSDEC, unpubl.b). However, the New York State Department of Health (DOH) has issued a health advisory on eating salmonids from Lake Ontario because their flesh contains potentially harmful levels of some chemical contaminants. The DOH recommends that all lake trout and chinook salmon, as well as larger sized coho salmon, steelhead and brown trout not be eaten. Smaller sized coho salmon, steelhead and brown trout should be eaten no more than once per month (NYSDOH, 1993). For further information on the fish advisory, see Chapter 4, section 1d.

The Zebra mussel, an exotic species, introduced into the Great Lakes by international shipping, is proliferating in the absence of predators. It is having an impact on the AOC. These impacts include impacts on the sport fishery (competition for food), improvement in water clarity, and actions necessary by humans to prevent water intakes from becoming clogged with zebra mussels.

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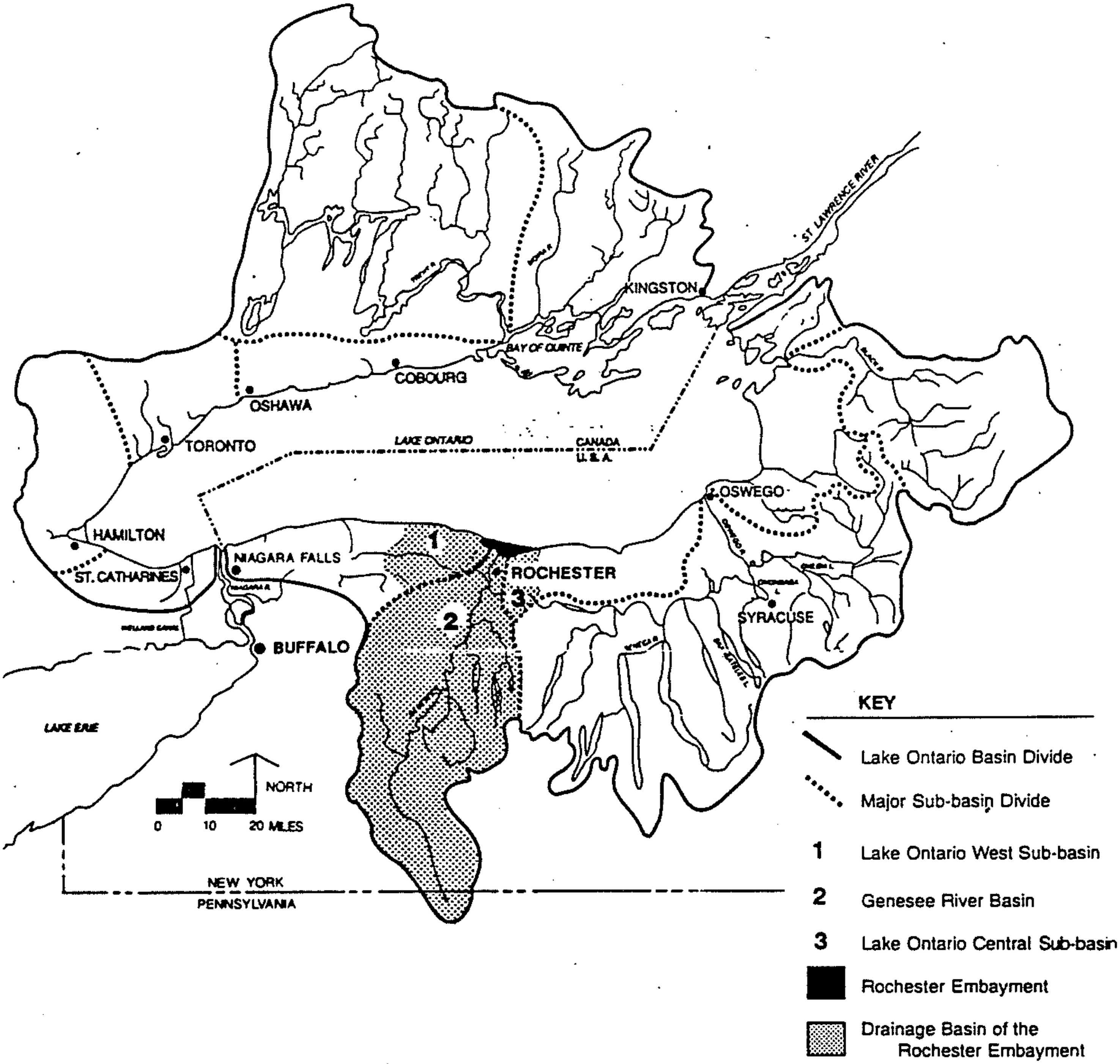


FIGURE 2-1. LOCATION MAP: ROCHESTER EMBAYMENT AREA OF CONCERN AND ITS DRAINAGE BASIN.

Source: Lake Ontario Toxics Management Committeee (1989) (modified)

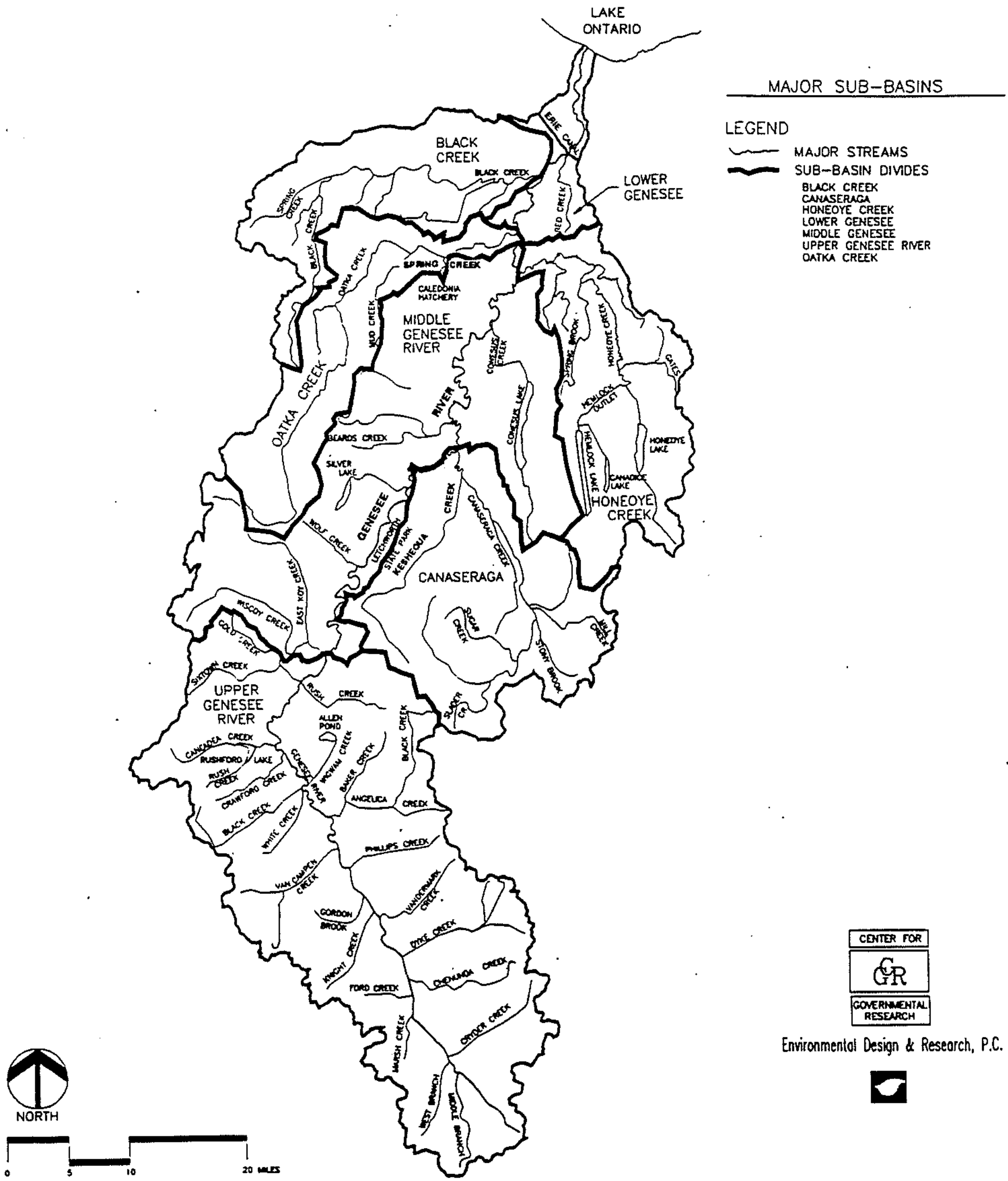


FIGURE 2-2. GENESEE RIVER BASIN

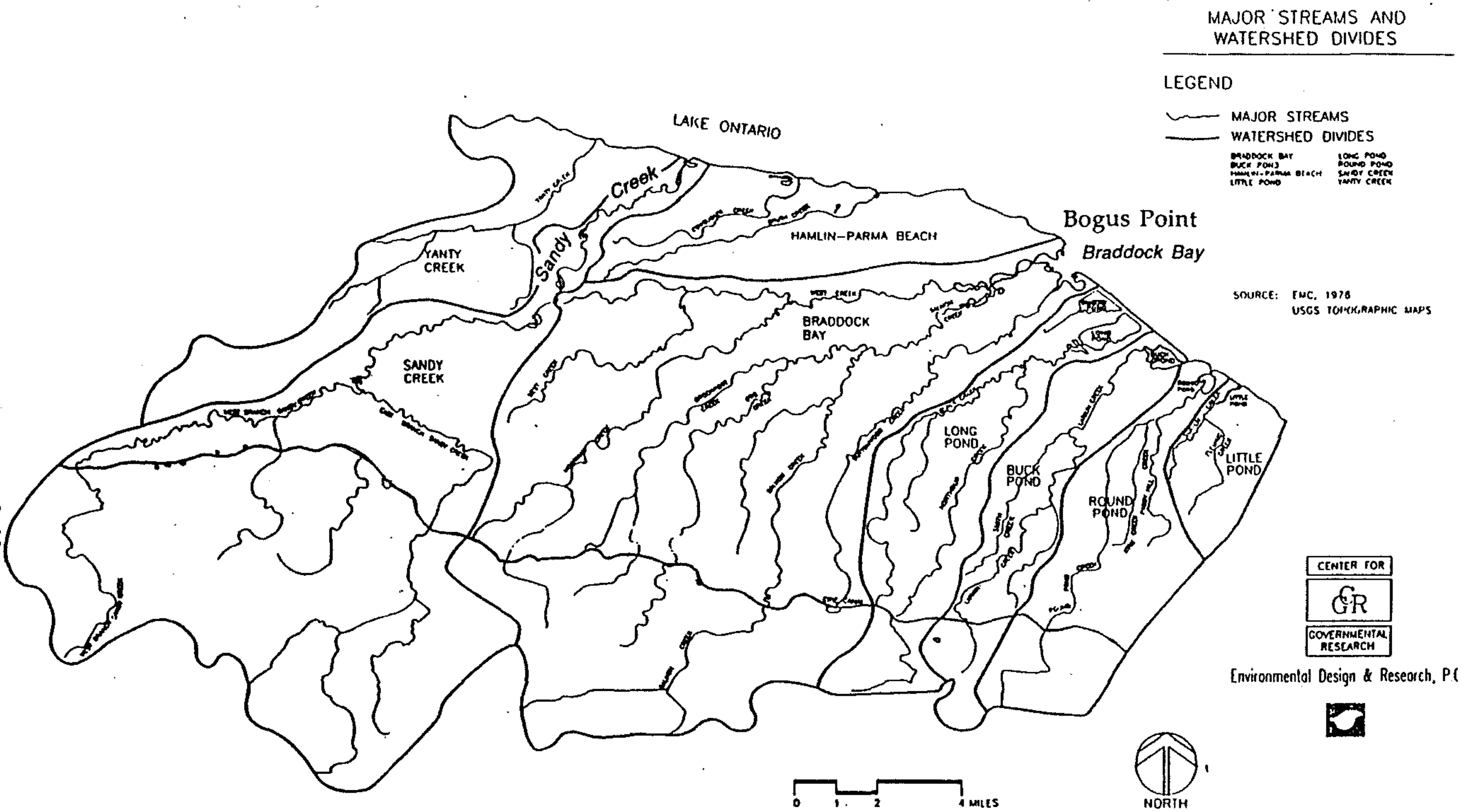


FIGURE 2-3. LAKE ONTARIO WEST SUB-BASIN

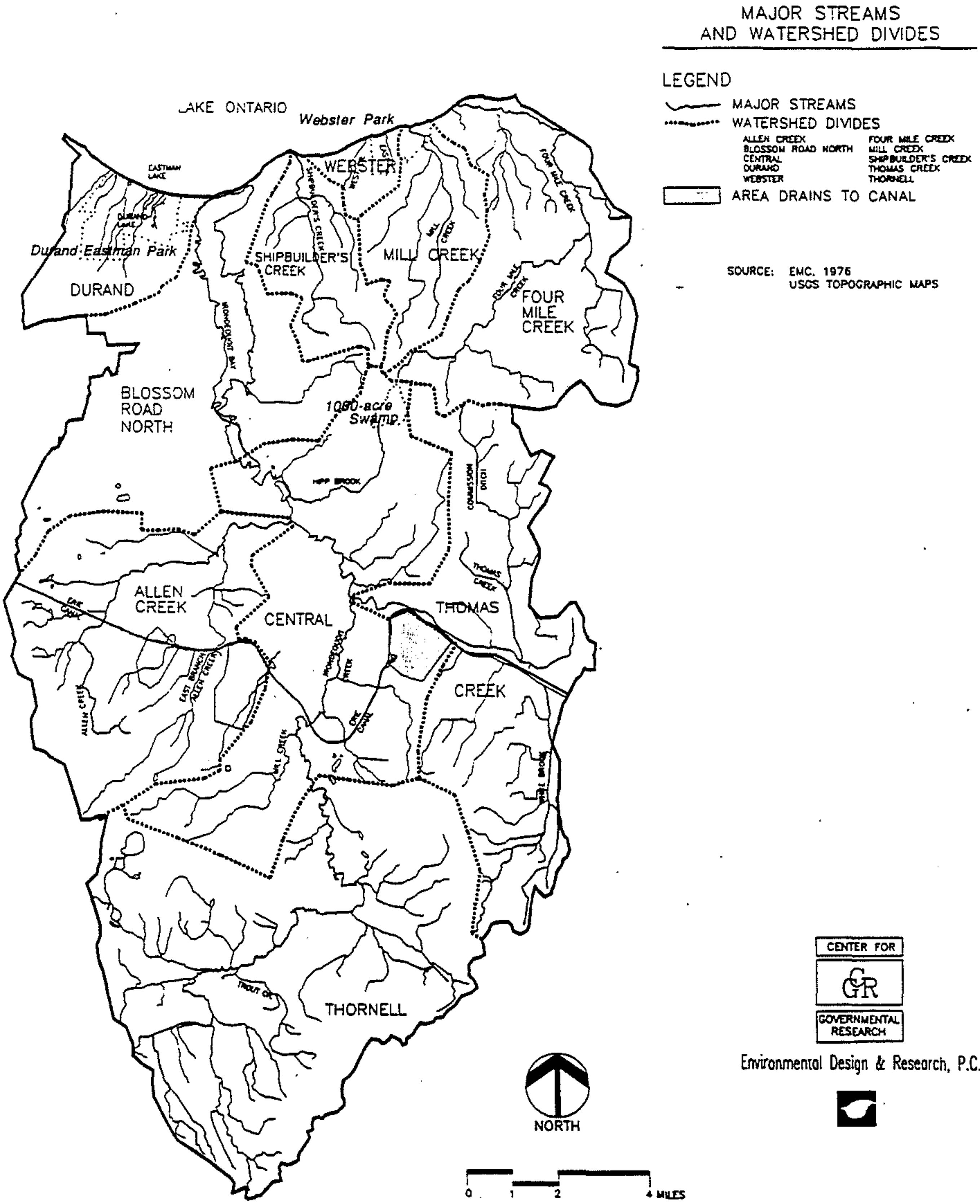


FIGURE 2-4. LAKE ONTARIO CENTRAL SUB-BASIN

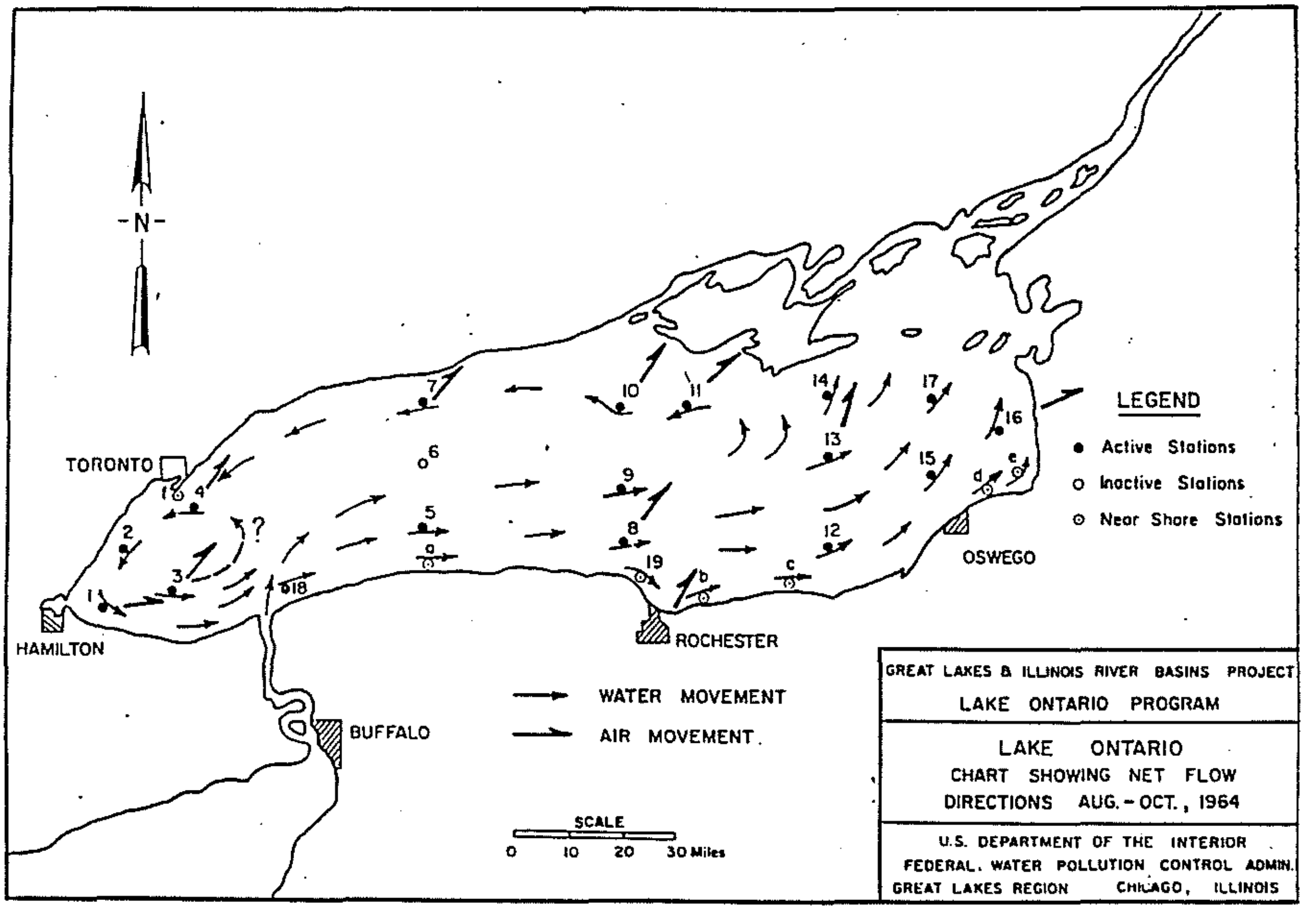


FIGURE 2-5. NET FLOW DIRECTIONS IN LAKE ONTARIO, AUGUST - OCTOBER

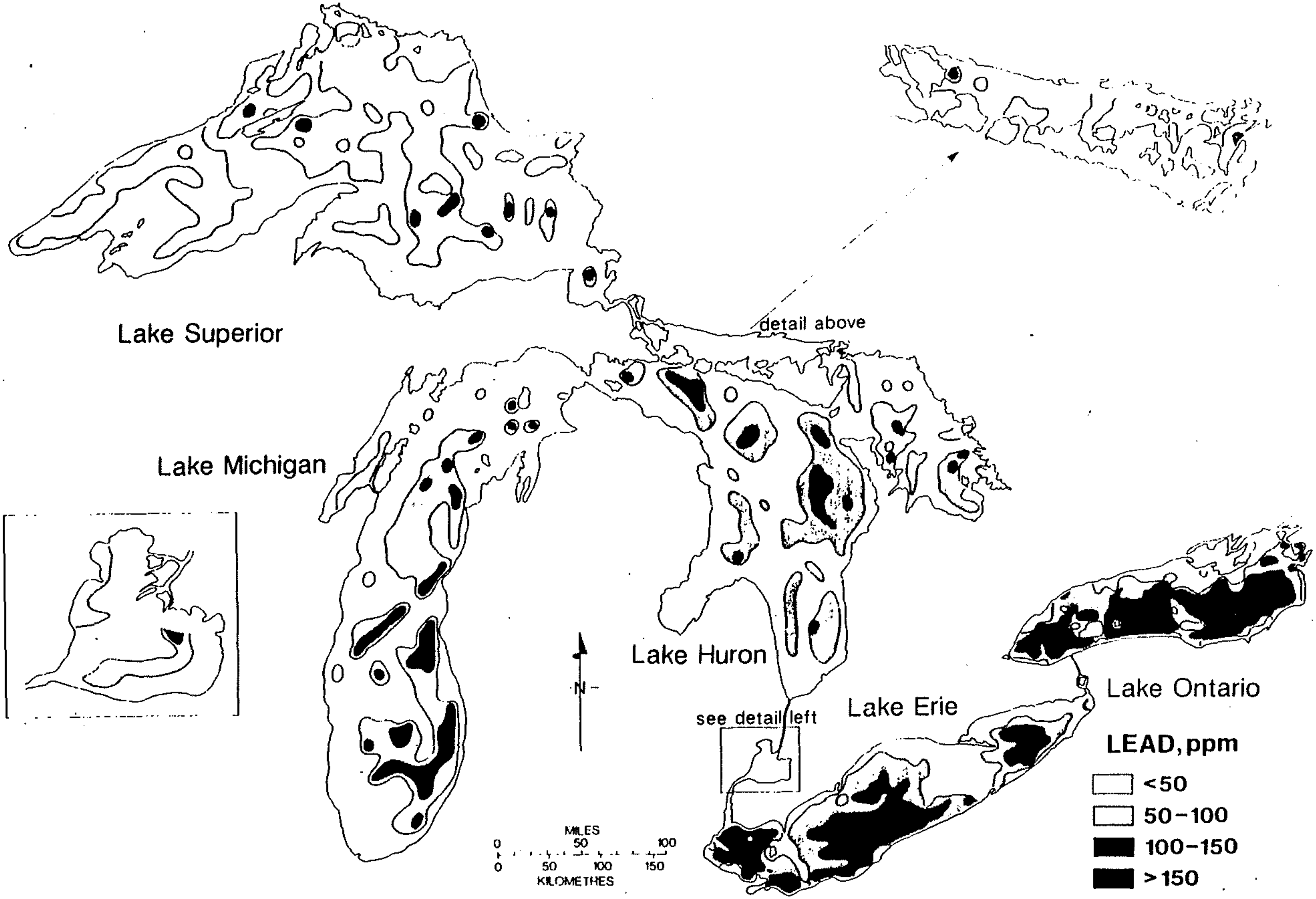
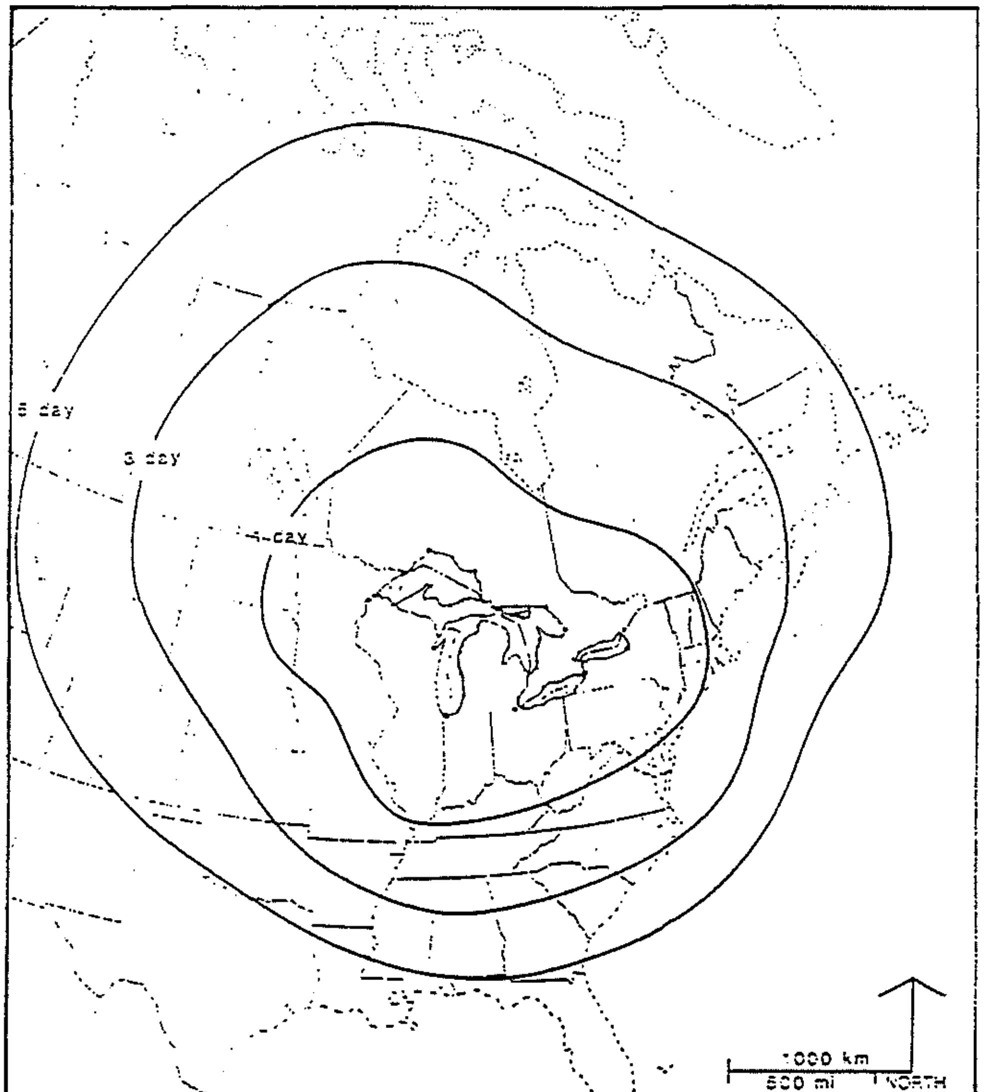


FIGURE 2-6.
LEAD CONCENTRATIONS IN SURFACE SEDIMENTS OF THE GREAT LAKES.

From: Great Lakes Science Advisory Board (1979).



Atmospheric Region of Influence for the Great Lakes Basin

Lines of the median location of an air parcel which would reach the Great Lakes Basin within the number of days shown. For example, the 3-day line indicates that it would take approximately three days for an air parcel to travel from a location on that line to the closest point on the Great Lakes.

FIGURE 2-8.
ATMOSPHERIC REGION OF INFLUENCE FOR THE GREAT LAKES BASIN

From: International Air Quality Advisory Board (March, 1988).

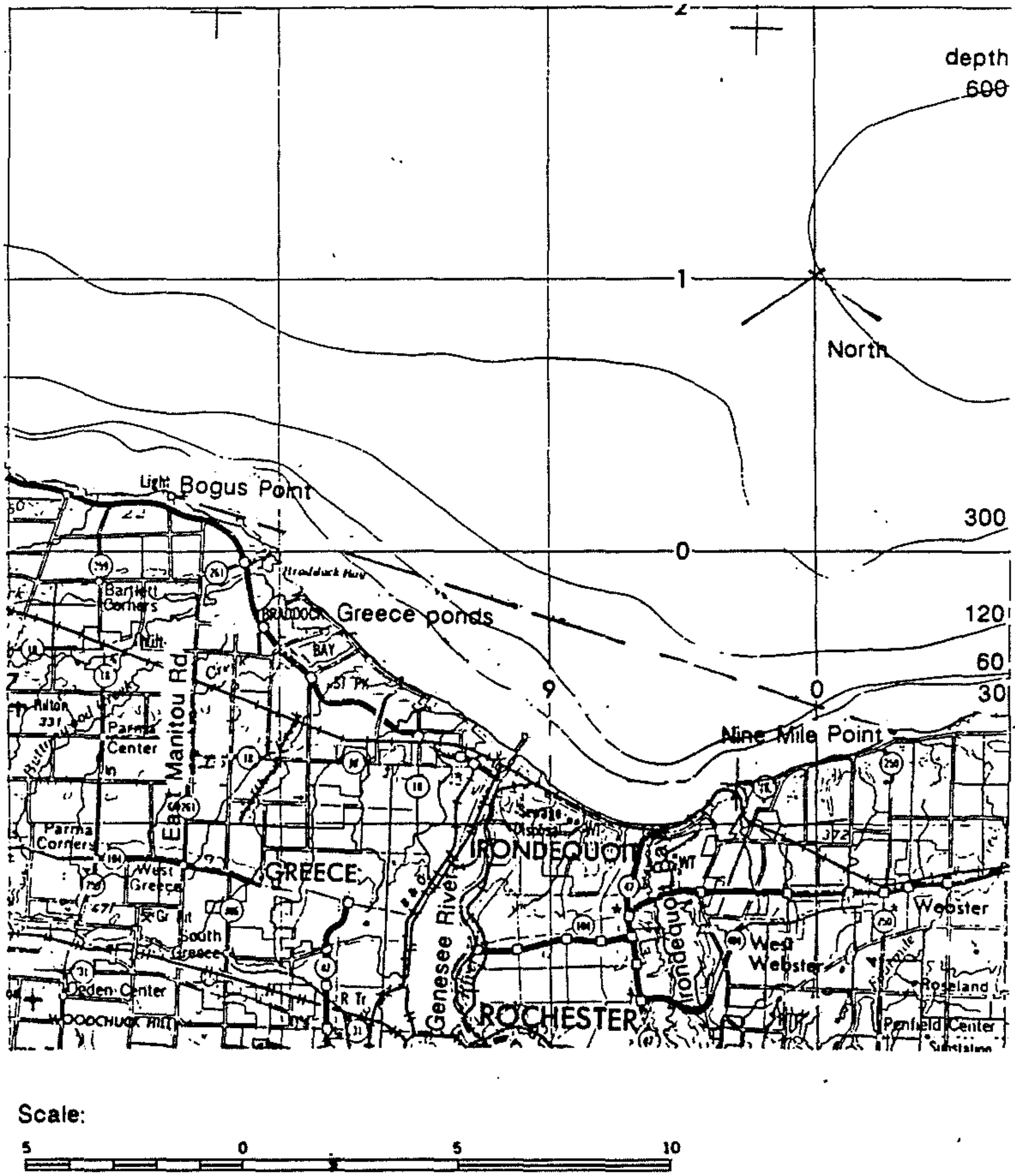
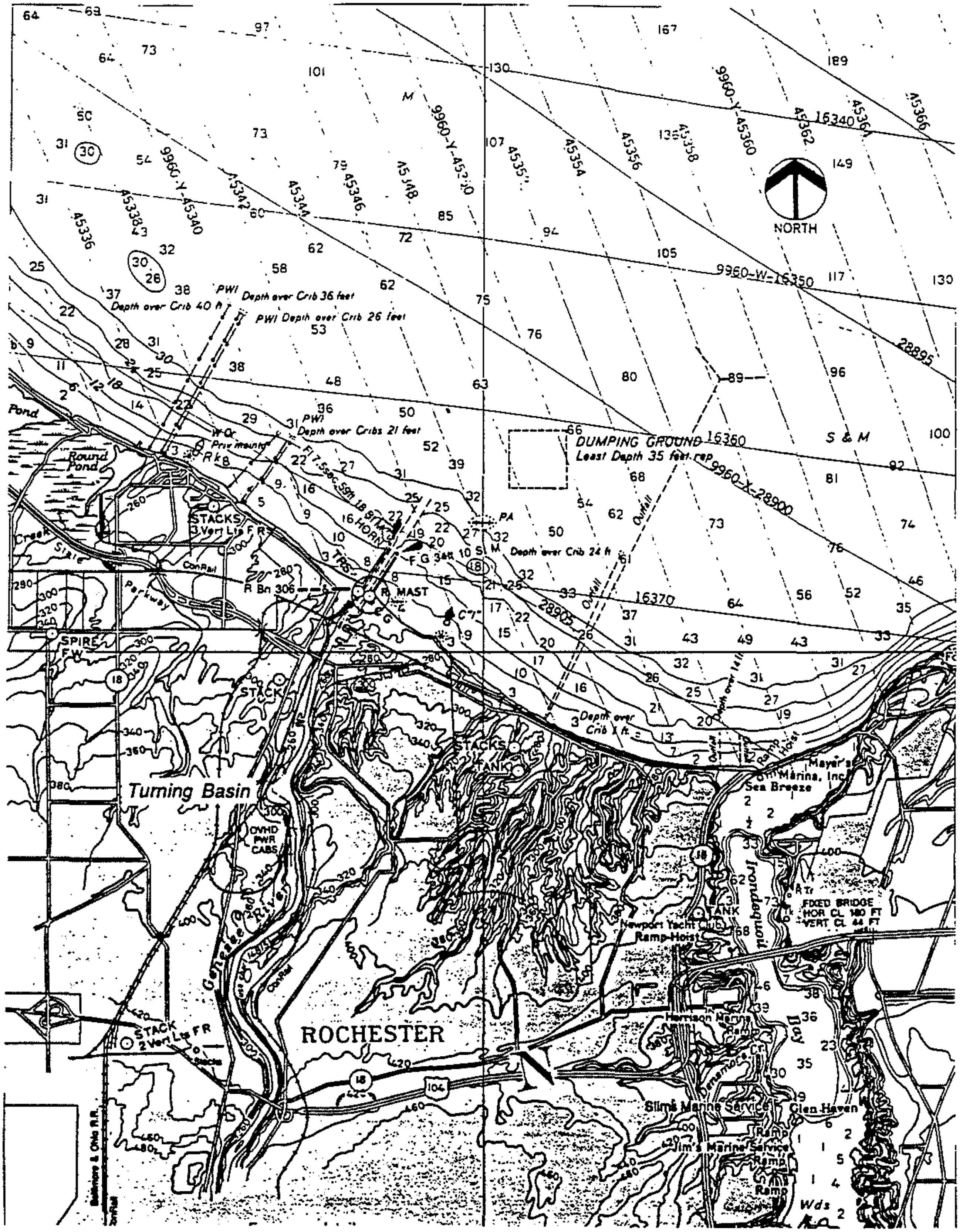


Figure 2-9: DETAIL OF LAKESIDE PORTION OF ROCHESTER EMBAYMENT AREA OF CONCERN: Bogus Point to Nine Mile Point



SCALE

1 Mile

FIGURE 2-10. ROCHESTER HARBOR

From: National Oceanic and Atmospheric Administration, National Ocean Service (1990).

CHAPTER 3
WATER USE AND QUALITY GOALS AND OBJECTIVES

The Rochester Embayment Remedial Action Plan is being prepared to address water quality problems that are impairing the beneficial uses of the water in the embayment. Many actions have already been taken to improve and protect water quality and restore beneficial uses in the AOC. This chapter is intended to describe the water quality goals relating to human and biological uses of the AOC. It will also outline goals to restrict or discontinue uses in order to improve water quality, and goals for new uses that could be added or restored in the future.

A. Existing Uses of the Rochester Embayment of Lake Ontario

1. Existing Human Uses

a. Recreation

Recreation is one of the primary uses of the AOC. Because the City of Rochester developed around the falls of the Genesee River and later around the Erie Canal, the lakefront was never industrialized as it was in many other Great Lakes cities. As a result, parks, marinas and private homes border the waterfront.

(1) Waterfront Recreation

Braddock Bay, Ontario Beach, Durand Eastman and Webster are the large lakefront parks along the embayment. The steep banks of the Genesee gorge are bordered by Maplewood, Turning Point, and Seneca Parks (see Figure 3-1).

According to the County's Waterfront Recreation Opportunities Study (EDR, 1989), existing and designated uses in the embayment area include 13 marinas and yacht clubs, 13 boat launch sites, 7 established fishing access sites, 5 areas with hiking trails, one campground, one amusement park, and one swimming beach. Many recreational opportunities also exist at Hamlin Beach State Park, west of the embayment. Primary contact recreation other than swimming includes waterskiing and surfing.

(2) Swimming

Ontario Beach Park, located on Lake Ontario immediately west of the mouth of the Genesee River, is the only location along the embayment where public swimming is permitted. A beach water quality model has been developed by the Monroe County Department of Health to determine when the beach should be closed. A water quality sampling program has been continued in order to verify or modify beach closure criteria. The beach is closed when the model predicts that water clarity or fecal coliform bacteria make the beach unsuitable for primary contact recreation.

(3) Boating

As of 1987, there were over 26,000 boats registered in Monroe County, and the number had grown 30% in the previous ten years. Over 90% of the boats were small (less than 26 feet long). More boats are registered to Monroe County residents than to residents of any other New York county except for Nassau and Suffolk on Long Island (EDR, 1989). Rochester Harbor had the greatest number of the boat slips in the county, not including those at private homes and cottages. Many of the boats that dock at nearby locations, such as Irondequoit Bay, also use the waters of the embayment extensively.

(4) Fishing, Hunting, and Trapping

Fishing is a popular activity in the AOC for residents and tourists. Over 70,000 fishing licenses are sold annually in Monroe County, and several charter boat services operate. Popular species caught in the area include trout and salmon (which are stocked by NYSDEC), perch, largemouth and smallmouth bass, northern pike, sunfish, and bullheads. The Empire State Lake Ontario (ESLO) Trout and Salmon Derby, based in Rochester, draws thousands of anglers and their boats to Monroe and six other counties three times a year (EDR, 1989; Rochester/Monroe County Convention and Visitors Bureau, no date).

The area near the Lower Falls of the Genesee River is a particularly attractive fishing spot during the salmon runs in the spring and fall.

For some segments of Rochester's population, local fish apparently represent a regular portion of the diet. These fish are usually caught along the shore or acquired from friends or unlicensed fish vendors. Concern has been expressed to the Monroe County Water Quality Management Advisory Committee that some residents, primarily in Rochester's Black, Asian and Hispanic communities, are consuming unsafe quantities and varieties of fish. The County is attempting to provide better information about the NYSDOH fish consumption advisory, due to toxic chemicals in Lake Ontario fish, and to provide suggestions about reducing the hazards that may accompany ingestion of contaminated fish.

Hunting of waterfowl also occurs along the Lake Ontario shoreline as does trapping of muskrats, raccoon, fox, and beaver. Hunting is popular throughout the AOC watershed for deer, small game, turkeys, and grouse.

b. Receiving Water for Wastewater

Wastewater discharges are discussed in Chapter 2, and will be addressed in greater detail in Chapter 5 (Identification of Pollutant Sources).

Wastewater enters the embayment via rivers and streams throughout the drainage basins, and from permitted discharges flowing directly into the embayment. The only permitted dischargers into the Genesee River below the lower falls are Kodak and several combined sewer overflows. Kodak, with a treated wastewater discharge averaging over 26 million gallons per day, is the largest industrial discharger (except for cooling water dischargers) in the watershed of the embayment. However, it should be noted that other permitted wastewater dischargers exist upstream in the Genesee, Lake Ontario West, and Lake Ontario Central basins and they may have an impact on the lower Genesee and/or the embayment.

There are no direct discharges of wastewater into the Rochester Embayment of Lake Ontario itself. (See Chapter 2 for a definition of the bounds of the embayment). Discharging into the lake near or beyond the outer limits of the embayment are the Monroe County Van Lare wastewater treatment plant, the Northwest Quadrant wastewater treatment plant, and the Town of Webster wastewater treatment plant.

Since at least 1970, the embayment has been used as a dump site for annual sediment dredging of the Genesee River channel sponsored by the U.S. Army Corps of Engineers (Figure 2-10.)

The Monroe County Pure Waters Master Plan report (1969), which set forth the ongoing process of consolidating and improving the treatment of wastewater in the county, identified Lake Ontario and the Genesee River as the only local water bodies judged to have enough conventional pollutant assimilation capacity to be receiving waters for wastes. Treatment plant discharges to smaller streams were to be phased out as soon as possible, with elimination of discharges to the Genesee as a long-term goal. At the same time, the report described the Rochester Embayment as an inappropriate site for major wastewater discharges due to the tendency of the winds and currents to bring wastewater back to shore instead of into the open lake. Plan implementation included relocating the outfall of the Van Lare wastewater treatment plant to the outer limits of the embayment, and the Combined Sewer Overflow Abatement Program to reroute combined sewage from the City of Rochester to the Van Lare plant instead of allowing it to discharge to the Genesee River and Irondequoit Bay.

The Pure Waters Master Plan also called for industrial effluents, except for cooling water and process water relatively free of pollutants, to be discharged to municipal treatment plants. This goal has not been fully realized; however, Monroe County does have an industrial wastewater pretreatment program that regulates industrial users of the public sewer system.

The discharge of wastewater to the most appropriate receiving waters improves water quality locally. But for some pollutants, such as persistent toxics that bioaccumulate, the total loading to the Great Lakes system is of primary importance, and this is unaffected by relocation of the discharge.

In addition to the point source discharges mentioned above, the embayment is also the ultimate receiving water for non-point source pollution carried with stormwater runoff. Largely uncontrolled stormwater runoff flows to creeks and tributaries, eventually bringing silt, nutrients and chemical contaminants into the embayment.

c. Drinking Water Supply

The waters of Lake Ontario provide drinking water for over 700,000 residents served by the Monroe County Water Authority and some residents served by the City of Rochester Water Bureau. Water intakes are within the western portion of the Rochester Embayment offshore of the Town of Greece (see Figure 3-1).

d. Industrial Water Supply

Eastman Kodak and RG&E draw water from the lake through intakes in the western portion of the embayment offshore of the Town of Greece. Many other industries use water purchased from the City of Rochester or the Monroe County Water Authority. The availability of clean water is an extremely important asset to local industries and to the potential economic development opportunities in the area.

e. Commercial Navigation

Navigation in the embayment is almost entirely recreational. The only freight hauling is done by Essroc Materials, Inc., which has cement loading facilities on the western side of the Genesee River below the Lower Falls. It receives deliveries 45-50 times per year.

The Army Corps of Engineers maintains a navigation channel from 21 to 24 feet in depth in the river mouth and out into the lake in order to facilitate shipping (see Figure 3-1).

2. Existing Biological Uses

The support of an ecological community is recognized as an important use of the embayment both for its own sake and because of the benefits it provides to humans.

The waters of the Rochester Embayment are considered eutrophic, in contrast to the mesotrophic waters along the coast on either side (EPA, 1988). The fishes inhabiting the embayment are more diverse than those of the open lake; the embayment supports warm and cool water species as well as the cold water fish common in the lake. Table 3-1 lists fish species found in the embayment offshore of Rochester Gas and Electric's Russell Station in 1976. With trophic changes in the lake since 1976, the same species are found in different proportions in 1993.

The New York Department of State has identified the lower Genesee River and Braddock Bay as two of 50 significant fish and wildlife habitats along the Great Lakes and St. Lawrence River within the state. Both of these areas contain wetlands, which are essential breeding grounds, feeding areas and habitats for many types of fish and wildlife.

The Genesee River significant habitat is the segment from the Lower Falls to the mouth. Here the waters are slow-moving and mingle with those of the lake. The banks below the falls are steep and wooded, with little development, and within the gorge are extensive stands of emergent vegetation. Further toward the mouth, however, the river is diked and surrounded by dense development.

The Coastal Fish and Wildlife Habitats Program (New York Department of State 1991b) describes the lower Genesee River as follows:

> The Genesee River is a highly productive warmwater fisheries habitat, supporting concentrations of many resident and Lake Ontario based fish species. Among the more common resident species are smallmouth bass, brown bullhead, northern pike, channel catfish, walleye, carp, and white sucker. Lake-run species found in the Genesee River include white bass, yellow perch, white perch, smelt, sheepshead, rock bass, and American eel. These fish populations are supplemented by seasonal influxes of large numbers of trout and salmon. In the spring, steelhead run up the river, and lake trout occur at the mouth. In fall, concentrations of coho and chinook salmon, brown trout, and steelhead, are found throughout the river during their spawning runs. The salmonid concentrations in the Genesee River are among the highest occurring in tributaries of Lake Ontario, and are largely the result of an ongoing effort by the NYSDEC to establish a major salmonid fishery in Lake Ontario through stocking.
>
> Wildlife use of the Genesee River is not well documented, but appears to be limited to those species that can inhabit a relatively narrow riparian corridor, and are somewhat tolerant of human activities in adjacent areas. Possible or confirmed bird species include mallard, wood duck, great horned owl, red-tailed hawk, spotted sandpiper, belted kingfisher, red-winged blackbird, swamp sparrow, and various woodpeckers and woodland passerine birds. Several beaver colonies inhabit the lower Genesee... Spotted salamander (SC)[1] and spotted turtle (SC) have been observed in the Lower Genesee River Gorge but the extent of use by these

1 (SC) = species of special concern; (T) = threatened; (E) = endangered.

species is not well documented. Other wildlife species occurring in the area probably include racoon, muskrat, northern water snake, and painted turtle.

Braddock Bay and Salmon Creek are described as follows (New York Department of State, 1991a):

Braddock Bay and Salmon Creek comprise one of the largest and most important coastal freshwater wetland complexes in New York State. This area supports large concentrations of many fish and wildlife species. Throughout the year, Braddock Bay is a major concentration area for many species of migratory birds. From late winter through early spring, large concentrations of waterfowl congregate in the bays, including such species as canvasback, redhead, greater scaup, and Canada goose. Northern harriers (T), rough-legged hawks, short-eared owls (SC), and snowy owls commonly winter in the bay area. Probable or confirmed nesting species at Braddock Bay include green-backed heron, northern harrier, black tern (SC), least bittern (SC), American bittern, sedge wren (SC), Henslow's sparrow (SC), grasshopper sparrow (SC), eastern bluebird (SC), mallard, blue-winged teal, wood duck, Virginia rail, sora, common moorhen, and marsh wren. The abundance and diversity of breeding birds in this area is rare in the Great Lakes Plain ecological region. Extremely large numbers of hawks, herons, waterfowl, shorebirds, warblers, and other birds pass through the area during their spring and fall migrations. Approximately 60,000 raptors were observed moving through the Braddock Bay area during the spring of 1984, and 70,000 raptors during 1985, including bald eagle (E), golden eagle (E), and osprey (T).

Other fish and wildlife species found in Braddock Bay and Salmon Creek include muskrat, mink and racoon... Also found here are Jefferson salamander (SC) and spotted salamander (SC). A very diverse fishery exists in Braddock Bay and Salmon Creek. Warmwater fish species present include white sucker, smallmouth bass, largemouth bass, white perch, and brown bullhead. The bay provides one of the few areas in western Lake Ontario where northern pike and largemouth bass spawn. Coldwater fish species found in the bay and in Salmon Creek include chinook and coho salmon, brown trout, and steelhead. These salmonids migrate into Salmon Creek to spawn (although unsuccessfully in most instances) (New York Dept. of State, 1991a).

Slater Creek, Sandy Creek, and Irondequoit Bay and Creek have also been identified as significant habitats. They are considered in further detail in the individual basin plans.

B. Goals

Goals and objectives for water bodies are contained in the Great Lakes Water Quality Agreement and in laws and policies of the federal, state and local governments. The Monroe County Water Quality Management Advisory Committee (WQMAC) has developed locally-oriented goals as part of the RAP process. Appendix B compares the goals and objectives of the Great Lakes Water Quality Agreement to some of the most relevant state, federal and local policies.

1. General Goals

a. Federal and State Laws Supporting Water Quality

A number of federal and state laws establish goals for water pollution control and coastal protection that are directly applicable to the RAP. These goals are quoted directly in this section. Note that although clean water and coastal management laws have similar goals of protecting natural resources, the water laws have extensive regulatory powers while the coastal zone laws are primarily advisory and are carried out by means of Local Waterfront Revitalization Plans (LWRPs).

(1) Water Pollution Prevention and Control, U.S. Code Title 33 Section 1251 (Clean Water Act):

> To restore and maintain the chemical, physical, and biological integrity of the Nation's waters.
>
> The discharge of pollutants into navigable waters [should] be eliminated.
>
> Wherever attainable, an interim goal of water quality which provides for the protection and propagation of fish, shellfish and wildlife and provides for recreation in and on the water [should] be achieved.

(2) Coastal Zone Management Act, U.S. Code Title 16 Section 1452:

> To preserve, protect, develop, and where possible, to restore or enhance, the resources of the Nation's coastal zone for this and succeeding generations.

("Coastal zone" refers to coastal waters and adjacent shorelands. All Great Lakes and connecting bays, estuaries etc. within the U.S. are defined as coastal waters.)

(3) New York Environmental Conservation Law, ECL 15-1501:

> To control and conserve State water resources for the benefit of all inhabitants of state, and public right to benefit of such resources.

(4) New York Environmental Conservation Law, ECL 17-0101:

> To maintain reasonable standards of purity of the waters of the state consistent with public health and public enjoyment thereof, the propagation and protection of fish and wild life [sic], including birds, mammals and other terrestrial and aquatic life, and the industrial development of the state, and to that end require the use of all known available and reasonable methods to prevent and control the pollution of the waters of the state of New York.

New York Environmental Conservation Law, ECL 17-1401:

> To safeguard the waters of the state from nonpoint source pollution by controlling and abating new and existing sources of nonpoint source pollution.

(5) New York State Waterfront Revitalization and Coastal Resources Act:

> To achieve a balance between economic development and preservation that will permit the beneficial use of coastal resources while preventing loss of living marine resources and wildlife, diminution of open space areas and public access to the waterfront, shoreline erosion, impairment of scenic beauty, or permanent adverse changes to ecological systems.

(6) New York State Freshwater Wetlands Act, ECL 24-0403:

> To preserve, protect and conserve freshwater wetlands and the benefits derived therefrom, to prevent the despoliation and destruction of freshwater wetlands, and to regulate use and development of such wetlands to secure the natural

benefits of freshwater wetlands, consistent with the general welfare and beneficial economic, social and agricultural development of the state.

(7) Other Applicable Legislation

Great Lakes Critical Programs Act (1990): Calls for the Administrator of the U.S. EPA to prepare a proposed water quality guidance for the Great Lakes system by June 30, 1991 to conform to the policy objectives and provisions of the Great Lakes Water Quality Agreement.

Nonindigenous Aquatic Nuisance Prevention and Control Act (1990): Calls for prevention of the introduction of exotic species into the Great Lakes. Includes the Great Lakes Fish and Wildlife Restoration Act, which seeks to protect and restore fish habitat.

Many other state and federal laws, particularly those dealing with hazardous waste management, have some bearing on the RAP as well.

b. Goals for Lake Ontario and the Area of Concern

Goal statements are quoted below from the Great Lakes Water Quality Agreement, the Lake Ontario Toxics Management Plan, state documents, and documents from Monroe County and the City of Rochester.

(1) Great Lakes Water Quality Agreement. International Joint Commission, 1978 (amended 1987). The Great Lakes Water Quality Agreement calls for pollution control activities covering point sources (including shipping), nonpoint sources, atmospheric sources, and in-situ sources (sediments). Its stated goals are as follows:

> The purpose of the Parties is to restore and maintain the chemical, physical, and biological integrity of the waters of the Great Lakes Basin Ecosystem. In order to achieve this purpose, the Parties agree to make a maximum effort to develop programs, practices and technology necessary for a better understanding of the Great Lakes Basin Ecosystem and to eliminate or reduce to the maximum extent practicable the discharge of pollutants into the Great Lakes System.
>
> Consistent with the provisions of the Agreement, it is the policy of the Parties that:
>
> (a) The discharge of toxic substances in toxic amounts be prohibited and the discharge of any or all persistent toxic substances be virtually eliminated;
>
> (b) Financial assistance to construct publicly owned waste treatment works be provided by a combination of local, state, provincial, and federal participation;
>
> (c) Coordinated planning processes and best management practices be developed and implemented by the respective jurisdictions to ensure adequate control of all sources of pollutants.

(2) Lake Ontario Toxics Management Plan, 1991 Update. Lake Ontario Secretariat. 1991. The Lake Ontario Secretariat was formed in 1987 by the EPA, NYSDEC, Environment Canada and the Ontario Ministry of the Environment. The plan's stated goal is as follows:

> The goal of the Lake Ontario Toxics Management Plan is a lake that provides drinking water and fish that are safe for unlimited human consumption and that

allows natural reproduction, within the ecosystem, of the most sensitive native species, such as bald eagles, ospreys, mink and river otter.

(3) New York State 25-Year Plan for the Great Lakes. New York State Department of Environmental Conservation. June, 1992. Four of the plan's six goals are water-quality related. They are:

Achieve chemical, physical and biological integrity of the waters of the Great Lakes to improve and sustain healthy diverse plant and animal communities and provide for safe public use and benefits.

Manage the Basin's water resources to meet current and future human and ecosystem needs, recognizing its true value (costs) and major uncertainties regarding its abundance, levels and impacts.

Ensure that natural and cultural resources of the ecosystem are managed to achieve healthy and diverse biological communities, and compatible coastal uses and benefits.

Achieve environmentally sustainable economic development through ecologically sensitive public and private decisionmaking that balances social, economic and environmental concerns.

(4) New York Coastal Management Program. New York Department of State.

The Coastal Management Program is intended to carry out the intent of state and federal coastal zone legislation. It has 44 policies, which local communities adapt to their own circumstances in preparing their Local Waterfront Revitalization Plans. Four of those most relevant to the RAP are listed below:

Significant coastal fish and wildlife habitats shall be protected, preserved, and, where practical, restored so as to maintain their viability as habitats.

Expand recreation use of fish and wildlife resources in coastal areas by increasing access to existing resources, supplementing existing stocks and developing new resources. Such efforts shall be made in a manner which ensures the protection of renewable fish and wildlife resources and considers other activities dependent on them.

Activities or development in the coastal areas will be undertaken so as to minimize damage to natural resources and property from flooding and erosion and by protecting natural protective features including beaches, dunes, barrier islands and bluffs.

Protect, maintain and increase the levels and types of access to public water-related recreation resources and facilities so that these resources and facilities may be fully utilized by the public in accordance with reasonably anticipated public recreation needs and the protection of historic and natural resources.

Recommendations of the Governor's Task Force on Coastal Resources (1991) build upon these and other goals with specific actions that could help meet the goals.

(3) Monroe County Goals

Goal and objectives from "Environment: A Policy Element of the Monroe County Comprehensive Development Plan," Sept., 1978:

To protect and improve the general well-being of present and future residents of Monroe County by preserving and enhancing the natural features of the environment.

To bring under control the pollution of water resources in Monroe County.

To protect from adverse development or uses the important land resources of Monroe County, including wetlands, floodplains and drainageways, woodlands, areas of steep slopes and erosive soils, and the Lake Ontario shoreline and its associated bays and ponds.

Pure Waters Master Plan Report, 1969:
The Pure Waters Master Plan was prepared by the County Pure Waters Agency. Its goal is the same as that of state law for water pollution control (see ECL 17-0101 in the previous section). Individual programs intended to meet this goal include consolidating wastewater treatment facilities; eliminating discharges to smaller water bodies; and treating combined sewage and industrial waste at municipal facilities.

(5) City of Rochester Goals

Included among many goals and policies affecting the city's waterfront areas are the following:

From the Lower Genesee River Land Use Plan, City of Rochester, 1979:

Protect environmentally sensitive, natural features of the river area such as wetlands, waterfalls, wooded areas and gorge walls.

From the Local Waterfront Revitalization Plan (LWRP), City of Rochester, 1989:

The Genesee River shall be protected, preserved, and if necessary and practical, restored so as to maintain its viability as a habitat.

(For more information on specific goals, see the approved LWRP.)

D. Local Goals Developed in the RAP Process

The following goals and objectives for the Rochester Embayment have been developed by the Monroe County Water Quality Management Advisory Committee (WQMAC) as part of their work on this RAP. The Monroe County Water Quality Management Advisory Committee is the stakeholders group that has been advising throughout the RAP process. For further information on who the WQMAC is, see chapter 1.

The WQMAC used the following definitions for goals and objectives in the development of the following: Goals: A goal is a statement of purpose about the end result (desired state of being) of a proposed management activity. Objectives: An objective is a specific, quantifiable step that will lead to fulfilling the goal (statement of condition). Specific actions to achieve the goals and objectives will be included in the Stage II RAP.

These goals are consistent with the International Joint Commission's philosophy of virtual elimination of persistent toxic substances as stated in the Great Lakes Water Quality Agreement.

In the following objectives, "virtual elimination" or "elimination" refers to a process that must be negotiated among all affected parties in order to obtain reasonable and achievable results. For toxics, it is recognized that the most effective way to achieve this objective of virtual elimination is by dealing with the toxics at the source.

GOAL: Virtual elimination of toxic substances causing fish consumption advisories.

-Objectives:

Scheduled elimination of the releases and runoff of persistent toxic substances that necessitate health advisories for the Rochester Embayment of Lake Ontario

Continued monitoring of persistent toxic chemicals which are concentrated in the fish populations within the Rochester Embayment of Lake Ontario.

A formal system is in a place which mandates the coordination with other RAP jurisdictions in order to develop a schedule for eliminating the discharge of persistent toxic substances.

GOAL: Public beaches in the Rochester Embayment are open for swimming, based upon best available health and safety standards.

-Objectives:

Targeted reduction of beach closures due to human waste contamination of water.

Targeted reduction of beach closures due to stormwater runoff.

GOAL: Shorelines and waterways are free of aesthetically objectionable materials.

-Objectives:

Reduction of *Cladophora* (algae) and zebra mussels within the Rochester Embayment to below nuisance levels.

Continuous improvement of water clarity throughout the Embayment, including the lower Genesee River.

Virtual elimination of raw or untreated sewage discharges into the Embayment.

Maintenance of fisheries' trophic (food chain) relationships to minimize fish die- offs and fouled beaches.

Waterways free of debris, trash, oil and other visible pollutants.

GOAL: Contaminated sediments in the lower Genesee River have no negative impact upon the water quality and biota in the Rochester Embayment; sediment quality is suitable for open lake disposal.

-Objectives:

Dredging in the lower Genesee River is restricted to maintenance of established commercial and recreational channels.

Scheduled elimination of discharges of chemicals that contaminate sediments and harm aquatic life.

GOAL: Water and shore habitats within the Rochester Embayment support thriving fish and wildlife populations.

-Objectives:

Maintenance of all present water and shore habitats which are critical to aquatic and terrestrial organisms.

Prohibition of discharges into the Rochester Embayment which adversely affect aquatic habitats.

Public education programs which focus upon the importance of wetlands and other habitats necessary to support fish and wildlife populations.

GOAL: Diversity of plant and animal communities within the Rochester Embayment.

-Objectives:

Continuing maintenance and enhancement of animal and plant populations.

Self-sustaining populations of walleye, Lake trout, Hexagenia (Mayfly larvae), and fish eating birds and mammals (ospreys, mink, eagles),

Protective legislation, policies, and enabling powers for appropriate agencies in order to assure maintenance and enhancement of diverse and self-sustaining fish and wildlife populations.

GOAL: Drinking water produced from Lake Ontario has no unusual or unpleasant taste.

-Objective:

Minimal algae blooms in the Embayment.

GOAL: The benthic macroinvertebrate community (e.g. clams, worms, insect larvae, crayfish) in the lower Genesee River is not degraded by pollution.

-Objective:

Scheduled elimination of sources of sediment- associated toxic contaminants and other pollutants, including sediments that impede the survival of a healthy and diverse benthic macroinvertebrate community.

GOAL: The littoral zone (shoreline area) of the Rochester Embayment is mesotrophic (intermediate levels of algae production) rather than eutrophic (high levels of algae production).

-Objectives:

The biological community of the Embayment is mesotrophic, as indicated by USEPA lists of phytoplankton indicator species.

Scheduled elimination of point and non-point discharges that impede survival of a healthy and diverse planktonic community.

GOAL: **Water from the embayment and its tributary drainage basins which is used for agricultural and industrial purposes can be used with minimum added cost due to exotic species (zebra mussels, etc.).**

Since there are three watersheds (Lake Ontario West Basin, Lake Ontario Central Basin, and Genesee Basin) that drain into the Rochester Embayment of Lake Ontario, it is appropriate to list the following goals and objectives that were developed by the three citizen advisory subcommittees of the Water Quality Management Advisory Committee. These subcommittees are advising on the development of watershed plans for each of these three watershed basins:

LOCALLY-DEVELOPED WATER QUALITY GOALS FOR THE GENESEE BASIN

GOAL: **Streambank stabilization & erosion prevention.**

GOAL: **Maintenance of high quality of drinking water in the lakes that are used for that purpose.**

GOAL: **Maintenance of high water quality in streams and lakes in the Genesee Basin.**

GOAL: **Groundwater should be free of chemical contamination.**

-Objective:

Meet all relevant safety standards for drinking water.

GOAL: **Water quality should be able to support native fish populations.**

GOAL: **Preservation/enhancement of natural wetlands.**

-Objective:

Management of stormwater runoff from development in watersheds where there are wetlands.

GOAL: **Shorelines and waterways will be free of odors, and visible material that is injurious to fish and wildlife and that degrades water quality and its appearance.**

GOAL: **No accelerated eutrophication in lakes and streams.**

GOAL: **Sediments should be free from contaminants.**

GOAL: **Better information base on zebra mussels as they affect water quality and the food chain.**

GOAL: **Maintenance of navigable waters.**

-Objective:

Allocate federal funds for cleanup of waterways.

GOALS and OBJECTIVES FOR THE LAKE ONTARIO WEST BASIN

GOAL: **Shorelines and waterways are free of objectionable materials which degrade water quality and appearance.**

-Objectives:

No trash on shorelines or in waterways.

No oil on shorelines or in waterways.

No unnatural foam on shorelines or in waterways.

Maintain unobstructed stream flow (that may have been altered due to ice storm debris, litter, etc.).

GOAL: **Stabilized soil/reduced siltation.**

-Objective:

Stabilization of streambanks and reduction of erosion from bare or exposed soil (eg. construction sites).

GOAL: **Increased citizen awareness of water quality/environmental issues.**

-Objectives:

More public access to water for environmental education.

More public access to water for recreation purposes/land aquisition.

GOAL: **Preservation of natural wetlands/no net reduction of wetlands.**

-Objectives:

Maintain and protect present wetlands.

Creation of new wetlands.

GOAL: **Provide good fish and wildlife habitat.**

-Objective:

Maintain shorelines, wetlands, and waterways.

GOAL: **Improved communication between all parties involved in water quality management.**

-Objective:

Land use/water quality information exchange network.

GOAL: **Optimum water quality of streams, bays and ponds.**

-Objectives:

Control plant and algal growth in ponds and waterways.

Reduction of toxic substances in water bodies.

LAKE ONTARIO CENTRAL BASIN/IRONDEQUOIT BASIN WATER QUALITY GOALS & OBJECTIVES

GOAL: **Waterways free of debris, trash, oil, and other visible pollutants.**

-Objectives:

An inventory of sources of pollutants.

A sustainable debris removal and trash removal/prevention program.

Mitigation methods for sources that are difficult to control, e.g., nonpoint source pollutants.

Continuous improvement of water clarity in waterways of the Central/Irondequoit Basin.

Virtual elimination of raw or untreated sewage discharges into waterways.

GOAL: **Integrity of steep slopes and stream banks.**

-Objectives:

Land use plans which conform to best currently available information regarding maintenance of steep slopes, erosive soils, and sensitive vegetation.

Conservation, by public acquisition or protective agreements, of slopes and stream banks prone to erosion and unlikely to survive the usage restrictions possible on privately-owned land.

GOAL: **Ecological and aesthetic balance of Irondequoit Bay and waterways.**

-Objectives:

Appropriate mix of flora and fauna to achieve ecological balance.

Best attainable control of odor causing factors.

Environmental awareness of the value of wetlands, streams and other water bodies.

Preservation of natural wetlands and other sensitive areas.

Maintenance of all present water and shore habitats which are critical to aquatic and terrestrial organisms.

Dredging in Irondequoit Bay is restricted to maintenance of established commercial and recreational channels.

Minimal algal blooms in Irondequoit Bay and other waterways.

GOAL: Water entering streams, ponds, lakes and wetlands maintained at highest achievable quality.

-Objectives:

Continuing improvements in control over pollutants entering streams.

Improvements in stream standards which reflect up-to-date technological capability.

Goal: Fish caught in Irondequoit Bay and other waters in the Central/Irondequoit Basin watershed are safe to eat according to dietary standards which are generally accepted by the scientific community.

-Objectives:

Virtual elimination of discharges and runoff of persistent toxic substances that necessitate health advisories.

Continued monitoring of persistent toxic chemicals which are concentrated in fish populations.

Goal: The deep areas of Irondequoit Bay is mesotrophic (intermediate levels of plankton production) rather than eutrophic (high levels of plankton production).

-Objectives:

The biological community in deep areas of Irondequoit Bay is mesotrophic, as indicated by USEPA lists of phytoplankton indicator species.

Scheduled elimination of point and non-point discharges that impede survival of a healthy and diverse planktonic community.

2. Water, Sediment and Biota Guidelines and Objectives

Detailed objectives for the quality of water, sediment and biota in the U.S. have been developed by IJC, EPA and the Food and Drug Administration (FDA), and in New York by the NYSDEC and the New York State Department of Health (NYSDOH). They are based on the protection of human health and aquatic life.

The ambient standards with some regulatory basis are the NYSDEC water quality standards, which are used to develop effluent discharge permits, and the FDA standards, which are used to determine whether fish are suitable for human consumption, and the EPA/NYSDEC drinking water standards, which apply to treated water supplies and groundwater that is consumed untreated. Numerical standards work towards achieving the broad goals set forth in legislation and in the Great Lakes Water Quality Agreement, such as eliminating pollutant discharges or reducing them to the extent practicable.

a. Water Quality Guidelines

The Great Lakes Water Quality Agreement, in Annex 1, contains specific objectives for many water quality parameters. It also states that any organic compounds that are persistent and likely to be toxic should be present at a level below detection. A supplement to Annex I recognizes that detection levels will be subject to change as technology improves and new levels are adopted. The EPA has developed water quality criteria for a long and growing list of chemicals, but these criteria are not enforceable by the federal government. Instead, the Federal Clean Water Act, as amended, requires states to classify waters according to their best uses and to adopt substance specific water quality standards that support those uses. State standards are to be based on the water quality criteria published by EPA, or on other "scientifically defensible" grounds (40 CFR 131.11). States enforce the water quality standards primarily through the regulation of point source dischargers. The 1987 Federal Water Quality Act strengthened previously existing law by requiring states to adopt numerical criteria for toxic substances that impair designated uses, or to use biomonitoring methods to support their narrative standards. It also required states to develop strategies for controlling non-point source pollution. New York State controls point source dischargers through the State Pollutant Discharge Elimination System (SPDES). The state has set criteria for many toxics. The State has also prepared a non-point source strategy.

The Rochester Embayment, as a part of Lake Ontario, is classified by NYSDEC as a Class A water, or an international boundary water as defined under the Great Lakes Water Quality Agreement. The best uses are: source of water fordrinking, culinary or food processing purposes, primary contact recreation and any other uses. The 6-mile stretch of the Genesee River below the Lower Falls is a Class B water, whose best uses are primary contact recreation and any other uses except drinking, culinary or food processing purposes.

NYSDEC water quality standards may be found in the state rules and regulations, 6NYCRR Parts 700-705 (updated September, 1991). State standards for conventional pollutants (such as coliform bacteria, turbidity and dissolved solids) in the Class A Special category incorporate most of the IJC objectives for these pollutants.

EPA criteria are listed in Quality Criteria for Water, 1992, published by the U.S. Government Printing Office. NYSDEC guidance values (unenforceable criteria) are published in the Ambient Water Quality Standards and Guidance Values, Division of Water Technical and Operational Guidance Series (TOGS) 1.1.1.

Standards and criteria for several pollutants that are particular problems in Lake Ontario and/or the Rochester Embayment are presented in Tables 3-2 and 3-3. Table 3-2 shows enforceable standards, and Table 3-3 shows criteria that are not enforceable but should be taken into account when setting standards.

In addition to the chemicals for which there are specific objectives, the IJC has identified hundreds of "hazardous polluting substances" based on their toxicity and risk of discharge to the Great Lakes system. The goal is to minimize or eliminate the risk of their release (Annex 10, GLWQA).

The DEC has been tightening pollutant discharge permit limits over the years, first controlling conventional pollutants, then metals, then organic solvents and pesticides. Now all discharges in NYSDEC Region 8 have been brought into compliance with water quality standards via the State Pollution Discharge Elimination System (SPDES) permits. But SPDES permits do not yet reflect the IJC goal of virtual elimination of persistent toxics, nor the goals of pollutant elimination in state and federal law. The NYSDEC Division of Water is advancing a Water Quality Enhancement and Protection Policy to augment ambient standards and treatment technologies in dealing with pollution-sensitive areas, persistent toxic substances, and waters that are of high quality. It will add new categories for water classification, a new process for reviewing water quality impacts, and substance bans to move towards the Clean Water Act goal of eliminating discharges to waters (Monaghan, 1991).

b. Sediment Guidelines

Many pollutants are associated with sediments. There are no legally enforceable sediment standards for the waters of New York, but there are guidelines available. The EPA has produced guidelines for designating sediments as nonpolluted, moderately polluted, or heavily polluted, and is currently developing sediment criteria. In addition, the IJC has identified background levels of 18 substances in sediments in the Great Lakes. That includes data on 10 substances (two nutrients, 7 metals, and volatile solids) in the Rochester Basin of Lake Ontario. The IJC Surveillance Work Group recognizes that additional work is necessary to quantify background levels of pollutants in the basins where no data currently exists. The Work Group suggests that sediment with concentrations less than or equal to background levels is acceptable. (Surveillance Work Group, 1987). For further information on sediment guidelines and background levels, see Appendix C.

The DEC has developed sediment criteria to assist in evaluating the threat of contaminated sediments to fish and wildlife and other aquatic organisms. The NYSDEC clean-up standards task force is also currently evaluating different approaches to defining clean-up criteria for the protection of human health and the environment.

c. Biota Guidelines

The concern about contaminants in water and sediments is sparked by the effect of these contaminants on fish, wildlife, agricultural products and humans. Increasingly it is recognized that natural communities should be monitored as well as water and sediments. Natural communities can show, for example, the combined effects of different pollutants whose interaction could not have been predicted.

Lake Ontario and the Genesee River can never be expected to return to their pre-development condition. Irreversible changes have occurred due to the arrival of new species and the effects of human settlement, including the removal of the forest cover along spawning streams and the alteration of shoreline habitats. But realistic goals can be set for the biological community, given present conditions and the prospect of remedial actions.

(1) Ecosystem Objectives

Ecosystem objectives are being developed by the IJC for various types of lake environments, based primarily on the presence and health of certain indicator species. Ecosystem objectives for shallow, nearshore waters such as the

Rochester Embayment have not yet been published, although smallmouth bass was recommended as a possible indicator species (Ecosystem Objectives Subcommittee, 1990). But the Ecosystem Objectives Subcommittee has recommended three general ecosystem objectives for Lake Ontario (Lake Ontario Secretariat, 1991):

> The Lake Ontario ecosystem should be maintained and as necessary restored or enhanced to support self-reproducing diverse biological communities.
>
> The presence of contaminants shall not limit the use of fish, wildlife and waters of the Lake Ontario basin by humans and shall not cause adverse health effects in plants and animals.
>
> We as a society shall recognize our capacity to cause great changes in the ecosystem, and we shall conduct our activities with responsible stewardship for the Lake Ontario Basin.

To attain these goals, the committee recommended five ecosystem objectives:

> Aquatic communities: The waters of Lake Ontario shall support diverse healthy, reproducing and self-sustaining communities in dynamic equilibrium, with an emphasis on native species.
>
> Wildlife: The perpetuation of a healthy, diverse and self-sustaining wildlife community that utilizes the lake for habitat and/or food shall be ensured by attaining and sustaining the waters, coastal wetlands and upland habitats of the Lake Ontario basin in sufficient quality and quantity.
>
> Human Health: The waters, plants and animals of Lake Ontario shall be free from contaminants and organisms resulting from human activities at levels that affect human health or aesthetic factors such as tainting, odor and turbidity.
>
> Habitat: Lake Ontario offshore and nearshore zones and surrounding tributary, wetland and upland habitats shall be of sufficient quality and quantity to support ecosystem objectives for health, productivity and distribution of plants and animals in and adjacent to Lake Ontario.
>
> Stewardship: Human activities and decisions shall embrace environmental ethics and a commitment to responsible stewardship.

In most areas of the AOC, more baseline data are needed for assessing both the abundance and the condition of naturally occurring species. But, as stressed by the subcommittee, habitat maintenance is essential if any biota goals are to be attained.

(2) Wetlands Protection

In the AOC, wetlands are the most crucial habitats deserving of protection. Both state and federal laws, described above, seek to preserve wetlands. In order to encroach upon a wetland area, a permit must be obtained from NYSDEC and/or from the U.S. Army Corps of Engineers, which is charged with implementing

Section 404 of the Clean Water Act. State designated wetlands have a minimum size of 12.4 acres, but the Corps regulates wetlands of one acre or more in size. Farmers participating in fed···al farm programs can be penalized for encroaching upon wetlands.

The Great Lakes Water Qua··· Agreement (Annex 13) contains the following statement related to wetlands, as part of its proposed program of non-point source controls:

> Significant wetland areas in the Great Lakes System that are threatened by urban and agricultural development and waste disposal activities should be identified, preserved and, where necessary, rehabilitated.

(3) Fish Consumption

For some chemicals, standards have been established for concentrations in fish. These standards are for protection of humans or fish-eating wildlife. They are shown in Tables 3-2 and 3-3.

C. Proposals for Desired Uses

Proposals for enhanced uses of the Rochester Embayment include the elimination of the toxic materials in edible fish, and the removal of water quality-based swimming restrictions along the embayment. Durand Eastman Park and Webster Park once had public swimming, but discontinued this use due to poor water quality. The County has developed a long-term goal of opening a swimming beach at Durand Eastman Park (EDR, 1989). If the beach is reopened, it will require new bathing facilities, and will likely use a water quality model similar to that used at Ontario Beach.

Increased recreational access to the lake, river and shoreline is another generally recognized goal, as long as development is consistent with ecosystem objectives. In 1982 the DEC and the Office of Parks, Recreation and Historic Preservation issued the Strategic Plan for Economic Development through Expansion of Waterway Access to the Great Lakes. It provided for state construction of harbors, breakwaters, boat ramps, etc., intended to stimulate local development of marinas and associated facilities.

In 1983 the Statewide Comprehensive Recreation Plan (revised 1988) called for development of available resources to their optimum recreational potential while preserving unique natural and cultural assets.

The New York State Coastal Management Program (Policy 9) advocates "increasing access to existing fish and wildlife resources, supplementing existing stocks, and developing new resources" (NY Dept. of State, 1991c). Monroe County recently completed its Waterfront Opportunities Study, and is considering additional marinas, fishing access sites, and trails for several areas along the shore. The City of Rochester and the towns of Penfield, Webster, Irondequoit and Greece are participating in the Local Waterfront Revitalization Program administered by the Department of State. In Rochester the plans call for major renovations of the Charlotte waterfront and the development of an Urban Cultural Park along the Genesee River. These waterfront developments depend on a healthy aquatic environment and financing for their success.

The enhancement of biological resources is also stressed by state and federal policies. The policies include habitat restoration as well as pollution abatement, as stated in the policies of the New York State Coastal Management Program (described above). The federal Great Lakes Fish and Wildlife Restoration Act of 1990 proposes to provide assistance "to encourage cooperative conservation, restoration and management of the fish and wildlife resources and their habitat of the Great Lakes Basin." The Great Lakes Water Quality Agreement (Annex 13) also calls for restoring significant wetlands if necessary.

The enhancement of commercial fishing and the development of commercial aquaculture in Lake Ontario are other goals that have been identified in the state's proposed fisheries management plan (Eckert, 1989) and in the Coastal Management Prpgram. The Office of General Services, DEC and the Corps of Engineers have devised an aquaculture permit system (NYSDEC, 1989), but whether any such enterprises will occur in the embayment depends on the interest of private companies and individuals as well as on the condition of the water and sediments.

The State Coastal Management Program and related efforts, such as fisheries enhancement and the Waterway Access Expansion Program, encourage water- dependent uses and increase local attention to waterfront areas. This is resulting in the intensification of all types of shoreline land uses. It is important when planning recreational and development programs to be sensitive to the value of the littoral zone for biological uses. Frequently, these programs and the private development they foster can lead to the loss of wetlands and degradation of habitats (NYSDEC, 1985). The appropriate balance will enhance human uses while still protecting natural resources, particularly coastal wetlands that sustain biological productivity in the embayment.

D. Proposals for Discontinued or Restricted Uses

Many proposals for discontinued and restricted uses are contained in the laws and policies outlined in Section B. They include virtual elimination of the discharge of persistent toxic substances (IJC), elimination of discharge of all pollutants (U.S. Clean Water Act), prevention of new pollution (New York law), cessation of discharge of municipal and industrial waste into the embayment (Pure Waters Master Plan), and control of non-point source pollution. All levels of government have some commitment to reducing the use of water bodies as sinks for pollutants from urban runoff and erosion.

The Pure Waters Master Plan includes as a goal the relocation of dredge spoil disposal to sites outside the embayment. This proposal was extensively researched, but the community and the Corps of Engineers agreed instead to minimize pollutant inflows, primarily from Kodak and CSO's, in order to improve the quality of the sediments (Monroe County Dept. of Planning, 1990). There are no plans to cease commercial navigation in the lower Genesee River to reduce the need for dredging. However, the U.S. Army Corps of Engineers has indicated verbally to the WQMAC that they intend to dredge every other year rather than every year. The state Department of Transportation actively encourages commercial navigation on the Great Lakes, and the City of Rochester's LWRP mentions the transport of products like cement as an important water-dependent use in the coastal zone.

Other proposals for restricted uses relate to the land along the shoreline. The County's 1978 Comprehensive Development Plan states an intention to discourage nonrecreational development along Lake Ontario. This would take a great deal of political will to achieve, and it is not completely supported by the LWRPs that are being developed by the towns and the city. The LWRPs are based on the 44 coastal management policies developed by the New York Department of State. The first two policies are:

> Restore, revitalize and redevelop deteriorated and underutilized waterfront areas for commercial, industrial, cultural, recreational and other compatible uses.
>
> Facilitate the siting of water-dependent uses and facilities on or adjacent to coastal waters.

Water-dependent uses can include commerce and industry, although other policies call for recreational uses to be accommodated if possible.

The Coastal Management Program, the County Comprehensive Plan and the local LWRPs advocate careful development that avoids problems with flooding and erosion and protects natural features like beaches and bluffs. Restrictions would be most stringent in the Significant Coastal Fish and Wildlife Habitats that have been designated and mapped.

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TABLE 3-1

FISH NET SURVEY
SUMMARY OF SPECIES ABUNDANCE (1)
RUSSELL POWER STATION
MAY-OCTOBER 1976

Species	Total Specimens	Per Cent of Total Catch
Alewife *Alosa pseudoharengus*	895	46.1%
Spottail shiner *Notropis hudsonius*	358	18.4%
White perch *Morone americana*	345	17.8%
Rainbow smelt *Osmerus mordax*	114	5.9%
Gizzard shad *Dorosoma cepedianum*	64	3.3%
Brown trout *Salmo trutta*	50	2.6%
Carp *Cyprinus carpio*	41	2.1%
White bass *Morone chrysops*	30	1.5%
Steelhead/Rainbow trout *Salmo gairdneri*	11	0.6%
White sucker *Catostomus commersoni*	7	0.4%
Yellow perch *Perca flavescens*	6	0.3%
Coho salmon *Oncorhynchus kisutch*	5	0.3%
Redhorse sucker *Moxostoma sp.*	3	0.2%

TABLE 3-1 (continued)

Species	Total Specimens	Per Cent of Total Catch
Rock bass *Ambloplites rupestris*	2	0.1%
Smallmouth bass *Micropterus dolomieui*	2	0.1%
Brown bullhead *Ictalurus nebulosus*	2	0.1%
Freshwater drum *Aplodinotus grunniens*	2	0.1%
Burbot *Lota lota*	1	0.1%
Golden shiner *Notemigonus crysoleucas*	1	0.1%
Longnose gar *Lepisosteus osseus*	1	0.1%
Northern pike *Esox lucius*	1	0.1%
Walleye *Stizostedion vitreum*	1	0.1%
TOTAL	1942	

NOTE: 1. These data reflect total individuals per species taken over all sampling stations and dates.

Source: Bio Systems Research, Inc. (1977). *Rochester Gas and Electric Corporation fish net survey (1976)*. Biological monitoring program, Russell Power Station. Buffalo, NY: Author.

TABLE 3.2. WATER QUALITY AND FISH TISSUE - ENFORCEABLE STANDARDS

	NYSDEC SURFACE WATER QUALITY STANDARDS				FDA FISH TISSUE
	AQUATIC LIFE			HUM. HLTH	HUMAN HEALTH
	Survival	Propagation	Bioaccum.		
	ug/l	ug/l	ug/l	ug/l	ppm fillet
Chlordane (total)					0.3
DDT + metabolites			0.001		5.0
Dieldrin				0.001*	0.3
Mirex	0.001	0.001		0.04	0.1
Dioxin (2,3,7,8 TCDD)				0.000001	0.00005
Hexachlorobenzene					
Octachlorostyrene					
PCB (total)			0.001	0.01	2.0
Cyanide	22	5.2		100	
Aluminum (ionic)		100			
Arsenic	360	190		50	
Cadmium	3.9**	1.13**		10	
Copper	18.**	11.8**		200	
Iron	300	300		300	
Lead	82.**	3.2**		50	
Mercury				2.0	1.0
Nickel	1844.**	96.**			
Silver	4.1**	0.1 (ionic)		50	
Zinc	321.**	30		300	

* Aldrin + dieldrin   **Hardness-dependent; value assumes 100 mg/l hardness.

NOTE: Aquatic standards for cadmium, lead, nickel, silver and zinc are for the acid soluble form (except where noted for silver). Aquatic standards for copper are for the dissolved form.

Sources:

Lake Ontario Secretariat. (1990). Lake Ontario Toxics Management Plan. Draft Update.

New York State Dept. of Environmental Conservation. (1991). Water Quality Regulations for Surface Waters and Groundwaters. Effective September 1, 1991.

TABLE 3.3. WATER QUALITY AND FISH TISSUE - UNENFORCEABLE CRITERIA FOR PROTECTION OF AQUATIC LIFE

	WATER QUALITY				FISH TISSUE		
	EPA		NYSDEC	IJC	NYSDEC		IJC
	Acute	Chronic			Tox.	Carcin.	
	ug/l	ug/l	ug/l	ug/l	ppm whole fish	ppm whole fish	ppm whole fish
Chlordane (total)	2.4	0.0043	0.002	0.06	0.5	0.37	
DDT + metabolites	1.1	0.001		0.003	0.2	0.27	1.0
Dieldrin	2.5	0.0019	0.001*	0.001*	0.022*		
Mirex		0.001		0.005	0.33	Below detection	
Dioxin (2,3,7,8 TCDD)	<0.01	<0.00001			0.000003	0.0000023	
Hexachlorobenzene					0.33	0.2	
Octachlorostyrene					0.02		
PCB (total)	2	0.014			0.11	0.11	0.1
Cyanide	22	5.2	5				
Aluminum							
Arsenic	360.(tri.) 850.(pent.)	190.(tri.)					
Cadmium	3.9	1.1	0.2				
Copper	18.**	11.8**	5				
Iron		1000	300				
Lead	82.**	3.2**	3.2**	5			
Mercury	2.4	0.012	0.2	0.2			0.5
Nickel	1400	160.**	96.**	25			
Silver	4.1		0.1				
Zinc	120	110	30				

* aldrin + dieldrin **Hardness-dependent; value assumes 100 mg/l hardness. The value of the criterion increases as the hardness of the water increases. The hardness value of Lake Ontario is 120 mg/L.

Sources:

International Joint Commission. (1987). Great Lakes Water Quality Agreement.

Lake Ontario Secretariat. (1990). Lake Ontario Toxics Management Plan. Draft Update.

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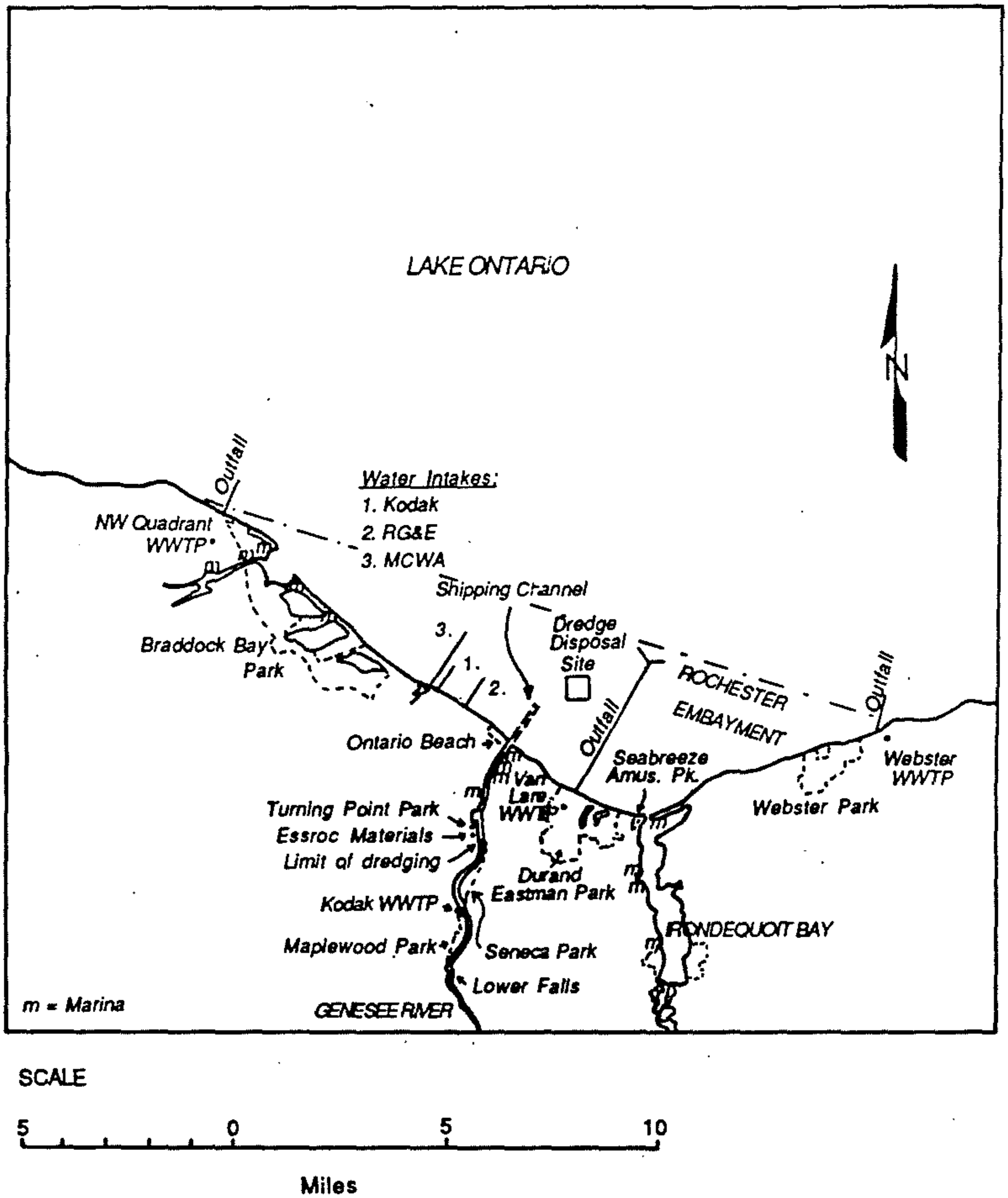

FIGURE 3-1 HUMAN USES OF EMBAYMENT

ROCHESTER EMBAYMENT REMEDIAL ACTION PLAN
Chapter 4. WATER QUALITY CONDITIONS/PROBLEMS

This chapter summarizes current indicators of water quality conditions that affect the AOC, and establishes the basic environmental impairments and their causes. This is done using a systematic review of evidence compared against use impairment guidelines for each of the Great lakes Water Quality Agreement indicators.

1. Impaired Uses

a. Guidelines for Problem Definition

The Great Lakes Water Quality Agreement (GLWQA) (Annex 2) defines "impairment of beneficial uses" as a change in the chemical, physical or biological integrity of the Great Lakes System sufficient to cause any of the following:

(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;
(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.

These impairments are explained in greater detail in the listing/delisting guidelines published in the newsletter FOCUS (IJC, 1991). The guidelines are shown in Figure 4-1.

b. Impaired Uses Identified by International Joint Commission (IJC)

When designating the Rochester Embayment as an Area of Concern (AOC) in 1985, the IJC identified the types of problems as conventional pollutants, heavy metals, toxic organics, contaminated sediments, and fish consumption advisories (Great Lakes Water Quality Board, 1985). At that time the list of fourteen impairments had not yet been developed. Later, the Rochester Embayment was described as having the following impaired uses designated by the IJC (Center for the Great Lakes, 1990):

(1) Fish Consumption Advisories
(10) Beach Closings
(11) Degradation of Aesthetics

FIGURE 4-1

GUIDELINES FOR RECOMMENDING THE LISTING AND DELISTING OF

USE IMPAIRMENT	LISTING GUIDELINE	DELISTING GUIDELINE	RATIONALE	REFERENCE
RESTRICTIONS ON FISH AND WILDLIFE CONSUMPTION	When contaminant levels in fish or wildlife populations exceed current standards, objectives or guidelines, or public health advisories are in effect for human consumption of fish or wildlife. Contaminant levels in fish and wildlife must be due to contaminant input from the watershed.	When contaminant levels in fish and wildlife populations do not exceed current standards, objectives or guidelines, and no public health advisories are in effect for human consumption of fish or wildlife. Contaminant levels in fish and wildlife must be due to contaminant input from the watershed.	Accounts for jurisdictional and federal standards; emphasizes local watershed sources.	Adapted from Mack 1988
TAINTING OF FISH AND WILDLIFE FLAVOR	When ambient water quality standards, objectives, or guidelines, for the anthropogenic substance(s) known to cause tainting, are being exceeded or survey results have identified tainting of fish or wildlife flavor.	When survey results confirm no tainting of fish or wildlife flavor.	Sensitive to ambient water quality standards for tainting substances; emphasizes survey results.	See American Public Health Association (1980) for survey methods
DEGRADED FISH AND WILDLIFE POPULATIONS	When fish and wildlife management programs have identified degraded fish or wildlife populations due to a cause within the watershed. In addition, this use will be considered impaired when relevant, field-validated, fish or wildlife bioassays with appropriate quality assurance/quality controls confirm significant toxicity from water column or sediment contaminants.	When environmental conditions support healthy, self-sustaining communities of desired fish and wildlife at predetermined levels of abundance that would be expected from the amount and quality of suitable physical, chemical and biological habitat present. An effort must be made to ensure that fish and wildlife objectives for Areas of Concern are consistent with Great Lakes ecosystem objectives and Great Lakes Fishery Commission fish community goals. Further, in the absence of community structure data, this use will be considered restored when fish and wildlife bioassays confirm no significant toxicity from water column or sediment contaminants.	Emphasizes fish and wildlife management program goals; consistent with Agreement and Great Lakes Fishery Commission goals; accounts for toxicity bioassays.	Adapted from Manny and Pacific, 1988; Wisconsin DNR 1987; United States and Canada, 1987; Great Lakes Fishery Commission 1980
FISH TUMORS OR OTHER DEFORMITIES	When the incidence rates of fish tumors or other deformities exceed rates at unimpacted control sites or when survey data confirm the presence of neoplastic or preneoplastic liver tumors in bullheads or suckers.	When the incidence rates of fish tumors or other deformities do not exceed rates at unimpacted control sites and when survey data confirm the absence of neoplastic or preneoplastic liver tumors in bullheads or suckers.	Consistent with expert opinion on tumors; acknowledges background incidence rates.	Adapted from Mac and Smith, 1988; Black 1983; Baumann et al. 1982
BIRD OR ANIMAL DEFORMITIES OR REPRODUCTIVE PROBLEMS	When wildlife survey data confirm the presence of deformities (e.g. cross-bill syndrome) or other reproductive problems (e.g. egg-shell thinning) in sentinel wildlife species.	When the incidence rates of deformities (e.g. cross-bill syndrome) or reproductive problems (e.g. egg-shell thinning) in sentinel wildlife species do not exceed background levels in inland control populations.	Emphasizes confirmation through survey data; makes necessary control comparisons.	Adapted from Kubiak 1988; Miller 1988; Wiemeyer et al. 1984
DEGRADATION OF BENTHOS	When the benthic macroinvertebrate community structure significantly diverges from unimpacted control sites of comparable physical and chemical characteristics. In addition, this use will be considered impaired when toxicity (as defined by relevant, field-validated, bioassays with appropriate quality assurance/quality controls) of sediment-associated contaminants at a site is significantly higher than controls.	When the benthic macroinvertebrate community structure does not significantly diverge from unimpacted control sites of comparable physical and chemical characteristics. Further, in the absence of community structure data, this use will be considered restored when toxicity of sediment-associated contaminants is not significantly higher than controls.	Accounts for community structure and composition; recognizes sediment toxicity; uses appropriate control sites.	Adapted from Reynoldson 1988; Henry 1988; IJC 1988

Source: Focus on International Joint Commission Activities, March/April 1991

Figure 4-1

GREAT LAKES AREAS OF CONCERN

USE IMPAIRMENT	LISTING GUIDELINE	DELISTING GUIDELINE	RATIONALE	REFERENCE
RESTRICTIONS ON DREDGING ACTIVITIES	When contaminants in sediments exceed standards, criteria, or guidelines such that there are restrictions on dredging or disposal activities.	When contaminants in sediments do not exceed standards, criteria, or guidelines such that there are restrictions on dredging or disposal activities.	Accounts for jurisdictional and federal standards; emphasizes dredging and disposal activities.	Adapted from IJC 1988
EUTROPHICATION OR UNDESIRABLE ALGAE	When there are persistent water quality problems (e.g. dissolved oxygen depletion of bottom waters, nuisance algal blooms or accumulation, decreased water clarity, etc.) attributed to cultural eutrophication.	When there are no persistent water quality problems (e.g. dissolved oxygen depletion of bottom waters, nuisance algal blooms or accumulation decreased water clarity, etc.) attributed to cultural eutrophication.	Consistent with Annex 3 of the Agreement; accounts for persistence of problems.	United States and Canada, 1987
RESTRICTIONS ON DRINKING WATER CONSUMPTION OR TASTE AND ODOR PROBLEMS	When treated drinking water supplies are impacted to the extent that: 1) densities of disease-causing organisms or concentrations of hazardous or toxic chemicals or radioactive substances exceed human health standards, objectives or guidelines; 2) taste and odor problems are present; or 3) treatment needed to make raw water suitable for drinking is beyond the standard treatment used in comparable portions of the Great Lakes which are not degraded (i.e. settling, coagulation, disinfection).	For treated drinking water supplies: 1) when densities of disease-causing organisms or concentrations of hazardous or toxic chemicals or radioactive substances do not exceed human health objectives, standards or guidelines; 2) when taste and odor problems are absent; and 3) when treatment needed to make raw water suitable for drinking does not exceed the standard treatment used in comparable portions of the Great Lakes which are not degraded (i.e. settling, coagulation, disinfection).	Consistency with the Agreement; accounts for jurisdictional standards; practical; sensitive to increased cost as a measure of impairment.	Adapted from United States and Canada, 1987
BEACH CLOSINGS	When waters, which are commonly used for total-body contact or partial-body contact recreation, exceed standards, objectives, or guidelines for such use.	When waters, which are commonly used for total-body contact or partial-body contact recreation, do not exceed standards, objectives, or guidelines for such use.	Accounts for use of waters; sensitive to jurisdictional standards; addresses water contact recreation; consistent with the Agreement.	Adapted from United States and Canada, 1987; Ontario Ministry of the Environment 1984
DEGRADATION OF AESTHETICS	When any substance in water produces a persistent objectionable deposit, unnatural color or turbidity, or unnatural odor (e.g. oil slick, surface scum).	When the waters are devoid of any substance which produces a persistent objectionable deposit, unnatural color or turbidity, or unnatural odor (e.g. oil slick, surface scum).	Emphasizes aesthetics in water; accounts for persistence.	Adapted from the Ontario Ministry of the Environment 1984
ADDED COSTS TO AGRICULTURE OR INDUSTRY	When there are additional costs required to treat the water prior to use for agricultural purposes (i.e. including, but not limited to, livestock watering, irrigation and crop-spraying) or industrial purposes (i.e. intended for commercial or industrial applications and noncontact food processing).	When there are no additional costs required to treat the water prior to use for agricultural purposes (i.e. including, but not limited to, livestock watering, irrigation and crop-spraying) and industrial purposes (i.e. intended for commercial or industrial applications and noncontact food processing).	Sensitive to increased cost and a measure of impairment.	Adapted from Michigan DNR 1977
DEGRADATION OF PHYTOPLANKTON AND ZOOPLANKTON POPULATIONS	When phytoplankton or zooplankton community structure significantly diverges from unimpacted control sites of comparable physical and chemical characteristics. In addition, this use will be considered impaired when relevant, field-validated, phytoplankton or zooplankton bioassays (e.g. <u>Ceriodaphnia</u>; algal fractionation bioassays) with appropriate quality assurance/quality controls confirm toxicity in ambient waters.	When phytoplankton and zooplankton community structure does not significantly diverge from unimpacted control sites of comparable physical and chemical characteristics. Further, in the absence of community structure data, this use will be considered restored when phytoplankton and zooplankton bioassays confirm no significant toxicity in ambient waters.	Accounts for community structure and composition; recognizes water column toxicity; uses appropriate control sites.	Adapted from IJC 1987
LOSS OF FISH AND WILDLIFE HABITAT	When fish and wildlife management goals have not been met as a result of loss of fish and wildlife habitat due to a perturbation in the physical, chemical, or biological integrity of the Boundary Waters, including wetlands.	When the amount and quality of physical, chemical, and biological habitat required to meet fish and wildlife management goals have been achieved and protected.	Emphasizes fish and wildlife management program goals; emphasizes water component of Boundary Waters.	Adapted from Manny and Pacific, 1988

TABLE 4-1
EXISTENCE OF USE IMPAIRMENTS IN ROCHESTER EMBAYMENT AREA OF CONCERN

		Portion of Area of Concern	
		Lower Genesee River	Rochester Embayment of Lake Ontario
(1)	Restrictions on Fish and Wildlife Consumption	YES	YES
(2)	Tainting of Fish and Wildlife Flavor	UNKNOWN	UNKNOWN
(3)	Degradation of Fish and Wildlife Populations	YES	YES
(4)	Fish Tumors or Other Deformities	UNKNOWN	UNKNOWN
(5)	Bird OR Animal Deformities OR Reproductive Problems	YES	YES
(6)	Degradation of Benthos	YES	UNKNOWN
(7)	Restrictions on Dredging Activities	YES	NO
(8)	Eutrophication or Undesirable Algae	N/A*	YES
(9)	Restrictions on Drinking Water, or Drinking Water Taste and Odor Problems	N/A*	YES
(10)	Beach Closings	N/A*	YES
(11)	Degradation of Aesthetics	YES	YES
(12)	Added Costs to Agriculture Or Industry	YES	YES
(13)	Degradation of Phytoplankton and Zooplankton Populations	YES	UNKNOWN
(14)	Loss of Fish and Wildlife Habitat	YES	YES

* N/A= not applicable. See narrative for explanation of why each of these are not applicable.

c. **Impaired Uses Identified by RAP Process**

The Monroe County Water Quality Management Advisory Committee (WQMAC) is the primary citizens' advisory committee for the Remedial Action Plan. The WQMAC has identified additional use impairments based on a careful assessment of local conditions (Table 4-1). Since some impairments only affect one portion of the AOC, the WQMAC has divided the AOC into two segments: the lower Genesee River and the part of Lake Ontario within the Rochester Embayment. A use is considered impaired if it is impaired in either the river or the lake. Table 4-1 shows that 12 of the 14 use impairments exist in the Area of Concern. Some common causes include build-up of PCBs in fish tissue, the presence of biiological oxygen demanding substances, an overabundance of sediment, and the nutrient phosphorus.

d. **Impaired Uses In the AOC**

Each known GLWQA use impairment indicator is discussed, with the IJC listing guidelines. (See Figure 4-1 for complete guidelines.) Evidence and causes are given for each. The numbering of these impairments corresponds with the numbers on table 4-1.

(1) **RESTRICTIONS ON FISH AND WILDLIFE CONSUMPTION.**
<u>IJC Guidelines:</u> *When public health advisories are in effect for human consumption of fish and wildlife, and contaminant levels are due to contaminant input from the watershed.*

Status: Impaired.

Evidence: The New York State Department of Health issued the following 1992 advisories for Lake Ontario:

WOMEN OF CHILDBEARING AGE AND CHILDREN UNDER 15 SHOULD EAT NO FISH FROM LAKE ONTARIO.(This means all females who may have children at some point should eat none.)

ADVICE FOR PERSONS OTHER THAN ABOVE:
American eel, channel catfish, lake trout, chinook salmon, coho salmon over 21", rainbow trout over 25", and brown trout over 20": EAT NONE.

White sucker, white perch, smaller coho salmon, rainbow trout and brown trout: EAT NO MORE THAN ONE MEAL PER MONTH. In the western half of Lake Ontario (not including the Rochester Embayment), the NYSDOH recommends eating no white perch.

Carp in Irondequoit Bay: EAT NONE.

WILDLIFE CONSUMPTION RESTRICTIONS THROUGHOUT NEW YORK STATE:

Merganser Waterfowl:	Eat None.
Other Waterfowl:	Skin and Trim. Eat no more than two meals per month.

Snapping turtles: Discard fat, liver and eggs.

Causes (known): The State Health Department issues consumption advisories when one or more contaminants exceed FDA action levels or tolerance limits. Long-term exposure to high levels of these chemicals has been linked to health effects such as cancer (in laboratory animals) or nervous system disorders (in humans) (NYSDOH 1992). The Health Department considers multiple chemical contaminant concentrations in fish when making their advisory (Forti, T. pers. comm. 12/92). The Health Department uses its own recommended maximum guideline for dioxin (10 ppt {parts per trillion}); for other compounds, the FDA criteria are used (see Table 3-2 in the previous chapter also outlines IJC standards for these chemicals.) One exceedance results in a warning to eat no more than one meal per month. A contaminant level three or more times the standard results in a warning to eat none. Organochlorine contaminant levels are added together before the determination is made; in other words, the level of each organochlorine contaminant in the fish is divided by its tolerance level, then those fractions are added. If the sum exceeds one, an advisory to eat no more than one meal per month will be issued; if the sum exceeds three, an advisory to eat none will be issued (Forti, T., pers. comm. 4/91). Thus, a contaminant that never exceeds tolerance levels by itself could still contribute to the advisories.

The contaminants primarily responsible for the advisories in Lake Ontario fish and wildlife are mirex, PCBs and dioxin . Most species are on the advisory list because of exceedences of mirex but in white perch west of Point Breeze, dioxin is the contaminant of greatest concern (Sloan, R., pers. comm. 5/29/91). PCBs fluctuate near the action levels, and occasionally contribute to the advisories (Haynes, J. M., pers. comm. 6/21/91). In 1985, lake trout were found to exceed guidelines for PCB, mirex, and chlordane (Sloan, 1987, p. 126-128).

The fish analyzed in Lake Ontario, such as trout, salmon, bass and white perch, range throughout the lake and could pick up contaminants anywhere throughout their territory. The watersheds that flow to the Rochester Embayment area have not been identified as a significant source of mirex or dioxin, most of which are believed to originate from the Niagara River area. Another known source of mirex to Lake Ontario is from the Oswego River. However, chemicals such as PCBs and chlordane, which were once in widespread use, may have sources within the watershed and may be contributing to lakewide fish consumption advisories. Chlordane is an insecticide which has now been banned from use.For information on sources of PCB's, see Chapter 5. Table 4-2 provides information on PCB levels in sediments of the Embayment and its watershed. Figure 2 gives the locations of the sampling stations.

Fish from areas draining into the embayment can give some indication of whether these contaminants are present in the watershed. Table 4-3 shows selected results of the NYSDEC's toxics analysis for local fish . Carp collected from Irondequoit Bay in 1981 and 1984 were found to exceed FDA standards for PCB, chlordane and mirex. Three species of fish in Canadice lake exceeded standards for PCB when tested in 1984;

Table 4-2 Bulk Sediment Analyses: Polychlorinated Biphenyls (PCBs)

Location/Source/Date	PCB 1016/1242 mg/Kg	PCB 1221 mg/Kg	mg/Kg	PCB 1248 mg/Kg	PCB 1254 mg/Kg	PCB 1260 Total PCB	Heavily Polluted EPA Criteria	NYSDEC Criteria	IJC Dredging Guideline
EPA ROC 01 05/03/81	0.02 W		0.02	0.013	0.007	.04	>1	.11	0.05
EPA ROC 01R 05/03/81	0.02 W		0.04	0.02	0.015	.075			
EPA ROC 02 05/03/81	**0.02 W**		**0.046**	**0.05**	**0.025**	**.121**			
EPA ROC 03 05/03/81	**0.02 W**		**0.22**	**0.31**	**0.19**	**.72**			
EPA ROC 04 05/03/81	0.02 W		0.03	0.025	0.022	.077			
EPA ROC 05 05/03/81	0.02 W		0.025	0.016	0.011	.052			
EPA ROC 06 05/03/81	0.02 W		0.02	0.029	0.035	.084			
EPA ROC 07 05/03/81	0.02 W		0.03	0.026	0.022	.078			
EPA ROC 08 05/03/81	**0.02 W**		**0.06**	**0.18**	**0.07**	**.31**			
EPA ROC 09 05/03/81	ND		0.009	0.028	0.006	.043			
EPA ROC 09R 05/03/81	ND		0.008	0.017	0.008	.033			
EPA ROC 10 05/03/81	ND		0.032	0.023	0.015	.07			
EPA ROC 11 05/03/81	ND		0.027	0.011	0.005	.043			
EPA ROC 12 05/03/81	ND		0.025	0.021	0.007	.053			
EPA ROC 14 05/03/81	ND		0.017	0.009	0.005	.031			
Genesee River at Boxart Street									
RIBS 08/16/89	**1 W**	**1 W**	**1 W**	**3**	**1 W**	**3**			
RIBS 08/22/90	**1 W**	**1 W**	**1 W**	**2**	**3**	**5**			
Genesee River at Cuylerville									
RIBS 08/15/89	1 W	1 W	1 W	1 W	1 W	0			
RIBS 08/21/90	1 W	1 W	1 W	1 W	1 W	0			
Oatka Creek at Garbutt									
RIBS 08/16/89	**3**	**1 W**	**1 W**	**3**	**1 W**	**6**			
RIBS 08/22/90	**1 W**	**1 W**	**1 W**	**2**	**1 W**	**2**			
Honeoye Creek at Mendon									
RIBS 08/16/89	**1 W**	**1 W**	**1 W**	**1**	**1 W**	**1**			
RIBS 08/22/90	**1 W**	**1 W**	**1 W**	**1**	**1 W**	**1**			
Genesee River at Scio									
RIBS 08/15/89	1 W	1 W	1 W	1 W	1 W	0			
RIBS 08/21/90	1 W	1 W	1 W	1 W	1 W	0			
Canaseraga Creek at Mt. Morris									
RIBS 08/15/89	1 W	1 W	1 W	1 W	1 W	0			
RIBS 08/21/90	1 W	1 W	1 W	1 W	1 W	0			

1 Calculation of total PCB's considers values not detected or below minimum response levels as zero.

ND = Not detected.
W in EPA data means below the minimum instrument response level.
W in NYSDEC RIBS (Rotating Intensive Basin Study) data means that the finding was less than the detection limit, and the number next to the W is the detection limit.

IJC Dredging Guideline from IJC Surveillance Study (page 9).

Figure 4-2
Map of Sampling Locations

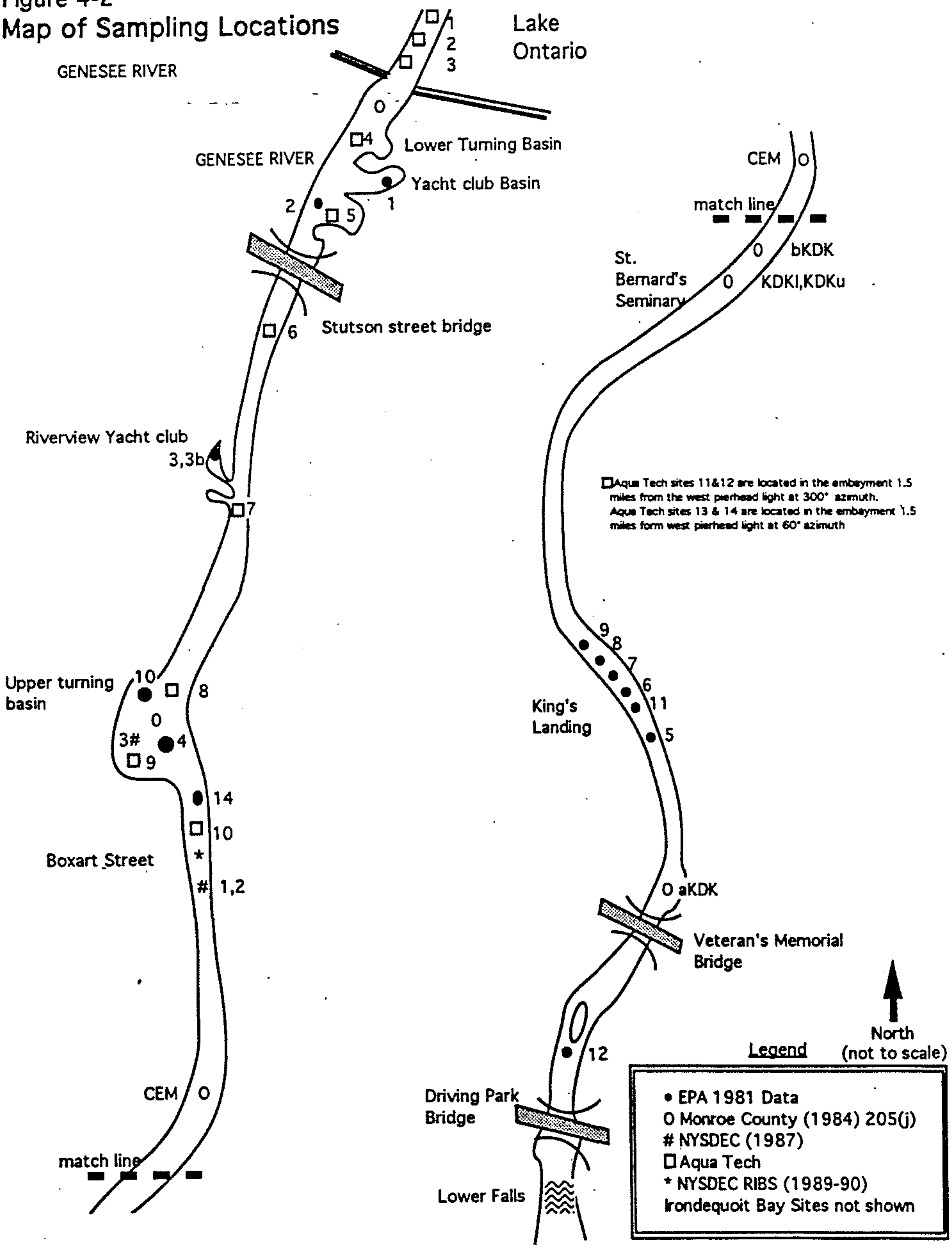

TABLE 4-3 TOXIC SUBSTANCES IN FISH IN THE WATERSHED OF THE ROCHESTER EMBAYMENT

Location	Year	Species	No. Fish Analyzed	No. of Analyses	Average Length (mm)	Length Range (mm)	Average Weight (g)	Weight Range (g)	Average PCB (ppm)	PCB Range (ppm)
Irondequoit Bay										
	1981	**Carp**	**14**	**1**	**603**	**509-690**	**3088**	**2087-4808**	**5.16***	**-**
		Black crappie	17	1	225	200-285	191	118-435	0.74	-
	1984	**Carp**	**8**	**3**	**576**	**532-660**	**2581**	**2130-3560**	**3.61***	**3.26-4.43***
Genesee River										
- Belvedere	1982	Smallmouth bass	3	2	289	250-326	318	204-431	0.16	0.15-0.17
		White sucker	5	1	347	328-378	413	363-499	0.05	-
- Canadea	1982	Smallmouth bass	3	2	358	313-439	658	295-1270	0.10	0.07-0.15
- Fillmore	1982	Smallmouth bass	4	2	336	317-386	499	363-771	0.08	0.08-0.10
		White sucker	5	1	343	329-352	390	363-408	0.03	-
- W. Henrietta	1982	Northern pike	1	1	638	-	1300	-	0.23	-
		Walleye	3	2	547	454-712	1910	860-3940	0.69	0.18-1.71
		Carp	**3**	**1**	**575**	**548-603**	**2687**	**2260-3260**	**2.09***	**-**
- Lower Falls	1982	Smallmouth bass	7	2	196	164-272	123	60-300	0.36	0.25-0.50
		Walleye	3	1	513	502-523	1513	1340-1700	1.43	-
Canaseraga Creek										
- Dansville	1982	Brown trout	3	1	275	259-290	240	200-260	0.21	-
		Northern pike	1	1	490	-	940	-	0.15	-
		Redhorse spp.	7	1	337	319-358	411	360-480	0.18	-
Silver Lake	1983	Largemouth bass	8	2	443	384-499	1698	1020-2540	0.14	0.14-0.15
		Yellow perch	7	1	201	195-210	109	100-120	0.06	-
Oatka Creek										
- Union St. Bridge										
	1983	Brown trout	18	3	246	213-312	156	120-320	0.11	0.10-0.14
Conesus Lake										
- McPherson Pt.										
	1983	Largemouth bass	8	1	264	235-299	282	170-460	0.02	-
		Smallmouth bass	3	1	327	320-340	533	460-580	0.14	-
		Yellow perch	36	2	206	190-242	132	100-200	0.05	0.05-0.05
Honeoye Lake										
- Richmond	1983	Smallmouth bass	15	3	399	357-440	985	700-1300	0.09	0.07-0.10
- Burns Point	1983	Yellow perch	22	2	255	240-290	-	-	0.06	0.02-0.07
Hemlock Lake	1984	Lake trout	14	14	644	515-734	2886	1400-4560	0.49	0.30-0.76
		Yellow perch	15	4	221	177-354	118	66-362	0.04	0.02-0.14
Canadice Lake	1984	Lk. trout <381 mm	4	4	375	365-380	402	363-410	1.22	1.01-1.59
		Lk. trout >381 mm	**25**	**25**	**575**	**381-738**	**2371**	**416-4640**	**7.65***	**0.78-20.54***
		Smallmouth bass	**6**	**3**	**344**	**318-380**	**622**	**470-910**	**1.41**	**0.79-2.65***
		Yellow perch	**9**	**3**	**283**	**230-358**	**339**	**150-680**	**1.12**	**0.32-2.67***

*** Exceeds FDA guidelines for fish consumption**

TABLE 4-3 (cont.)

Location	Year	Species	Average DDT (ppm)	DDT Range (ppm)	Average Dieldrin (ppm)	Dieldrin Range (ppm)	Average HCB (ppm)	HCB Range (ppm)	Average Lindane (ppm)	Lindane Range (ppm)
		FDA Guideline:	5.0		0.3					
Irondequoit Bay										
	1981	Carp	0.58	-	0.01	-	0.02	-	0.01	-
		Black crappie	0.13	-	0.02	-	0.01	-	<0.01	-
	1984	Carp	0.85	0.72- 1.15	0.02	0.01- 0.02	<0.01	<0.01- 0.01	0.01	0.01- 0.01
Genesee River										
- Belvedere	1982	Smallmouth bass	0.03	0.03- 0.04	<0.01	<0.01-<0.01	<0.01	<0.01-<0.01	<0.01	<0.01-<0.01
		White sucker	0.03	-	<0.01	-	<0.01	-	<0.01	-
- Canadea	1982	Smallmouth bass	0.04	0.01- 0.06	<0.01	<0.01-<0.01	<0.01	<0.01-<0.01	<0.01	<0.01-<0.01
- Fillmore	1982	Smallmouth bass	0.03	0.03- 0.03	<0.01	<0.01-<0.01	<0.01	<0.01-<0.01	<0.01	<0.01-<0.01
		White sucker	0.01	-	<0.01	-	<0.01	-	<0.01	-
- W. Henrietta	1982	Northern pike	0.04	-	<0.01	-	<0.01	-	0.01	-
		Walleye	0.07	0.04- 0.15	<0.01	<0.01- 0.01	<0.01	<0.01-<0.01	0.01	0.01- 0.01
		Carp	0.26	-	0.01	-	<0.01	-	<0.01	-
- Lower Falls	1982	Smallmouth bass	0.04	0.03- 0.06	<0.01	<0.01-<0.01	<0.01	<0.01-<0.01	<0.01	<0.01-<0.01
		Walleye	0.28	-	0.02	-	<0.01	-	0.02	-
Canaseraga Creek										
- Dansville	1982	Brown trout	0.13	-	<0.01	-	<0.01	-	<0.01	-
		Northern pike	0.18	-	<0.01	-	<0.01	-	<0.01	-
		Redhorse spp.	0.18	-	<0.01	-	<0.01	-	<0.01	-
Silver Lake	1983	Largemouth bass	0.06	0.06- 0.08	<0.01	<0.01-<0.01	<0.01	<0.01-<0.01	<0.01	<0.01-<0.01
		Yellow perch	0.01	-	<0.01	-	<0.01	-	<0.01	-
Oatka Creek										
- Union St. Bridge	1983	Brown trout	0.02	0.02- 0.03	<0.01	<0.01-<0.01	<0.01	<0.01-<0.01	<0.01	<0.01-<0.01
Conesus Lake										
- McPherson Pt.	1983	Largemouth bass	0.01	-	<0.01	-	<0.01	-	<0.01	-
		Smallmouth bass	0.07	-	<0.01	-	<0.01	-	<0.01	-
		Yellow perch	0.01	0.01- 0.01	<0.01	<0.01-<0.01	<0.01	<0.01-<0.01	<0.01	<0.01-<0.01
Honeoye Lake										
- Richmond	1983	Smallmouth bass	0.03	0.03- 0.04	<0.01	<0.01-<0.01	<0.01	<0.01-<0.01	<0.01	<0.01-<0.01
- Burns Point	1983	Yellow perch	0.02	0.01- 0.02	<0.01	<0.01-<0.01	<0.01	<0.01-<0.01	<0.01	<0.01-<0.01
Hemlock Lake	1984	Lake trout	0.78	0.36- 1.21	0.02	0.02- 0.03	<0.01	<0.01-<0.01	0.02	0.01- 0.03
		Yellow perch	0.97	0.03- 0.27	<0.01	<0.01-<0.01	<0.01	<0.01-<0.01	<0.01	<0.01-<0.01
Canadice Lake	1984	Lk. trout <381 mm	0.11	0.09- 0.12	<0.01	<0.01-<0.01	<0.01	<0.01-<0.01	<0.01	<0.01-<0.01
		Lk. trout >381 mm	0.51	0.07- 1.17	0.03	<0.01- 0.06	0.02	<0.01- 0.06	<0.01	<0.01- 0.03
		Smallmouth bass	0.10	0.04- 0.13	<0.01	<0.01-<0.01	<0.01	<0.01-<0.01	<0.01	<0.01-<0.01
		Yellow perch	0.07	0.02- 0.14	<0.01	<0.01-<0.01	<0.01	<0.01-<0.01	<0.01	<0.01-<0.01

HCB = hexachlorobenzene

TABLE 4-3 (cont.)

Location	Year	Species	Average Mirex (ppm)	Mirex Range (ppm)	Average Mercury (ppm)	Mercury Range (ppm)	Average Chlordane (ppm)	Chlordane Range (ppm)
		FDA Guideline:	0.1		1.0		0.3	
Irondequoit Bay	1981	**Carp**	**0.13***	-	0.33	-	0.10	-
		Black crappie	0.01	-	0.30	-	0.04	-
	1984	**Carp**	**0.04**	**0.04-0.06**	**NA**	-	**0.68***	**0.22-0.92***
Genesee River								
- Belvedere	1982	Smallmouth bass	<0.01	<0.01-<0.01	0.61	0.58-0.66	0.01	0.01-0.01
		White sucker	<0.01	-	0.58	-	<0.01	-
- Canadea	1982	Smallmouth bass	<0.01	<0.01-<0.01	0.72	0.60-0.97	<0.01	<0.01-<0.01
- Fillmore	1982	Smallmouth bass	<0.01	<0.01-<0.01	0.63	0.60-0.72	0.02	0.01-0.03
		White sucker	<0.01	-	0.48	-	<0.01	-
- W. Henrietta	1982	Northern pike	<0.01	-	0.52	-	<0.01	-
		Walleye	<0.01	<0.01-0.01	0.52	0.40-0.76	0.01	<0.01-0.03
		Carp	<0.01	-	0.38	-	0.03	-
- Lower Falls	1982	Smallmouth bass	<0.01	<0.01-<0.01	0.33	0.30-0.38	0.01	0.01-0.01
		Walleye	0.02	-	0.56	-	0.05	-
Canaseraga Creek								
- Dansville	1982	Brown trout	<0.01	-	0.18	-	0.02	-
		Northern pike	<0.01	-	0.50	-	0.01	-
		Redhorse spp.	<0.01	-	0.44	-	0.02	-
Silver Lake	1983	Largemouth bass	<0.01	<0.01-<0.01	0.85	0.75-1.02	0.01	0.01-0.02
		Yellow perch	<0.01	-	0.26	-	<0.01	-
Oatka Creek								
- Union St. Bridge	1983	Brown trout	<0.01	<0.01-<0.01	0.14	0.14-0.14	<0.01	<0.01-<0.01
Conesus Lake								
- McPherson Pt.	1983	Largemouth bass	<0.01	-	0.20	-	<0.01	-
		Smallmouth bass	<0.01	-	0.30	-	0.02	-
		Yellow perch	<0.01	<0.01-<0.01	0.11	0.11-0.12	<0.01	<0.01-<0.01
Honeoye Lake								
- Richmond	1983	Smallmouth bass	<0.01	<0.01-<0.01	0.45	0.35-0.62	0.01	0.01-0.01
- Burns Point	1983	Yellow perch	<0.01	<0.01-<0.01	0.20	0.18-0.21	<0.01	<0.01-<0.01
Hemlock Lake	1984	Lake trout	<0.01	<0.01-<0.01	NA	-	0.10	0.06-0.14
		Yellow perch	<0.01	<0.01-<0.01	NA	-	0.01	<0.01-0.03
Canadice Lake	1984	Lk. trout <381 mm	<0.01	<0.01-<0.01	NA	-	0.03	0.02-0.04
		Lk. trout >381 mm	<0.01	<0.01-<0.01	NA	-	0.13	0.02-0.33
		Smallmouth bass	<0.01	<0.01-<0.01	NA	-	0.02	0.01-0.07
		Yellow perch	<0.01	<0.01-<0.01	NA	-	0.02	<0.01-0.03

* Exceeds FDA guidelines for fish consumption.

Source: Sloan, R. (1987). Toxic substances in fish and wildlife analyses since May 1, 1982. Vol. 6. (Technical Report 87-4(BEP)). Albany: NYSDEC Division of Fish and Wildlife.

the suspected cause was an unauthorized dump of PCB-containing equipment, which has since been cleaned up. Fish in the lower Genesee River have been found with PCB and mercury levels higher than allowed for the protection of fish-eating wildlife, but none have exceeded FDA standards except for carp in the Genesee River at West Henrietta.

(3) **DEGRADATION OF FISH AND WILDLIFE POPULATIONS.** IJC Guidelines: *When fish and wildlife management programs have identified degraded fish or wildlife populations due to a cause within the watershed, or when bioassays confirm toxicity from water column or sediment contaminants.*

Status: Impaired for mink.

Evidence: Among wildlife species in the area of concern, population degradation has been observed for mink. While this impairment is common to the entire shoreline of Lake Ontario, it has been identified as a use impairment in the AOC. This reflects the concern of the local RAP Advisory Committee who has set an objective of "...self sustaining populations of ... mink." Very few mink are now trapped within two miles of Lake Ontario, but the population increases as one moves away from the lake (Carroll, D., pers. comm. 6/17/91). Mink, which are high level predators with diets includeing fish, are believed to be highly sensitive to toxins. Foley et al. (1988) investigated the toxins in mink trapped in various parts of New York State. Previous studies of captive mink had demonstrated harmful effects from a diet of fish with PCB concentrations as low as .64 µg/L, and reproductive failure at dietary concentrations of 5 µg/L. The Foley study found fish from Lake Ontario and the Genesee River with PCB concentrations within that range. Concentrations of PCB and DDE in wild mink and otter were found to correlate significantly with concentrations of those chemicals in fish from the same areas. While land use has become more urbanized during recent years, mink are found in other urbanized areas away from Lake Ontario. Therefore, the absence of mink in the Rochester Embayment cannot be attributed solely to land use changes.

Separate from the known impairment for mink, the lower Genesee River is an area of suspected fish population degradation. Anglers using sonar have alleged a "fishless" segment of the river downstream of the lower falls and upstream of the Riverside Cemetery. The exact location of this segment, when it occurs and its real extent are unknown. *(Woodfield et al. 1992)* In the past, occasional fish kills occurred in the lower Genesee. At the request of the WQMAC, the NYSDEC is conducting a two-year study in 1992-93 to determine the following (Woodfield et al, 1992):

* Whether there is a fishless segment in the river;
* If so, whether caged fish exhibit a toxicity response in the area;
* Possible sources of toxicity (storm sewers, Kodak effluent, lower falls leachate);
* Whether benthic or water column dwelling macroinvertebrates are accumulating toxic chemicals;
* Whether caged fish accumulate toxic chemicals;
* Whether sediment exerts a toxic effect on test organisms.

Results of this study should provide evidence for or against degradation of fish and invertebrate populations due to toxicity in the lower river.

(NOTE: Several bird kills have occurred in the watershed, associated with lawn pesticide applications. These are discussed more thoroughly in the basin plan reports.)

Degradation of the black tern population is discussed under (14).

Causes (probable): For mink, as discussed above, the consumption of fish contaminated with PCBs may have contributed to population degradation.

Separate from the known impairment for mink, fish and aquatic wildlife populations **may** be affected by levels of PCBs and mercury in fish higher than allowed for the protection of fish-eating wildlife, by water column and/or sediment toxicity as evidenced by the results of ambient river-water toxicity testing discussed under (13) Degradation of Phytoplankton and Zooplankton Population, and river and embayment sediment bioassays discussed below and under (6) Degradation of Benthos.

Sediment bioassays performed for the US Army Corps of Engineers in support of dredging activities appear to show that toxicity of river and embayment sediments decreased between 1985 and 1990, as evidenced by reduced mortality in fish and zooplankton on exposure to sediments for 96 hours (AquaTech, 1986 and AquaTech 1990). Results are shown in table 4-4.

The 1985 bioassays using *Pimephales promelas* (Fathead minnow) indicated the sediments at three sites in the river and all four sites in the embayment were Moderately Polluted, as evidenced by 10-50% mortality (AquaTech, 1985). In 1990, the *P. promelas* bioassays indicated the sediments were Nonpolluted, as evidenced by less than 10% mortality (AquaTech, 1990). (Note: The actual 1990 Aqua Tech Report has a typographical error that reports species length in millimeters but has it incorrectly labeled as centimeters).

The 1985 bioassays of river and embayment sediments using *Daphnia magna* (zooplankton, water column dweller in the food chain of some fish and wildlife), which is a more sensitive species than *P.promelas*, found the sediments from all but one site to be moderately polluted (criteria of10-50% mortality); however, it should be noted that the control in that study showed 8% mortality . The average mortality of the experimental group was 15.6%. (AquaTech, 1985). The 1990 *D.magna* bioassays indicated nonpolluted sediments (criteria of <10% mortality) at seven of the river sites and moderately polluted sediments at the other three, and Moderately polluted sediments in the Irondequoit Bay outlet and in the embayment. The control in the 1990 study showed 2.2% mortality. The average mortality in the experimental group was 11.74 (AquaTech, 1990). Results for most sites examined in both studies showed a decrease in toxicity between 1985 and 1990; four sites exhibited increases.

(5) **BIRD OR ANIMAL DEFORMITIES OR REPRODUCTION PROBLEMS.** IJC Guidelines: *Impairment exists when wildlife survey data confirm the presence of deformities (e.g. cross bill syndrome) or other reproductive problems (e.g. eggshell thinning) in sentinel wildlife species. Impairment does not exist when the incidence rates of deformities or reproductive problems in sentinel wildlife species do not exceed background levels in inland control populations.*

Status: Mink reproduction impaired; bird or animal deformities unknown.

Evidence: For evidence about mink reproduction problems, see the written information provided on pages 4-13 and 4-14 under the use impairment for "Degradation of fish and wildlife populations).

Braddock Bay is a well known area for observing and studying birds see impairment 14 for further information on related bird issues). The greatest volume of birds are observed during spring and autumn migrations; the percentage of local birds is not known, so it is difficult to attribute any observed deformities to conditions in the AOC (E.Brooks, pers.comm. 9/29/92).

Deformities have not been noted in raptors (Jeff Dodge, pers.comm. 9/28/92) or black terns (S.Skelly, pers.comm. 9/29/92).

Passerines (small songbirds etc) are also banded and studied in the Braddock Bay area. Deformities (e.g. an oven bird with grossly crossed bill) have been observed and documented in spring and autumn reports. For the period of 1985-1992, a total of 29 banded birds out of 27,500 were observed to have deformities at Braddock Bay. Many of these are migratory birds. (E. Brooks letter to , R. Burton 9-30-92) There is no evidence that water quality contributed to these deformities.

(6) **DEGRADATION OF BENTHOS.** IJC Guidelines: *When the benthic macroinvertebrate community structure significantly diverges from unimpacted control sites, or when bioassays show elevated toxicity of sediment contaminants.*

Status: Impaired for Genesee River, unknown for the Rochester Embayment.

Evidence: The DEC Division of Water, Bureau of Monitoring and Assessment sampled benthos in the Genesee River portion of the embayment in 1974, 1980 and 1990 as part of its Rotating Intensive Basin Studies (RIBS). The studies evaluated community structure, to assess overall water quality. Results indicate that the benthos is more degraded toward the mouth of the river.

In 1974, the area below the lower falls was described as follows (Bode, 1980): Station 6 (above Kodak discharge) exhibited "Reduced species richness and number of individuals reflects poor water quality; caddisflies are absent"; Station 7 (below Kodak discharge) and Station 8 (near Stutson Street bridge) exhibited "Further reductions in species richness as water quality worsens; caddisflies and mayflies are entirely absent; fauna is dominated by tolerant midges and oligochaetes."

The 1980 study described this same area as follows (Bode, 1980): "Stations 6 and 7 both exhibited communities indicative of poor water quality, although both showed some improvement since the 1974 sampling. Stations 7 and 8 had faunas similar to the most polluted section of the Buffalo River, and appeared to suffer from both organic and toxic pollution." The improvements since 1974 included the appearance of caddisflies and mayflies (both require more oxygen).

The 1990 survey showed that conditions had changed little from 1980 (Bode, et al., 1991). The table below shows assessments made in the 1990 study.

Genesee River at Route 104 Bridge	Slightly to moderately impacted
Genesee River above Kodak discharges	Slightly to moderately impacted
Genesee River below Kodak discharges	Moderately impacted
Genesee River at Charlotte docks	Severely impacted

It is unknown whether the Lake Ontario portion of the embayment suffers from degradation of benthos, as no studies have been done since 1976.

In 1972, as part of the International Field Year on the Great Lakes (IFYGL) efforts, Nalepa and Thomas observed that oligochaetes were the dominant form of bottom fauna in the shallow areas of the embayment. Over 75% of the oligochaetes were *Limnodrilus hoffmeisteri*, which is an indicator species associated with pollution (Nalepa and Thomas, 1976).

In 1976, healthy communities were observed off RG&E's Russell Station (RG&E, 1977). That study noted a diverse and abundant benthic community, typical of those in Lake Ontario. *Pontoporeia affinis*, considered to be an oligotrophic indicator, was one of the most abundant amphipods. Among the oligochaetes, tubificidae had the largest species diversity and numbers. *Limnodrilus* , a pollution tolerant genus, was present in small numbers. There were large numbers of mesotrophic genera such as *Aulodrilus* and *Potamothrix*. In addition, there were small numbers of *Stylodrilus heringanus*, which is an oligotrophic species. Among the chironomids, pollution tolerant forms (*Chironomus* spp. and *Cryptochironomous* spp.) usually dominated.

Sediment bioassays using the benthic macroinvertebrate *Hexagenia limbata* (burrowing mayfly) were performed in 1985 with sediments from the river and embayment, and in 1990 with sediments from the river, Irondequoit Bay outlet, and the embayment (AquaTech, 1985 and

AquaTech, 1990). Results are shown in Table 4-4. There were 12 locations where sediment bioassays were done in both years. Of those 12 sites, the results from 7 of them indicate some decrease in mortality while 5 indicate an increase in mortality. The results from both years indicate the sediments fit into the "Moderately Polluted" category at all sites, as evidenced by 10-50% mortality of *H.limbata* on exposure to sediments for 96 hours. Unlike the apparent trend discussed under (3) Degradation of Fish and Wildlife for the water column dwelling *Pimephales promelas* (fathead minnow) and *Daphnia magna* (zooplankton), results of the studies with *H.limbata*, a more sensitive species, do not show noticeable improvement between 1985 and 1990. The NYSDEC study of the lower Genesee River (Woodfield et al. 1992), discussed under the previous impairment, will provide more information on the benthic community and whether it appears to be impacted by toxic chemicals in sediments.

Causes (known): The water quality implications of limited diversity of organisms--specifically those that are related to "polluted" waters is historically due to oxygen depletion.

Causes (possible): Organisms from the NYSDEC's river sample sites, with the exception of the Route 104 bridge location, were tested for chemical contaminants in 1989-90 as part of the Rotating Intensive Basin Study (Bode et al. 1992). Silver, copper, nickel, iron and PCBs were found at concentrations above background levels. Silver concentrations were in the top 1% of all New York State values. (High levels of titanium and aluminum were also found in a single crayfish. The other chemicals were present in many organisms.) Information on metals in sediments as documented by Aqua Tech are presented in Table 4-5. The presence of elevated levels of contaminants in tissues suggests that pollutants might be adversely affecting the benthic communities. More specific tests would be needed to determine whether these pollutants or other conditions are affecting these benthic communities.

(7) **RESTRICTIONS ON DREDGING ACTIVITIES.** IJC Guidelines: *When contaminants in sediments exceed standards, criteria or guidelines such that there are restrictions on dredging or disposal activities.*

Status: Impaired in Genesee River.
Note: The restrictions that are in place prohibit a method of dredging known as "overflow" dredging. These restrictions should be maintained even if sediment quality is improved in order to prevent excessive turbidity at public beaches. Navigational dredging methods other than the "overflow" method are allowed.

Table 4-4 Sediment Bioassays

Site/Criteria	*Pimephales promelas* (Fathead minnow) August 1985	May 1990	*Hexagenia limbata* (Burrowing mayfly) August 1985	May 1990	*Daphnia magna* (Zooplankter) August 1985	May 1990
Average size of 25 representative organisms						
Length (cm)	3.25 ±0.72	1.89 ± .33	3.79 ±0.80	3.26 ± .31		
Weight (g)	0.19 ±0.04	0.10 ±0.06	0.49 ±0.19	0.34 ±0.09		
Mortality (%) determined by 96-hour sediment bioassay (3 tests per site):						
Nonpolluted	<10	<10	<10	<10	<10	<10
Moderate	10-50	10-50	10-50	10-50	10-50	10-50
Heavy	>50	>50	>50	>50	>50	>50
Control	0	0	13	11.6	8	2.2
R-1	15	3.3	32	30.0	17	4.4
R-2	10	0	22	16.6	18	6.6
R-2R	–	0	–	28.3	–	7.7
R-3	7	0	33	18.3	19	8.9
R-4	8	0	27	33.3	18	12.2
R-5	5.0	0	37	18.3	20	8.9
R-6	1.0	0	30	23.3	11	5.5
R-7	8	3.3	27	18.3	12	8.9
R-8	8	0	20	30.0	19	7.7
R-9	5	3.3	17	28.3	10	14.3
R-10	20	0	22	30.0	12	12.2
R-11	27	–	33	–	7	–
R-12	15	–	25	–	11	–
R-13	12	0	32	18.3	11	12.2
R-14	12	0	13	20.0	10	24.4
I-1	–	0	–	40.0	–	16.6
I-2	–	0	–	26.6	–	12.0
I-3	–	0	–	21.6	–	15.4
I-3R	–	0	–	25.0	–	11.1
I-4	–	3.3	–	48.3	–	17.7

Source: Aquatech, December 1990, The Analyses of Sediments From Rochester and Irondequoit Harbors, Technical Report, Bioassays.

Table 4-5 Bulk Sediment Analyses: Metals and Cyanide

Location/Date/Source	Al mg/Kg	Sb mg/Kg	As mg/Kg	Ba mg/Kg	Be mg/Kg	Cd mg/Kg	Cr mg/Kg	Cu mg/Kg	Fe mg/Kg	Pb mg/Kg	Mn mg/Kg	Hg mg/Kg	Ni mg/Kg	Se mg/Kg	Ag mg/Kg	Tl mg/Kg	Zn mg/Kg	Total CN- mg/Kg
EMBAYMENT SITES																		
R-11 AqT 09/ /85	–	–	12.2	77	–	2.4	12	33	–	25	–	0.09	22	–	12	–	100	0.08
R-12 AqT 09/ /85	–	–	6.4	67	–	2.0	11	25	–	20	–	0.09	19	–	7.8	–	87	0.06
R-13 AqT 09/ /85	–	–	7.1	90	–	3.0	21	31	–	30	–	0.40	25	–	4.1	–	140	0.12
R-13 AqT 08/ /90	–	–	5	33	–	0.4	16	21	13000	27	290	0.8	17	< 0.7	0.9	–	110	0.34
R-14 AqT 09/ /85	–	–	6	100	–	2.5	21	30	–	31	–	0.56	26	–	4	–	140	0.32
R-14 AqT 08/ /90	–	–	5	37	–	0.9	18	23	14000	23	330	0.7	20	< 1	1	–	110	0.49
RIVER SITES BELOW LOWER FALLS																		
R-1 AqT 09/ /85	–	–	7	40	–	0.5	7	24	–	7	–	0.43	14	–	0.1	–	52	.12
R-1 AqT 08/ /90	–	–	7	64	–	<0.5	9	22	21000	15	570	0.08	19	< 2	4	–	69	.26
R-2 AqT 09/ /85	–	–	8.2	52	–	0.5	7.2	29	–	6.7	–	0.17	17	–	3.7	–	54	.06
R-2 AqT 08/ /90	–	–	7	48	–	0.5	6	17	17000	9	410	0.08	14	< 1	3	–	50	.38
R-2R AqT 08/ /90	–	–	7	54	–	0.5	7	19	18000	9	460	0.06	15	< 1	5	–	57	.62
R-3 AqT 09/ /85	–	–	6.5	47	–	0.5	5.5	20	–	8	–	0.68	13	–	4	–	51	.26
R-3 AqT 08/ /90	–	–	6	46	–	<0.5	7	16	18000	9	390	0.05	14	< 1	3	–	51	.37
LTB 205j 05/16/84	–	< 0.7	13	–	< 0.7	< 0.7	22	32	–	8.0	–	< 0.07	59	< 0.7	9.7	<0.7	345	1.29
R-4 AqT 09/ /85	–	–	6.9	62	–	0.5	7.4	24	–	8.8	–	0.04	19	–	4.4	–	59	.05
R-4 AqT 08/ /90	–	–	6	50	–	< 0.5	8	18	19000	10	430	0.05	16	< 1	8	–	60	.66
ROCO1 EPA / /81	10000	–	–	82	–	1.0	20	30	23000	24	580	0.1	25	–	4.8	–	100	–
ROCO2 EPA / /81	9000	–	–	100	–	4.1	24	51	21000	67	390	0.3	23	–	14	–	170	–
R-5 AqT 09/ /85	–	–	7.5	89	–	2.5	14	31	–	25	–	0.10	24	–	15	–	116	.24
R-5 AqT 08/ /90	–	–	6	41	–	< 0.4	6	14	15000	8	360	0.07	13	< 0.6	4	–	47	.61
R-6 AqT 09/ /85	–	–	5.8	82	–	1.4	10	25	–	19	–	0.07	19	–	13	–	85	.22
R-6 AqT 08/ /90	–	–	6	42	–	< 0.4	7	16	17000	12	830	0.07	13	< 0.6	3	–	55	.61
ROCO3 EPA / /81	15000	–	–	410	–	29	65	98	31000	250	470	0.5	37	–	23	–	780	–
ROCO3b EPA / /81	17000	–	–	140	–	6.5	38	58	32000	170	510	0.3	36	–	5.8	–	280	–
R-7 AqT 09/ /85	–	–	10.7	83	–	2.0	12	27	–	19	–	0.09	19	–	16	–	92	.26
R-7 AqT 08/ /90	–	–	7	45	–	< 0.5	9	19	17000	10	420	0.08	15	< 0.7	8	–	58	.57
R-8 AqT 09/ /85	–	–	10	90	–	2.5	12	30	–	24	–	0.08	20	–	14	–	107	1.19
R-8 AqT 08/ /90	–	–	6	41	–	< 0.5	6	15	14000	9	320	0.09	12	< 0.7	4	–	44	.45
ROC10 EPA / /81	8600	–	–	86	–	3.1	21	28	19000	34	380	0.2	23	–	11	–	140	–
ROCO4 EPA / /81	8800	–	–	86	–	2.3	19	28	20000	31	440	0.4	24	–	8.5	–	120	–
UTB 205j 05/16/84	–	< 0.7	8.1	–	< 0.7	4.0	19	38	–	9.7	–	< 0.07	47	< 0.7	10.0	< 0.7	143	1.86
R-9 AqT 09/ /85	–	–	5	70	–	1	10	25	–	12	–	0.06	21	–	5	–	67	0.14
3u DEC / /87	20000	–	5.9	138	1.9	< 2.8	26	38	28000	40	519	0.08	30	< 0.5	7	–	155	–
BXRT RIBS 08/16/89	6700	–	–	–	–	1 W	–	20	15000	20	420	0	20	–	–	–	70	–
BXRT RIBS 08/22/90	5300	–	–	–	–	1 W	–	12	14000	20	610	0	20	–	–	–	44	–
R-9 AqT 08/ /90	–	–	9	47	–	< 0.5	8	18	18000	9	370	0.06	16	< 0.7	5	–	58	.89
ROC14 EPA / /81	8300	–	–	72	–	1.5	17	25	19000	27	410	0.2	21	–	6.6	–	99	–
R-10 AqT 09/ /85	–	–	9.3	114	–	2.3	13	29	–	23	–	0.07	18	–	25	–	92	.52
R-10 AqT 08/ /90	–	–	6	47	–	< 0.5	8	18	17000	9	340	0.07	15	< 0.7	6	–	59	.85
1u DEC / /87	9800	–	3.0	67	1.1	< 2	14	20	16000	18	258	< 0.04	16	< 0.5	< 4.0	–	77	–
2u DEC / /87	16000	–	8.6	1400	1.7	20	110	220	26000	240	435	1.94	4	0.8	< 4.0	–	976	–
EPA Criteria																		
Non-polluted			< 3	< 20			< 25			< 40			< 20				< 90	< .10
Heavily polluted			> 8	> 60		> 6	> 75			> 60		≥ 1	> 50				> 200	> .25
NYSDEC Standard			5	N/A		.8	26			27		.11	22				85	
IJC Surveillance Work Group - Dredging Guideline			8			1.5	120	45	45550	50	1625	3	90				105	1
Rochester Basin Background						1		46	46200	30	1700	.09					108	

Al = Aluminum Sb = Antimony As = Orsebic Ba = Barium Be = Beryllium Cd = Codmium Cr = Chromium Cu = Copper Fe = Iron Pb = Lead Mn = Morganese Hg = Mercury Ni = Nickel Se = Selenium Ag = Silver
Tl = Thallium Zn = Zinc CN- = Cynaide

Table 4-5 Bulk Sediment Analyses: Metals and Cyanide (Continued)

Location/Date/Source	Al mg/Kg	Sb mg/Kg	As mg/Kg	Ba mg/Kg	Be mg/Kg	Cd mg/Kg	Cr mg/Kg	Cu mg/Kg	Fe mg/Kg	Pb mg/Kg	Mn mg/Kg	Hg mg/Kg	Ni mg/Kg	Se mg/Kg	Ag mg/Kg	Tl mg/Kg	Zn mg/Kg	Total CN- mg/Kg
CEM 205j 08/03/84	–	< 0.8	19	–	0.6	4.8	24	40	–	49	–	0.56	37	< 0.8	20	< 0.8	187	14.2
bKDK 205j 08/03/84	–	< 0.8	12	–	< 0.5	2.9	21	25	–	41	–	0.15	29	< 0.8	24	< 0.8	112	4.6
KDKu 205j / /84	–	< 0.8	12	–	0.81	27	37	46	–	69	–	0.89	41	< 0.8	27	< 0.8	440	4.58
KDK1 205j / /84	–	< 0.7	16	–	< 0.5	6.5	23	32	–	41	–	0.47	35	< 0.7	12	< 0.7	194	10.9
ROCO9 EPA / /81	6600	–	–	48	–	0.9	13	21	16000	24	330	0.2	18	–	4.7	–	76	–
ROCO8 EPA / /81	9200	–	–	240	–	9.1	37	73	23000	130	230	0.4	24	–	30	–	220	–
ROCO7 EPA / /81	7200	–	–	64	–	4.2	16	28	17000	39	330	0.1	19	–	9.2	–	95	–
ROCO6 EPA / /81	6700	–	–	45	–	0.5	14	27	16000	34	300	0.1	20	–	4.4	–	80	–
ROC11 EPA / /81	7000	–	–	49	–	0.6	12	16	15000	14	320	0.1K	17	–	2.7	–	62	–
ROCO5 EPA / /81	5500	–	–	32	–	0.2W	11	15	14000	15	240	0.1W	16	–	2.1	–	51	–
aKDK 205j 08/03/84	–	< 0.7	5.8	–	< 0.5	< 0.7	10	16	–	15	–	< 0.1	16	< 0.7	1.1	< 0.7	57	< 0.7
ROC12 EPA / /81	5200	–	–	30	–	0.4	11	17	12000	31	190	0.2	14	–	0.4	–	55	–
IRONDEQUOIT BAY OUTLET SITES																		
I-1 AqT 08/ /90	–	–	2	6	–	1	2	3	3900	5	110	0.07	3	< 1	< 0.5	–	31	.72
I-2 AqT 08/ /90	–	–	2	7	–	0.5	2	3	4100	5	130	0.07	4	< 1	0.5	–	31	.37
I-3 AqT 08/ /90	–	–	2	170	–	0.5	8	51	2600	< 5	800	0.06	2	< 4	0.5	–	15	<.20
I-3R AqT 08/ /90	–	–	2	140	–	1	8	5	2800	5	720	0.04	2	< 3	0.5	–	17	<.20
I-4 AqT 08/ /90	–	–	1	6	–	0.5	2	1	2900	5	91	0.04	2	< 0.7	< 0.5	–	22	1.03
SITES ABOVE LOWER FALLS																		
CNL 205j 08/02/84	–	<0.8	6.8	–	0.34	<0.8	11.4	15.7	–	16.3	–	0.14	21.0	<0.8	<0.8	<0.8	89.7	<0.8
aGCO 205j 08/02/84	–	<0.8	11.8	–	<0.6	<0.8	10.2	11.9	–	13.5	–	0.12	20.8	<0.8	<0.8	<0.8	43.7	<0.7
bGCO 205j 08/02/84	–	<0.7	12.2	–	<0.5	<0.7	11.9	13.3	–	15.0	–	<0.2	22.3	<0.7	<0.7	<0.7	46.0	<0.8
Genesee River at Cuylerville																		
RIBS 08/15/89	3800	–	–	–	–	1 W	–	8	9900	10 W	340	0	10	–	–	–	30	–
RIBS 08/21/90	4300	–	–	–	–	1 W	–	5	11000	10	310	0	10	–	–	–	97	–
Oatka Creek at Garbutt																		
RIBS 08/16/89	8100	–	–	–	–	5	–	100	19000	160	500	0	40	–	–	–	330	–
RIBS 08/22/90	2400	–	–	–	–	2	–	16	6100	30	420	0	30	–	–	–	110	–
Honeoye Creek at Mendon																		
RIBS 08/16/89	2100	–	–	–	–	2	–	5	4200	10 W	200	0	10 W	–	–	–	20	–
RIBS 08/22/90	1800	–	–	–	–	1 W	–	7	4400	10	190	0	10 K	–	–	–	21	–
Genesee River at Scio																		
RIBS 08/15/89	5900	–	–	–	–	2	–	9	15000	20	510	0	10	–	–	–	60	–
RIBS 08/21/90	5900	–	–	–	–	1	–	32	15000	30	380	0	20	–	–	–	110	–
Caneseraga Creek at Mt. Morris																		
RIBS 08/15/89	2100	–	–	–	–	1	–	5	5000	10 W	160	0	10 W	–	–	–	30	–
RIBS 08/21/90	2700	–	–	–	–	1 W	–	9	7300	10 K	230	0	10	–	–	–	29	–
EPA Criteria																		
Non-polluted			< 3	< 20			< 25			< 40			< 20				< 90	< .10
Heavily polluted			> 8	> 60		> 6	> 75			> 60		≥ 1	> 50				> 200	> .25
NYSDEC Standard			5	N/A		.8	26			27		.11	22				85	
IJC Surveillance Work Group - Dredging Guideline			8			1.5	120	45	45550	50	1625	3	90				105	.1
Rochester Basin Background						1		46	46200	30	1700	.09					108	

Al = Aluminum Sb = Antimony As = Orsebic Ba = Barium Be = Beryllium Cd = Codmium Cr = Chromium Cu = Copper Fe = Iron Pb = Lead Mn = Morganese Hg = Mercury Ni = Nickel Se = Selenium Ag = Silver
Tl = Thallium Zn = Zinc CN- = Cynaide

Evidence: At the request of Monroe County, the Department of Environmental Conservation has restricted the type of dredging in Rochester Harbor. Overflow dredging, which allows low density muds to overflow at the dredging site, is prohibited.

As of 1992, sediments from the Genesee River are deemed suitable for open lake disposal.

The 1990 sediment analysis showed most pollutants in the EPA's "nonpolluted" or "moderately polluted" range. However, some fell in the "heavily polluted" range. Cyanide pollution was heavy at all ten sample sites. See Chapter 5 for information on possible sources of cyanide. Other parameters that were in the "heavily polluted" range at one or two sites were arsenic, barium, COD, manganese, phosphorus, and total Kjeldahl nitrogen (Aqua Tech, 1990). Irondequoit Bay outlet channel sediments were sampled at four sites. Three were heavily polluted with cyanide and one was heavily polluted with barium, copper and manganese. Sampling of Irondequoit Bay Channel sites done in 1976 by the United States Environmental Protection Agency (USEPA) classified sediments in this area as unpolluted. (USACOE, 1979, Draft Phase 1 General Design Memorandum Volume 2, Appendix F).

Table 4-5 provides information on metals in the sediments.

A special study in 1986 investigated the impact of overflow dredging. Different dilutions of the overflow were used in toxicity tests of *Daphnia magna*. Fifty percent mortality occurred when organisms were exposed to 25 percent overflow for 96 hours (Aqua Tech, 1986). The cause of the toxicity was not determined.

Causes (known): The main reasons for requiring no overflow dredging are to reduce the release of toxic chemicals to the river (e.g. ammonia, which is toxic to fish), to reduce incidents of increased oxygen consumption in the river, and to reduce the impact of resuspended sediments and fecal coliform on the swimming beach. The River is more susceptible to negative impacts from overflow dredging because it has lower dissolved oxygen than the embayment. Overflow dredging in the River also has a direct impact on the nearby swimming beach.

(8) EUTROPHICATION OR UNDESIRABLE ALGAE. IJC Guidelines: *When there are persistent water quality problems (e.g. ,dissolved oxygen depletion, nuisance algal blooms, decreased water clarity, etc.) attributed to cultural eutrophication.*

Status: Impaired in Lake Ontario, not applicable in Genesee River because flowing rivers are not subject to eutrophication.

Evidence: While the central lake water quality targets for phosphorus have been met, the littoral zone still experiences massive blooms of *cladophora* and other algae. *Cladophora* , which adheres to rocks and other submerged objects, is visible along the Lake Ontario shore and sometimes contribute to beach closings at Ontario Beach. When the *cladophora* breaks away from its attachments, it accumulates along the shore, where it harbors and promotes coliform bacteria as it decomposes.

This impairment contributes to other impairments: drinking water taste and odor problems (9), beach closings (10), degradation of aesthetics (11), and degradation of phytoplankton and zooplankton populations (13).

Causes (known): Excess phosphorus from non-point source runoff still causes problems in local nearshore areas. See Chapter 5 for information on sources of phosphorus.

(9) RESTRICTIONS ON DRINKING WATER CONSUMPTION OR TASTE AND ODOR PROBLEMS. IJC Guidelines: *When treated drinking water supplies are impacted to the extent that ... taste and odor problems are present.*

Status: Impaired occasionally in Lake Ontario, not applicable in Genesee River because drinking water is not drawn from the River.

Evidence: Some taste and odor problems are noticed by customers of the Monroe County Water Authority, whose water intake is in the embayment. The problems occur primarily in August, when prolonged hot temperatures promote blue-green algae blooms.

Causes (known): Non-point source phosphorus. Weather phenomena can cause problems in water treatment as well. Sudden wind shifts can alter currents, changing the temperature or turbidity of the water reaching the supply intakes. As discussed under (12) Added Costs to Agriculture or Industry, sudden temperature or turbidity changes can upset the water treatment processes (Matsumoto *et al.* 1989).

See Chapter 5 for further information on sources of phosphorus.

(10) BEACH CLOSINGS. IJC Guidelines: *When waters, which are commonly used for total body contact or partial body contact recreation, exceed standards, objectives, or guidelines for such use.*

Status: Impaired in Rochester Embayment of Lake Ontario, not applicable in Genesee River because there are no beaches along the River.

Evidence: Figure 3-1 shows locations of current or former beaches. Webster beach along Lake Ontario in Webster Park was closed to swimming in 1965 due to massive algae problems, and facilities were removed. This beach has suffered from shoreline erosion, and there are no plans to reopen it because it is not conducive to a swimming beach (cobbles rather than sand form the beach).

Durand Beach along Lake Ontario in Durand Eastman Park was closed to swimming in 1966, and public facilities were removed. Because of a lack of funds for its restoration, this beach remains officially closed, although it is accessible and is heavily used by the public. The remaining water quality problem is related to stormwater from three streams that flow onto the beach. Actions are under way to divert this stormwater beyond the beach. This should be done by 1994. However, many other issues remain before the beach can be pened (financial considerations).

Ontario Beach immediately west of the Genesee River was closed to swimming from 1967 to 1976 after the State Public Health Law set standards for coliform bacteria that could not be met. Ontario Beach reopened in 1976, using monitoring and weather-based models to measure and predict water quality (Burton, 1976). Permit conditions require bathing restrictions on days when the model predicts unacceptable water quality. Model criteria have been tightened a number of times since 1976, in response to evaluation of the model's effectiveness in predicting water quality. The frequency of beach closure since 1976 is shown in Table 4-6.

Causes (known): Coliform bacteria, algae (*Cladophora*), turbidity.

The problems at Ontario Beach were studied extensively in order to develop a model to determine when swimming should be restricted (Burton, R., pers. comm. 7/10/92; Burton, R., 1975). In the past, the Genesee River plume was considered responsible for many of the beach closings; however, bacteria levels in the river have shown a decrease since implementation of the Combined Sewer Overflow Abatement Program (CSOAP) program (see Figure 4-3 and Table 4-7, and the river plume should be a less significant problem in the future.

It can take up to two days for the Genesee River plume to reach the beach, allowing some bacteria to die off in the process. Local streams which flow to Lake Ontario west of Ontario Beach in the Town of Greece deliver bacteria much more rapidly during rainfall events than does the Genesee. Of these local streams, Slater Creek, which drains an urbanized area and empties adjacent to Ontario Beach, is the most important pollutant source. Round Pond Creek has also presented serious problems in the past, but these have diminished somewhat since pump station overflows were eliminated in that watershed. Table 4-8 shows the coliform counts in several streams and lakefront areas. The high concentrations in Slater Creeks are evident. When looking at this data, it is important for the reader to know that 1991 was a dry, low flow year.

Cladophora algae is another major reason for swimming restrictions. Accumulated masses of *cladophora* washed up on shore serve as breeding grounds for the bacteria that cause beach closings. Decaying clumps of algae have been found to contain high concentrations of coliform bacteria (MCHD, unpublished). Algae must be raked from the beach before swimming is allowed. When algal amounts are too great, this procedure is not feasible.

Table 4-6.

Summary of Ontario Beach Closure Statistics: 1976-1991

Year	Season	Total #days	Open #days (%)	Closed #days (%)
1976	03Jul-06Sep	66	50 (76)	16 (24)
1977	22Jun-05Sep	76	59 (78)	17 (22)
1978	24Jun-04Sep	73	69 (95)	4 (5)
1979	24Jun-03Sep	72	66 (92)	6 (8)
1980	21Jun-01Sep	73	69 (95)	4 (5)
1981	20Jun-07Sep	80	66 (82)	14 (18)
1982	19Jun-06Sep	80	72 (90)	8 (10)
1983	25Jun-05Sep	73	59 (81)	14 (19)
1984	23Jun-03Sep	73	44 (60)	29 (40)
1985	22Jun-02Sep	73	65 (89)	8 (11)
1986	26Jun-01Sep	68	47 (69)	21 (31)
1987	20Jun-07Sep	80	66 (82)	14 (18)
1988	25Jun-05Sep	73	61 (84)	12 (16)
1989	26Jun-04Sep	71	53 (75)	18 (25)
1990	23Jun-03Sep	73	53 (73)	20 (27)
1991	22Jun-02Sep	73	53 (73)	20 (27)
16-Year Total		1177	952 (81)	225 (19)

FIGURE 4-3

Genesee River Membrane Filter Fecal Coliform Daily Log Mean

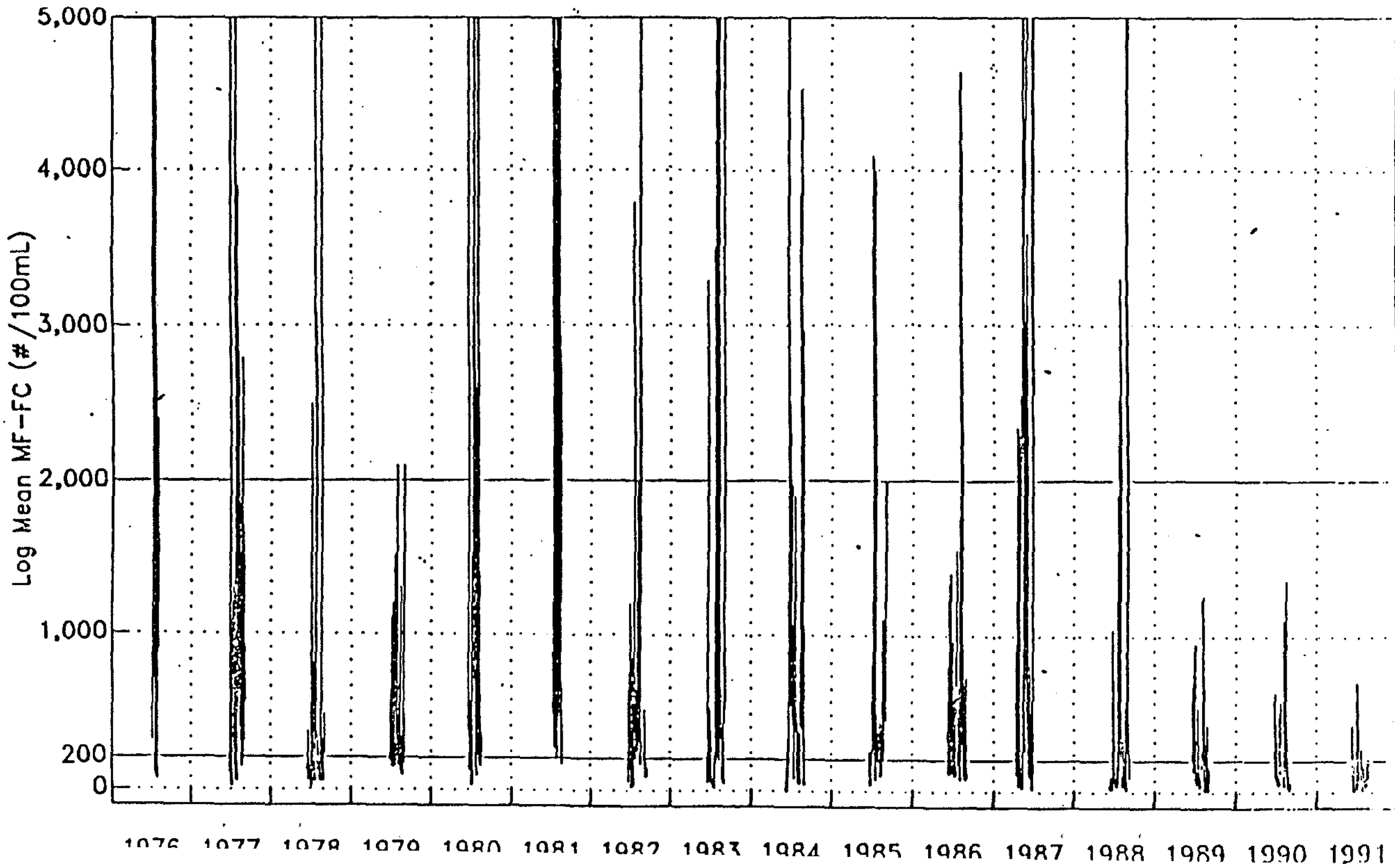

TABLE 4-7 Genesee River: Membrane Filter Fecal Coliform: 1976 - 1991

Statistic	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Monitoring Location	1	1	1	2	2	2	2	2	2	2	2	2	2	3	3	3
Season start	05/31	06/20	06/13	06/28	06/19	07/08	06/22	07/02	04/27	06/19	06/09	06/2	06/07	06/21	06/17	06/13
Season end	09/06	08/24	09/03	09/04	08/21	08/27	09/28	09/06	09/02	09/02	09/01	09/07	09/06	09/04	8/31	08/23
# Days sampled	92	62	82	65	61	41	74	34*	124	75	79	79	92	74	74	64
# Samples	1304	634	858	658	283	188	492	155*	1366	437	452	530	681	853	520	504
Membrane Filter Fecal Coliform																
Season Log Mean (#/100mL)	**822**	**882**	**194**	**348**	**597**	**1791**	**327**	**341***	**591**	**349**	**456**	**680**	**375**	**139**	**116**	**68**
Season Minimum (#/100mL)	5	10	<5	20	6	80	10	4	6	10	<10	10	4	7	<10	<4
Season Maximum (#/100mL)	220000	120000	130000	1300	70000	140000	100000	17000	30000	8000	30000	70000	39600	1200	6700	1760
Season Results >400 (%)	64.7	70.5	1.9	40.9	50.2	84.0	39.2	45.2	65.7	43.5	54.9	65.1	50.5	19.8	15.2	5.6
Flow at Driving Park (USGS)																
Season Mean (cfs)	**2374**	**2316**	**817**	**557**	**819**	**1527**	**2122**	**1187**	**4251**	**648**	**1856**	**126**	**647**	**2693**	**803**	**479**
Season Minimum (cfs)	665	506	417	242	30	1010	755	590	373	446	297	488	396	526	480	360
Season Maximum (cfs)	7480	7270	1720	1145	1860	2840	6860	4250	13600	1770	6700	5090	1860	11500	1650	900
Total rainfall during season																
Rochester airport (NOAA)	**11.84**	**9.46**	**5.20**	**3.74**	**6.48**	**6.89**	**8.02**	**10.63**	**6.66**	**15.68**	**3.23**	**8.74**	__	__	__	__

***No samples in August 1983**

Table 4-8 Lake Ontario Shoreline Points: Membrane Filter Fecal Coliform

Summer Log Mean: 1972 - 1991

Location	1972	1973	1974	1975	1976	1977	1978	1979	1980	1981	1982	1983	1984	1985	1986	1987	1988	1989	1990	1991
Hamlin Beach	--	10	37	30	16	11	12	14	11	23	26	32	21	25	43	27	25	17	24	12
Westphal Road	--	9	31	20	19	9	7	8	10	39	25	14	21	17	32	13	11	21	7	9
Lighthouse Road	--	--	48	9	37	6	7	11	12	23	18	14	13	15	11	21	20	6	17	21
Manitou Road	--	8	9	6	16	4	10	13	8	22	8	16	7	9	8	19	8	4	19	--
Grandview Beach	--	--	14	19	16	8	5	48	12	12	32	32	23	28	11	20	11	7	93	22
Rigney Bluff	--	--	18	20	26	8	13	10	11	47	37	32	18	26	20	30	12	9	91	8
Round Pond	--	--	--	--	--	--	27	35	680	760	43	49	56	21	27	27	43	21	26	21
Ontario Beach	82	21	30	34	34	24	14	15	10	49	61	70	51	56	44	66	64	48	67	44
Windsor Beach	62	20	27	13	38	--	--	--	--	--	--	--	--	--	--	--	--	--	--	--
Durand Beach	98	31	170	30	60	41	14	19	15	73	44	62	44	38	55	45	59	34	95	49
Irond.Bay Outlet	59	19	18	12	22	31	11	12	19	37	23	21	22	43	21	10	9	--	--	--
Oklahoma Beach	44	15	35	39	29	25	16	9	8	55	22	31	23	12	20	23	13	8	12	7
Forest Lawn	--	--	--	--	38	46	38	14	16	56	37	32	66	39	29	39	40	19	31	27
Webster Beach	39	35	68	11	19	34	10	15	11	63	21	57	39	65	49	64	17	22	88	13
Hamlin Stream	--	--	--	--	--	--	--	--	--	--	330	380	98	160	110	65	549	84	377	49
Slater Creek	--	--	--	--	610	6	5	15	440	380	230	1700	1400	530	972	864	1420	344	415	35
Stutson Street	190	120	450	220	1100	1200	140	190	230	1400	53	--	--	--	____	____	____	____	____	____
Beach Avenue	--	--	--	--	410	880	110	270	290	1400	320*	470*	370*							

* Ontario Beach Park Continuous Monitor, No Samples in August, 1983

Sources: Burton,RS et al. 1976. A Report on Water Quality at Ontario Beach 1973-1975.
and Monroe County Health Department. Annual Rochester Embayment Data Reports: 1977 - 1991

Additional monitoring sites for some years not reported here include Boxart Street, Charlotte Pump Station and Park Monitor.

During harbor dredging, resuspended sediment can bring bacteria to the beach when the wind and current are flowing in toward the beach.

(11) **DEGRADATION OF AESTHETICS**. IJC Guidelines: *When any substance in water produces a persistent objectionable deposit, unnatural color or turbidity, or unnatural odor.*

Status: Impaired.

Evidence: Algae (*Cladophora*) clings to rocks and washes up on shorelines, causing visual impairments along the lake shore. The presence of silt gives the river and part of the Embayment a muddy look. Litter and sediment are also visible, primarily in the lower river after storms.

Objectionable odors from rotting algae and from a chemical seep at the lower falls are occasionally evident.

At times, alewives in Lake Ontario experience massive die-offs and accumulate on beaches. Alewives are non-native species that tend to undergo population explosions and crashes, presumably because they are not completely adapted to the lake environment. They feed on plankton and are consumed by larger predatory fish such as trout and salmon. The remains of salmonids in the Lower Genesee that have died naturally after spawning, or who have been caught and discarded also cause localized odor problems.

Causes (known): Algae related to excess phosphorus, chemical seeps at the Lower Falls (see Chapter 5 for details), natural die-off of stocked fish, turbidity, littering and trophic imbalances (for alewives)

(12) **ADDED COSTS TO AGRICULTURE OR INDUSTRY**. IJC Guidelines: *Impairment exists when there are added costs required to treat the water prior to use for agricultural or industrial purposes. Impairment does not exist when there are no such costs.*

Status: Impaired due to zebra mussels.

Evidence: Significant added costs to agriculture or industry do not exist for reasons other than zebra mussels.

Zebra mussels in Lake Ontario and the lower Genesee River have resulted in extra water treatment costs primarily for industrial and municipal water uses. Increased costs include the cost of chlorination at the intakes, and extra maintenance of water-carrying infrastructure.

An extensive industrial water use survey was conducted in 1988 by the Rochester Water Bureau and the Industrial Management Council ("Water Survey," unpublished). Users of public water supplies were surveyed. About half of the respondents indicated they pretreat their water supplies, but most of those appeared to be guarding against possible periodic quality disruptions that could cause operational problems. Only 13% percent of the respondents said that the water quality was too poor or inconsistent for use without treatment.

SUNY Buffalo studied nearshore water quality variations in Lake Ontario in order to determine the frequency and possible causes of sudden changes that could disrupt water treatment or use (Matsumoto, et al. 1989). Temperature and turbidity data from 1981 through 1985 were analyzed for perturbation events defined as 10-unit fluctuations in temperature (°F) or turbidity (NTU) within a 24 hour period. The table below shows the number of such perturbation events each year.

Year	Events
1981	34
1982	46
1983	58
1984	70
1985	68

Most temperature-related events affecting water intakes occurred in summer, while most turbidity-related events occurred in fall, winter and spring, particularly in March and April. The main cause was determined to be shifting wind direction affecting lake currents. The sediments delivered by the Genesee River must be considered a primary cause of the turbidity events. These perturbations primarily affect industrial and municipal users.

The Monroe County Cooperative Extension reports no record of added costs to agriculture due to pollution (WQMAC minutes 9-20-90).

(13) DEGRADATION OF PHYTOPLANKTON AND ZOOPLANKTON POPULATIONS. IJC Guidelines: *When phytoplankton and zooplankton community structure significantly diverges from unimpacted control sites of comparable physical and chemical characteristics or **when plankton bioassays confirm toxicity in ambient waters.***

Status: Impaired in Lower Genesee River. Unknown in Lake Ontario.

Evidence: Toxicity testing performed as part of the 1989-90 Rotating Intensive Basin Studies (RIBS) using *Ceriodaphnia dubia* (zooplankton) indicated several occurrences of significant presumptive chronic toxicity (7-day Reproductive Impairments) at five of six sites in the Genesee Basin, and one occurrence of significant presumptive acute toxicity (7-day Survival) at one site (Kuzia & Heitzman, 1992). Results are shown in Table 4-9. The RIBS report indicates the coincidence of elevated phenols in several samples taken at the Genesee Docks at Boxart Street within the AOC boundaries which showed significant toxicity. However, no measured toxicants were present in adequate concentrations to account for the decreased reproduction.

Further work will be done in future RIBS efforts (1995-96) , as most of the Genesee Basin sites have been recommended for continuation in the program (NYSDEC, 1992).

The SUNY Brockport Biology Department has studied plankton in the open waters of Lake Ontario and off Hamlin Beach near the Brockport water intake, but does not have data from the embayment itself. In general, plankton in Lake Ontario are doing well, but due to the reduction in phosphorus inputs, the entire plankton community in the lake is undergoing changes in quantity and type that indicate improving trophic status (Makarewicz, 1991). In nearshore areas, however, waters are eutrophic and nutrients are still

TABLE 4-9 1989-90 RIBS AMBIENT WATER TOXICITY TESTING RESULTS
Species: *Ceriodaphnia dubia*

Sample Date	Test Date	ACUTE RESULTS (7day Survival) Percent (%) of Adult Survival	CHRONIC RESULTS (7day Reproductive Impairment) Test Reprod.	Control Reprod.	Percent (%) of Control Reprod.
Genesee River in Rochester, at Boxart Street (Lower Genesee River)					
03/21/89	03/24/89	100%	195	192	101.6%
06/27/89	07/01/89	100%	132	161	82.0%
10/05/89	10/16/89	80%	161	165	97.6%
04/24/90	**04/30/90**	**100%**	**143**	**208**	**68.8% SIGNIF** *
07/16/90	**07/24/90**	**80%**	**56**	**194**	**28.9% SIGNIF**
11/05/90	11/09/90	70%	179	220	81.4%
Genesee River in Cuylerville, at Route 20A/39 Bridge (Upstream of AOC)					
03/23/89	03/24/89	90%	196	192	102.1%
06/28/89	07/01/89	100%	106	161	65.8%
10/04/89	10/16/89	100%	254	165	153.9%
04/25/90	**04/30/90**	**90%**	**144**	**208**	**69.2% SIGNIF**
07/18/90	07/24/90	100%	125	194	64.4%
11/08/90	11/09/90	80%	170	220	77.3%
Oatka Creek in Garbutt, at Union Street Bridge (Upstream of AOC)					
03/22/89	03/24/89	100%	184	192	95.8%
06/27/89	07/01/89	100%	135	161	83.9%
10/05/89	10/16/89	70%	114	165	69.1%
04/24/90	**04/30/90**	**90%**	**98**	**208**	**47.1% SIGNIF**
07/16/90	**07/24/90**	**80%**	**39**	**194**	**20.1% SIGNIF**
11/05/90	11/09/90	90%	167	220	75.9%
Honeoye Creek in Mendon, at Plains Road Bridge (Upstream of AOC)					
03/21/89	03/24/89	90%	208	192	108.3%
06/28/89	07/01/89	100%	160	161	99.4%
10/04/89	10/16/89	100%	230	165	139.4%
04/25/90	04/30/90	100%	170	208	81.7%
07/18/90	07/24/90	90%	147	194	75.8%
11/08/90	11/09/90	80%	173	220	78.6%
Genesee River in Scio, at Knight Creek Road (Upstream of AOC) **(Low Hardness decreases reproduction here)**					
03/28/89	03/31/89	100%	159	213	74.6%
07/12/89	07/17/89	90%	165	218	75.7%
10/17/89	10/24/89	80%	168	180	93.3%
05/01/90	05/07/90	90%	133	186	71.5%
06/27/90	**07/02/90**	**80%**	**93**	**184**	**50.5% SIGNIF**
10/31/90	**11/05/90**	**30% SIGNIF**	**38**	**148**	**25.7% SIGNIF**
Canaseraga Creek in Mount Morris, at Route 408 Bridge (Upstream of AOC)					
03/23/89	03/24/89	100%	193	192	100.5%
06/28/89	07/01/89	100%	215	161	133.5%
10/02/89	10/16/89	100%	253	165	153.3%
04/25/90	**04/30/90**	**90%**	**131**	**208**	**63.0% SIGNIF**
07/18/90	07/24/90	100%	172	194	88.7%
11/07/90	11/09/90	100%	188	220	85.5%

Source: NYSDEC Rotating Intensive Basin Studies, Appendix C, January 1992.
For each sample, one Ceriodaphnia dubia is placed in each of ten replicate fifteen ml samples of the test water. A laboratory control water sample is run concurrently to determine if normal survival and reproduction occurs during the test event. At the end of 7 days, the mean reproduction rate for each sample is determined. If the reproduction rate in the sample is lower than in the control; and this difference is determined to be statistically significant, then the sample is presumed to be toxic.

overabundant, as shown by the excessive growth of *Cladophora* algae. In eutrophic waters, plankton communities are likely to be different than they are in other areas.

See discussion under the Eutrophication (8) impairment for more information on *Cladophora* excesses and causes.

At the time of this writing, we are not aware of any research documenting that zebra mussels have had an impact on reducing populations of zooplankton and phytoplankton, but there is anecdotal evidence that this may be occurring.

(14) **LOSS OF FISH AND WILDLIFE HABITAT.** IJC Guidelines: *When fish and wildlife management goals have not been met as a result of loss of fish and wildlife habitat due to a perturbation in the physical, chemical or biological integrity of the Boundary Waters, including wetlands.*

Status: Impaired.

Evidence: Loss of habitat is apparent when comparing past areas of wetlands and riparian habitat to those of today. This habitat loss over the long term has contributed to the decline of native fish species such as Atlantic salmon, lake trout, cisco, blue pike, sturgeon and walleye (Eckert, 1989). Bald eagles no longer nest in the Rochester area due to lack of habitat (Rathke and McRae, 1987, Vol. 1).

In reference to present fish and wildlife management goals, black terns are known to be suffering population declines in the Braddock Bay area. Historically, 40-50 nests per year were common, but in 1990 only four nests were found (Carroll, 1991). Wildlife managers suspect that black tern nesting is impacted by wakes of boats, the spread of purple loosestrife, and the greater presence of people in this area (pers. comm. D. Carroll, 1993). However, a black tern nesting colony in Yanty Creek has also disappeared, and that area has no boat traffic. It is possible that toxins in fish or other unknown causes are affecting the terns, which are at the western edge of their range here (Haynes, 1991).

Causes (known): General habitat losses have been caused by filling of wetlands along the last few miles of the Genesee river; filling and drainage of other wetlands; deforestation and agriculture; sedimentation (some of it natural); and development of lake, bay and pond shorelines. These changes are for the most part irreversible, but further degradation can be minimized.

Causes (possible): With regard to black terns, boat traffic is a suspected cause of nest disturbance.

e. Uses with Impaired Status not known for the AOC

This section summarizes the reasons why the WQMAC has determined that certain impairments are not known to exist in the AOC. Each possible use impairment is preceded by the impairment number corresponding to Table 4-1. The IJC's guidelines for identifying the impairments are summarized for each.

(2) **TAINTING OF FISH AND WILDLIFE FLAVOR.** IJC Guideline: *When ambient water quality standards, objectives or guidelines for the*

anthropogenic substances(s) known to cause tainting are being exceeded or survey results have identified tainting of fish or wildlife flavor.

Status: Unknown

Evidence: The New York State Department of Environmental Conservation (NYSDEC) has received approximately 6-8 complaints from anglers over the past five years who reported a chemical odor in salmonids caught in the lower Genesee (Woodfield *et al.*, 1992).

Survey results have not identified examples of tainting. Fishing groups have not expressed such concerns to personnel of the SUNY Brockport Biology Department or the Sea Grant Extension Program at Brockport. Both have actively sought out anglers to talk with them about fish quality.

Phenols have occasionally been measured in the river and embayment at levels that could cause tainting (see Table 4-10). The Part 700 State standard for total chlorinated phenols is 1 µg/L, and the standard for total unchlorinated phenols is 5 µg/L, for fish flesh. The standard for phenols in the Great Lakes Water Quality Agreement are not to exceed 1.0 µg per liter in public water supplies to protect against taste and odor in domestic water. EPA water quality data from 1981 (see Table 4-10) showed phenols at the mouth of the Genesee River at levels that could cause tainting (Rockwell and Palmer, 1985). That report states that of twenty one samples from three sites (the mouth of the Genesee and two sites outside the embayment), six samples had concentrations below the 4 µg/L level of detection, and the maximum was 22 µg/L. Recent results for samples from the river indicate generally lower phenol concentrations, but there are still occasional samples with phenols which exceed the 1 µg/L standard as shown in Table 4-10 (MCDH, unpubl; and RIBS '92).

The DEC's 1992 survey of the lower Genesee will include further research into this issue (Woodfield *et al.*, 1992).

Table 4-10 Water Column Phenol Concentrations (mg/L)

Location/Dates	1981 EPA[1] n	mean	range	1989-90 RIBS[2] n	mean	range	1988-91 MCHD[3] n	mean	range
Embayment (3 sites)	21		< 4-22						
River at Charlotte Pump Station				20	1.52	< 1.0-5.2	36	0.83	<1.0-4.0

(n=number of samples)

1 Rockwell, D.C. and Palmer, M.F. (1985). "Lake Ontario 1981 Limnology Survey: Niagara, Rochester, Oswego Areas." In Bertram,Paul (ed.) Limnology and Phytoplankton Structure in Nearshore Areas of Lake Ontario, 1981. (EPA-905-3-85-003). Chicago, IL U.S. EPA Great Lakes National Program Office.
Data in this report is not presented in a form which allows calculation of a mean value.

2 New York State Department of Environmental Conservation, (1992) Biennial Report : Rotating Intensive Basin Studies: Water Quality Assessment Program 1989-1990. Albany, NY:;NYSDEC Division of Water, Bureau of Monitoring and Assessment, in cooperation with the United States Geological Survey.

3 Monroe County Department of Health. (unpublished) Genesee River Water Quality Monitoring data, 1988-1991.

(4) **FISH TUMORS OR OTHER DEFORMITIES.** IJC Guidelines: *When the incidence rates of fish tumors or other deformities exceed rates at unimpacted control sites and when survey data confirm the presence of neoplastic or preneoplastic liver tumors in bullheads or suckers.*

Status: Unknown

Evidence: Electrofishing and netting in the embayment and in Sandy Creek are conducted by SUNY Brockport as part of its fisheries management courses. The fish are checked for visible deformities, but not for liver tumors. One large bullhead caught in Sandy Creek in 1990 had a skin tumor that was confirmed as cancerous. Since this is an isolated incident that could have a natural origin, it was not considered sufficient evidence to warrant listing fish tumors as an impairment (WQMAC, 6/7/91).

Fish examined as part of RG&E's annual impingement studies do not show an abnormally high incidence of tumors or deformities. RG&E does not routinely check for liver tumors, although on occasion fish from the river have been examined for them (Sawyko, P., pers. comm. 6/25/91).

Anglers have not complained about tumors or deformities.

Sediment contaminant data can help determine whether carcinogenic substances are present that might cause fish tumors. Extracts of Buffalo River sediments have been found to cause liver and skin neoplasia in brown bullheads, attributed at least in part to polynuclear aromatic hydrocarbons (PAHs) in the sediment (Black, 1988; NYSDEC, 1989). Buffalo River sediments had total PAH values averaging 23 ppm in a NYSDEC study and 38 ppm in an Erie County study (NYSDEC, 1989-Buffalo River RAP).

Table 4-11 illustrates levels of PAHs in sediments from the AOC and shows the Buffalo River values for comparison. Analyses in a 1981 EPA study in the lower Genesee River measured total PAH levels ranging from 0.66 to 5.91 ppm (Kizlauskas, et al., 1984). They were detected at all 14 sites. Benzo(a)pyrene comprised approximately one quarter of the total PAH levels, and was measured at concentrations approximately one quarter of those in the Buffalo River. Total PAH levels in the Genesee River measured nearly one order of magnitude lower than those reported in the Buffalo River.

More recent studies in the AOC have found PAHs less frequently than the 1981 study. The 1984 County Health Department 205j study (MCHD, 1986) detected fluoranthene, phenanthene, and pyrene at one river site. Other PAH's were either not detected or below detection limits at all other sites. Sediment analyses associated with the 1990 harbor dredging indicated detectable levels of PAHs at the site at the end of the jetties, where total PAHs were approximately 63 ppm, of which nearly half was fluoranthene. However, no PAHs were detected in samples from all nine other river sites and two embayment sites in that study (Aqua Tech 1990b);. (>>> Note: the 1990 study also found PAHs in the Irondequoit Bay outlet channel and at the Bay boat launch <<<)

In order to determine if this impairment exists, an investigation into liver tumors is needed.

TABLE 4-11

Poly Aromatic Hydrocarbons (PAH's) in Sediment of Rochester Embayment Area of Concern Compared to Buffalo River Values (values in mg/kg or ppm)

	BUFFALO RIVER[1]		1981 EPA[2]		1984 MCHD[3]	
	DEC	ERIE	Roch. Embmt.		Roch. Embmt.7 SITES	
	(n=10)	(n=58)	(n=14)	SITES	(n=7)	
	MEAN	MEAN	MEAN	RANGE	MEAN	RANGE
BENZO (A)PYRENE	1.229	2.056	0.60	N.D.-2.44	.071	<0.25-<1
TOTAL PAH (sum of mean values)	23.252	38.308	2.64	.66-5.911	2.20	<mdl-6.4

1: NYSDEC, 1989, Buffalo River RAP.

2: Kizlauskas et al., 1984. PAH's detected in all sites

3: MCHD, 1986. PAH's detected at one site, upstream of Kodak treatment plant.
All other values reported ND (not detected) or BDL (below detection limit)
To calculate total PAH: BDL is treated as 1/2 the detection limit
ND is treated as 0
mdl means minimum detection limit

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f. Impairments in the Rochester Embayment with Unknown Causes

Although some suspected or historic causes have been identified above, cause and effect relationships have not been firmly established for:

(3) Degradation of Fish and Wildlife Populations

(6) Degradation of Benthos.

g. Impairments in the Watersheds Tributary to the Rochester Embayment.

As part of the preparation of the Rochester Embayment RAP, three watershed plans have been developed for each of the 3 basins that flow to the Rochester Embayment of Lake Ontario. The basins are: The Lake Ontario Central Basin , the Lake Ontario West Basin and the Genesee River Basin. Subcommittees of the Water Quality Management Advisory Committee worked to identify the use impairments that exist in each of these basins. The use impairments that have been identified in each of these basins are outlined below. Many of the use impairments, pollutants causing the impairments, and sources of pollutants are the same or similar to those summarized for the Rochester Embayment. For further information on the basin use impairments, the reader should see the respective basin plans.

(1) Lake Ontario Central Basin Impairments

(a) <u>Impairment:</u> excessive quantities of algae and other plants. This impairment has been a historical problem in Irondequoit Bay. An existing water quality management plan for the Irondequoit Creek Basin has begun to address this problem. Actions taken include the diversion of 14 wastewater treatment plants' discharges out of the Bay watershed, the application of aluminum sulfate to the deep portions of Irondequoit Bay to seal nutrients in the sediments, and an effort to reduce phosphorus loadings in urban stormwater runoff in the watershed. Excessive quantities of algae also exist in ponds along the lakeshore west of Irondequoit Bay located in Durand Eastman Park, and in ponds located in the southern portion of the basin in Mendon Ponds Park in the town of Mendon. A diagnostic study has been done on one of the ponds in Mendon Ponds Park and an application has been made to the Clean Lakes Program to have diagnostic studies done on the ponds in Durand Eastman Park along the Lake Ontario shoreline. As in the embayment, the major factor causing this impairment is phosphorus. The sources of the pollution problems include stormwater runoff, agricultural fertilizers, air deposition, and internal recycling of phosphorus in Irondequoit Bay.

(b) <u>Impairment:</u> **stream bank erosion, excessive sedimentation.** Stream bank erosion is a problem in many portions of this watershed. The place in the watershed where this problem is most serious is along Irondequoit Creek in the town of Penfield, just upstream of Irondequoit Bay in an area known as Linear Park. At this location the stream banks are like a canyon with vertical sides in excess of 40 feet in height. Water quality is being degraded as sediments, eroded from the steep streambank by high flows carry nutrients and contaminants to Irondequoit Bay. A substantial amount of silt and sediment is being carried downstream to salmon and trout spawning beds, creating a problem for fish propagation, and the severe state of erosion is causing a potential danger to the people and property located adjacent to the eroding slopes on Irondequoit Creek. Other erosion and sedimentation problems occur because of debris that gets lodged in streambeds that causes scouring of banks. Sedimentation also occurs in this basin at construction sites. An erosion control technician program to address construction site erosion was instituted in this basin as part of the implementation of the Irondequoit Basin Water Quality Management Plan, however, funding for the program has been unstable.

<u>(c) Impairment:</u> **degradation of aesthetics** as evidenced by oil, trash, litter, and some foam. Sources of pollution include stormwater runoff, boats, construction practices, and littering. Confirmation of this impairment was done by subcommittee members who conducted stream surveys in the basin during the summer and fall of 1990.

<u>(d) Impairment:</u> **restrictions on fish and wildlife consumption in streams connected to Lake Ontario.** The cause of the impairments are persistent toxins such as PCB's and mirex, and in Irondequoit Bay, chlordane. See the discussion of this impairment in the Embayment section of this chapter.

<u>(e) Impairment:</u> **drinking water taste, odor and contamination problems**. This occurs for portions of the watershed that obtains its drinking water from Lake Ontario during the summer due to algae (related to phosphorus problems). See the discussion of this impairment for the Embayment. In some areas of the watershed where groundwater is the primary drinking water source, there are taste problems that stem from minerals from natural sources. Another problem with the groundwater supply in the Village of East Rochester is an excess of chloride in the water. East Rochester also has some excessive sodium due to the current water treatment process. The East Rochester groundwater supply was temporarily taken off line in November of 1992 while work is done to build a reverse osmosis treatment system. During the interim, Village residents are receiving water from the Monroe County Water Authority.

(f) Impairment: **loss of fish and wildlife habitat** has occurred due to encroachment by development, noise and shoreline degradation from motorized boating, fluctuating water levels, oxygen depletion in the water, toxic contamination of water, sedimentation, and loss of stream bank shade. Sources of these problems include urbanization, recreational uses, sewage and industrial discharges, and pollution from urban and agricultural runoff.

(g) Impairment: **degradation of fish and wildlife populations.** The factors causing this impairment are the same as those explained in the Embayment section. It should be noted that fish populations are making a comeback in Irondequoit Creek, with some natural spawning of brown trout occurring in the Creek.

(h) Unconfirmed Impairment: **fish tumors.** As part of a research study conducted in a large wetland complex immediately south of Irondequoit Bay, a high incidence of what appear to be tumors or abrasions were found on brown bullheads captured in 1990. Samples of the fish were not sent for pathological analysis, however, so it is not known whether these fish tumors were malignant, or whether the fish showed other indications of problems such as liver tumors. More work needs to be done in this area to confirm this possible impairment.

(i) Impairment: **Degradation of benthos (only in Irondequoit Bay)** This impairment is confirmed only in Irondequoit Bay, and is due to a lack of oxygen in the deep waters of the bay. This impairment is also likely in other eutrophic ponds such as those in Durand Eastman Park along the Lake Ontario shoreline west of Irondequoit Bay, and in Mendon Ponds Park, in the southern portion of the watershed in the town of Mendon.

(j) Impairment: **Contaminated sediment (if disturbed).** This impairment exists primarily in Irondequoit Bay and is due to years of accumulation of phosphorous, nitrogen, grease, oil, possibly metals from past inputs of wastewater from sewage treatment plants, combined sewer overflows, and activities related to recreational boating. Urban stormwater runoff also has a major impact on the accumulation of nutrients, grease, and oil.

(k) Impairment: **Beach closings and unsafe swimming conditions.** Two public beaches along Lake Ontario in this watershed were initially closed in the 1960's due to pollution problems,. These beaches, at Durand Eastman Park between Irondequoit Bay and the Genesee River, and at Webster Park, east of Irondequoit Bay are currently not operating primarily because the proper facilities, such as bath-houses and lifeguards, no longer exist at these sites. It is unknown what the water quality conditions are now at these locations because extensive monitoring does not occur. During the summer of 1992, periodic beach closings also occurred at North Ponds Park in the town of Webster due to excessive fecal coliform counts which were storm related.

2. Lake Ontario West Basin Impairments

(a) Impairment: **excessive quantities of algae and other plants.** The factors involved with this impairment are the same as those outlined for the eutrophication impairment for the Embayment. Specific locations in this basin where this is a problem are the many ponds adjacent to the Lake Ontario shore west of the Genesee River. These include Long Pond, Buck Pond, Cranberry Pond, and Round Pond. A diagnostic study of Long Pond has been proposed by Monroe County, and funds to conduct such work have been applied for under the federal Clean Lakes program.

(b) Impairment: **stream bank erosion, excessive sedimentation**
This problem has been confirmed by stream surveys conducted by members of the Lake Ontario West Basin Subcommittee during the summer and fall of 1990. There are no outstanding examples of stream bank erosion in this basin. Some of the streambank erosion and sedimentation problems were found to be due to blockages in streams, cutting grass too close to streams, and agricultural practices.Sedimentation occurs at construction sites as well as along stream banks. Increased stream flows due to development are also acknowledged to contribute to this problem.

(c) Impairment: **degradation of aesthetics.** Evidence of this impairment was found by volunteer stream surveyors in the summer of 1990. The evidence included sightings of oil, trash, litter, and dead fish and entrails from the gutting process. A foaming problem has also been occurring in Sandy Creek in the town of Hamlin, at the northwest corner of Monroe County. A great deal of work has been conducted to try to find the source of the foaming in Sandy Creek, but that source has not yet been found.

(d) Impairment: **restrictions on fish and wildlife consumption.** The factors for this impairment are the same as those for the Embayment.

(e) Impairment: **drinking water taste and odor problems.** This impairment occurs in portions of the watershed that obtains its drinking water from Lake Ontario. This taste and odor impairment occurs primarily during the summer due to algae (related to phosphorus problems). See the discussion of this impairment for the Embayment. In areas of the watershed where groundwater is the primary drinking water source, there are taste problems that stem from minerals from natural sources.

(f) Impairment: **added costs to agriculture or industry** (this has been confirmed for industry and may be a problem for agricultural irrigation in the future.) This issue is the same as for the embayment in that zebra mussels are impacting industry in this basin. Specific industries impacted in this basin are electric and water utilities. See the embayment impairments for more details on this issue. Agriculture uses water from the Erie Canal and streams for irrigation. The zebra mussel problem has not yet affected agriculture because irrigation has not been necessary since the zebra mussel infestation.

(g) Impairment: **loss of fish and wildlife habitat.** The factors for this impairment are the same as those outlined in the section describing the Embayment use impairment.

(h) Impairment: **degradation of fish and wildlife populations.** The factors for this impairment are the same as those outlined in the section describing the Embayment use impairment.

It should be noted that stormwater runoff from streams in this basin have been linked to beach closings at Ontario Beach, located in the Embayment. While this situation does not directly impact uses in the Lake Ontario West Basin, it does have a major impact on the beach closure impairment in the Rochester Embayment.

3. **Genesee Basin Impairments:**

(a) Impairment: **impaired recreational uses due to eutrophication, undesirable algae, and other aquatic plants.** This impairment is found in many areas of the Genesee Basin including Silver Lake, Conesus Lake, Rushford Lake, Lake LaGrange, Oatka Creek, Honeoye Lake, LeRoy Reservoir, Genesee River, Hemlock Outlet, Black Creek, Erie Canal, Honeoye Creek. The factors are the same as those impacting eutrophication and undesirable algae in the Rochester Embayment. It should be noted that agricultural runoff has a bigger impact in this basin than in other basins.

(b) <u>Impairment:</u> **stream and riverbank erosion/sedimentation.** The factors involved in this impairment are the same as those in the Embayment and in the other two watersheds. Some specific locations where this is deemed to be a problem include: Genesee River, Wiscoy Creek (west branch), Honeoye Creek (near village), Keshequa Creek, Canaseraga Creek, Red Creek, Oatka Creek, East Koy Creek, Little Beard's Creek, Lake LaGrange, Hemlock Outlet, Rush Creek, VanDerMark Creek, Black Creek. Some factors that are unique to this basin include erodible bedrock and soil types, flood flows, strong winds (which can carry sediments), and sediment lost from cropland or overgrazing on pastures. Sedimentation is a very large problem in this large watershed. One area where riverbank erosion is particularly severe is along the Genesee River in the town of Geneseo in Livingston County. The town has identified a large river meander where large chunks of earth slough off into the River frequently.

(c) <u>Impairment:</u> **degradation of aesthetics.** This impairment is known to exist at the following locations: Silver Lake, Wolf Creek (sewage odor), Wiscoy Creek, Silver Lake Outlet (sewage odor), Spring Brook (rotting algae odors), Honeoye Creek (rotting algae odors) , Little Conesus Creek, Oatka Creek (rotting algae). The factors contributing to the problem are similar to those in the other basins. Some of the specific indicators that have been observed by volunteer stream surveyors include oil sheens, trash/litter, some foaming, soap suds, algae, and rotting odors.

(d) <u>Impairment:</u> **restrictions on fish and wildlife consumption.** In addition to the fish consumption advisory for the lower Genesee River that is covered under the Embayment impairment section, there is also a fish consumption advisory in Canadice Lake, located in Ontario County. The advisory there is due to PCB's. The source of the PCB's in this area is a historic unauthorized dumping of transformer waste. This site is a superfund site that has been remediated, although the use impairment still exists.

(e) <u>Impairment:</u> **drinking water taste, odor, and contamination problems.** There are some taste problems with groundwater sources due to natural mineral content. Some groundwater wells near Letchworth Central School possibly have nitrate problems. Also, there are concerns about groundwater supply contamination in the town of Rush due to the fact that there are no public sewers, and in some locations there are septic systems in close proximity to each other. No serious specific groundwater problems have been identified, however. Some surface water supplies, such as the Hemlock and Canadice Lakes that serve the City of Rochester, but are located in the Genesee Basin in Ontario County, have occasional taste problems associated with algae in the summer months. One specific potential source of pollutants adding to the algae problem in the Hemlock Lake watershed is failing septic systems in that watershed. There is a known groundwater contamination problem that affect 45 wells in Monroe, Livingston, and Genesee Counties. The contamination is due to a trichlorethylene spill from a train derailment. The U.S. Environmental Protection Agency installed in-home water treatment systems for these homes. The wells are monitored quarterly.

(f) <u>Impairment:</u> **loss of fish and wildlife habitat.** Some specific locations where this impairment is thought to exist include: Canaseraga Creek, East Koy Creek, Oatka Creek, Genesee River,Caneada Creek, Knight Creek, VanDerMark Creek, Wiscoy Creek, Little Beard's Creek, (the self-sustaining brown trout population in Mill Creek may be threatened by nearby development). The factors causing habitat impairments include all of those mentioned for this impairment in the Embayment. Silt is a big factor in this basin. Some other factors identified by the advisory groups include temperature changes due to reduced shading, and the withdrawal of water for irrigation that reduces fish habitat. Erosion and sedimentation from streambank problems and from cropland activities are a large factor in this watershed.

(g) Impairment: **degradation of fish and wildlife populations** Some specific locations where this is thought by advisory group members to occur are: East Koy Creek (trib #4), Oatka Creek, Lake LaGrange, Silver Lake, Genesee River. The factors involved are the same as for the Embayment. However, the emphasis on streambank erosion factors and agriculture factors are greater in this watershed.

(h) Impairment: **degradation of benthos.** As part of the State-conducted sampling to determine fish & benthos health in the lower Genesee River, some control site sampling is also occurring in the portion of the Genesee River near the southern boundary of the City of Rochester. This data should be availble in 1993.

(i) Impairment: **degradation of zooplankton and phytoplankton.** Data collected as part of the Rotating Intensive Basin Studies, and presented in Table 4-11, indicates that there are some zooplankton survival problems when the zooplankton are exposed to the waters of certain water bodies in this watershed. Some specific problem areas are the Genesee River in Cuylerville, Oatka Creek in Garbutt, and at Canaseraga Creek in Mount Morris. In the Genesee River at Scio the water has low hardness values which affects the reproduction of zooplankton. The phytoplankton populations are also expected to change if the zebra mussel becomes common in basin waters.

(j) **Impairment: restricted public access to creeks**. This impairment exists in Oatka Creek, Black Creek and Honeoye Creek in Monroe County due to fallen trees and limbs due to the March 1991 ice storm. These creeks have become un-navigable due to the excessive amount of debris in the creeks.

2. Status of Toxic Contaminants

The Lake Ontario Toxics Management Plan, 1991 Update (Lake Ontario Secretariat, 1991) lists nine different priority pollutants that exceed one or more sets of standards or criteria in water or fish in the lake. These pollutants are:

Exceed Enforceable Fish Tissue Standards set to protect the Health of humans who eat the fish	Exceed EPA Guidelines (stricter than standards, but unenforceable) set to protect the Health of humans who eat the fish
Chlordane	DDT and metabolites
Dioxin	Dieldrin
Mercury	Hexachlorobenzene
Mirex	
PCBs	

Exceed NYSDEC Criteria set for fish in order to protect the health of Wildlife who eat the fish (i.e. mink and fish-eating birds)

Chlordane
DDT and metabolites
Dieldrin
Dioxin (2,3,7,8 TCDD)
Mercury
Mirex (mirex & photomirex)
Octachlorostyrene
PCBs

The Lake Ontario Toxics Management Plan intends for each RAP to quantify the loadings of these chemicals to the lake from the Area of Concern, and to attempt to reduce those loadings. The plan also includes commitments by the four participating agencies to improve estimates of nonpoint source inputs and to collect additional data on tributary loadings.

Although loadings of these priority chemicals cannot be estimated from available data, the information summarized below shows what is known about their occurrence in water, sediment, and fish in the AOC. Some information on loadings is included in Chapter 5. Table 4-12 summarizes some of the ambient water column data available for the priority pollutants of the embayment. The sparse data indicate violations of guidance values for mercury.

The sediments in the lower Genesee River and the nearshore area have been tested for mercury, PCBs and pesticides. Mercury levels in the 1981 EPA study and the 1984 County Health Department study ranged from <0.1 to 0.68 mg/kg - above the NYSDEC guidance value of 0.11, but low enough to qualify as "not heavily polluted" according to EPA criteria.

In 1985 and 1990, Aqua Tech tested for mercury in sediment at ten sites in Rochester Harbor. In 1985 the highest levels of mercury were found at the three sites closest to the river mouth (0.17 - 0.68 mg/kg) and at the site in Lake Ontario northwest of the river mouth, which is used as a control site for comparison with the dredge disposal site. Mercury levels at the control site averaged 0.48 mg/kg. In the 1990 study, mercury levels in Rochester Harbor sediment samples were all less than 0.11 mg/km, the NYSDEC guidance level. The highest levels of mercury (average 0.75 mg/kg) were found at the control site in the lake.

PCBs in river sediments were detected in the 1981 EPA study. Although present throughout the lower Genesee, PCBs were highest at the Riverview Yacht Basin (0.72 mg/kg). These levels were less than 10, so the sediments are classified as "not heavily polluted." In the Aqua Tech studies of 1985 and 1990, no PCBs were detected in the nearshore area or in Rochester Harbor (Aqua Tech, 1985 and 1990b).

The 1981 EPA study also found pesticides in the sediments at trace to low levels at all sites, with levels highest at the Riverview Yacht Basin. At that site, DDT and metabolites totaled 0.214 mg/kg, chlordane was .023 and dieldrin was .004 mg/kg. No detectable residues of these compounds were found by either the Monroe County Health Department (in 1984) or Aqua Tech (in 1985 and 1990).

Table 4-13 shows priority pollutant levels in young-of-the-year fish from the mouth of the Genesee River. These fish frequently serve as prey for other wildlife species. Only PCBs in 1987 exceeded the criteria for protection of fish-eating wildlife. However, PCBs in larger game fish from the basin consistently exceed these criteria. Mercury and DDT have also been found to exceed piscivorous (fish-eating) wildlife criteria at some sites in the basin, but chlordane levels have remained below those criteria except in Irondequoit Bay. Table 4-3, in the discussion of fish consumption advisories, shows chemical contaminants in game fish.

Pollutants from outside the area of concern.

Pollutant transport from the lake to the AOC is also a significant concern. Pollutants from Lake Ontario enter the embayment through the mixing of waters and through the movement of aquatic organisms who bring contaminants into the AOC. Predatory fish are efficient concentrators of pollutants that are extremely dilute in the water column or are contained primarily in sediments. These fish bring pollutants like mirex from the open lake into the rivers and streams of the AOC when they swim upstream to spawn and die (Lewis & Makarewicz, 1988). Fish consumption is impaired in the AOC in part because fish contaminated by sources from outside the AOC are caught in the AOC and used to establish local consumption advisories. Pollutants contained in atmospheric deposition also originate in areas outside the area of concern. This issue is addressed in more detail in chapter 5.

TABLE 4-12 TOXIC POLLUTANTS IN WATER OF EMBAYMENT

PARAMETER	STANDARD OR GUIDANCE (ug/L)	LAKE ONTARIO EPA 1981	IJC 1983 ng/L	MCWA 1990 (ann. avg.)	LOWER GENESEE[2] EPA 1973 (avg.)	DEC 1980-86	USGS 1987-90 (range) μg/L
Chlordane	0.002[1]	NT	0.000178	ND	NT	ND	NT
DDT	0.001	NT	0.155	ND	NT	ND	NT
Dieldrin	0.001	NT	0.325	ND	NT	ND	NT
Dioxin	0.000001	NT	NT	ND	NT	NT	NT
Hexachlorobenzene	0.02	NT	NT	ND	NT	ND	NT
Mercury	0.2[1]	NT	NT	ND	3.5*	ND	<0.1-0.5*
Mirex	0.001	NT	ND	ND	NT	ND	NT
Octachlorostyrene	N/A	NT	NT	NT	NT	NT	NT
PCBs	0.001	NT	0.430	ND	NT	ND	NT

NOTES:

NT = not tested. ND = not detected. * Exceeds standard. Standards are NYSDEC standards for protection of aquatic life except for hexachlorobenzene (human health protection).

[1] Guidance value - not enforceable as standard. The enforceable standard for mercury for drinking water supplies (including Lake Ontario) is 2 ug/L.

[2] 1973 values are averages of four stations from lower falls to mouth. DEC and USGS data are from Charlotte docks.

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TABLE 4-13 PRIORITY POLLUTANTS IN YOUNG OF THE YEAR FISH
MOUTH OF GENESEE RIVER

Parameter	Criteria for Piscivorous Wildlife Protection (ug/g)=ppm	1984 Spottail Shiner	1985 Spottail Shiner	1986 Spottail Shiner	1987 Emerald Shiner
Chlordane	0.37 (NYSDEC)	.009	ND	ND	ND
p, p' DDE	0.27 (NYSDEC)	.017	.008	.015	.054
Dieldrin	0.3 (IJC)	.005	.003	ND	.005
Mercury	0.5 (IJC)	.134	.107	.33	NT
PCB	0.11 (NYSDEC)	.081	.040	.074	.199*

NOTES:

* Exceeds criterion.

ND = not detected. NT = not tested.

SOURCE: Skinner, L. G. and Jackling, S. J. (1989). Chemical contaminants in young-of-the year fish from New York's Great Lakes basin, 1984-1987. Gloversville, NY: NYSDEC, Hale Field Station.

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ROCHESTER EMBAYMENT REMEDIAL ACTION PLAN

CHAPTER 5
IDENTIFICATION OF POLLUTANT SOURCES

6/8/93

A. Introduction

This chapter discusses the sources of the pollutants and associated loading factors, measured and estimated, which may be contributing to use impairments in the Rochester Embayment Area of Concern (AOC) and attempts to identify persistent toxic pollutants that may have sources in the AOC drainage basin. The chapter acknowledges that pollutant sources that affect local waters do not all originate in our AOC. Available data on pollutant discharges are presented along with a discussion of the relative importance of point and non-point sources using the Genesee River as an example. Each pollutant or pollutant category is then described and its sources outlined.

1. Pollutants Identified and Investigated

Pollutant sources were identified by evaluating a selected list of pollutants and estimating loadings with available data. The pollutants investigated are: those that are associated with impaired uses (see Chapter 4); eleven critical pollutants identified by the IJC Water Quality Board; the pollutants that are exceeding criteria in Lake Ontario (see Chapter 4); and additional pollutants identified in the Niagara River Toxics Management Plan, and supplemented by a subcommittee of the RAP Technical Group (the Loading Task Group). The list of pollutants investigated is presented in Table 5-1. For further information on how each pollutant on Table 5-1 was added to the list, see appendix D.

Of this initial list of chemicals, an additional technical group (the Priority Pollutant Task Group) made an initial determination which pollutants were of greatest concern to the Rochester Embayment based on toxicity, environmental effects, bioaccumulation, persistence, linkage with the use impairments identified in chapter 4, or the known local pollutant loadings. This preliminary list is presented in Table 5-2. The Priority Pollutant Task Group is working to finalize the priority list through the development of a quantitative process that considers the above noted criteria. Upon further evaluation, it is possible that the pollutants on this initial list may not ultimately be considered as the highest priority pollutants. This work is expected to be finalized as part of Stage II of the Rochester Embayment Remedial Action Plan.

2. Reference Sources

Reference sources utilized in estimating pollutant loadings included the following:

State Pollution Discharge Elimination System (SPDES) permit compliance records
State air emissions permit compliance records.
SARA toxic release inventory data
NYSDEC data on inactive hazardous waste sites
NYSDEC spill records
Atmospheric deposition data from local monitoring and from IJC monitoring project
Nationwide Urban Runoff Program (NURP) data on non-point source pollution in the Irondequoit Creek watershed
Studies by SUNY Brockport on pollutants in West Basin streams and ponds
U.S. Geological Survey water resources data reports (annual)
U.S. Army Corps of Engineers dredging data
Sediment analysis performed by Aqua Tech for the U.S. Army Corps of Engineers

3. Special Considerations

In estimating loadings, the following considerations emerge as possible sources of error or misinterpretation:

a. Non-detectables

Many pollutants show up on data forms as "not detected" or "below the detection limit." Detection limits depend on the analytical technology used to measure a specific pollutant and sometimes on the accuracy needed to meet standards; therefore, they may vary depending on the discharger. It cannot always be assumed that a chemical that was not detected was not present; it may have been present at a level below the detection limit. This possibility becomes significant for dischargers with very large flows (multiplying a small concentration by a large flow can yield a large annual load), and for chemicals that are harmful in concentrations so small that they are normally undetectable until they bioaccumulate in animals.

One way to present data containing "non-detects" is to give a range, the lowest value assuming the value was zero and the highest level assuming the value was at the detection limit.

To compute a single loading figure, many statisticians use a level of one-half the detection limit, allowing for a reasonable variation in chemical concentrations between zero and the detection limit. However, this method yields a loading figure for any chemical tested for, even if it has never been found and there is no reason to suspect its presence. The possible spurious loadings generated this way are most significant for the largest dischargers.

Therefore, the Ad Hoc Loading Task Group of the RAP Technical Group devised the following method to compute the loadings for direct State Pollutant Discharge Elimination System (SPDES) wastewater dischargers in the Rochester AOC drainage basin:

If 25% or more of the reported values are quantifiable, the remaining values reported at less than minimum detection limit (MDL) would be counted as one half the MDL in the loadings calculation.

If less than 25% of the reported values were quantifiable, the remaining values reported at less than MDL would be counted as zero in the loadings calculation.

b. Event Loadings

Regularly scheduled monitoring of a river or waste stream may not generate accurate annual loading figures because large percentages of the annual loadings of particular pollutants may occur during unusual events. Most pollutant discharges from streams occur during storms and snowmelt. Studies referred to in this chapter from the Irondequoit Basin and the Lake Ontario West Sub-basin included stream sampling during storm and snowmelt events as well as during base flow periods. But data collected by the U. S. Geological Survey (USGS) and the Dept. of Environmental Conservation (DEC) on the Genesee River is gathered on a scheduled basis, not necessarily during high runoff events. Thus it will tend to underestimate the total annual pollutant loading from the river.

Air emissions from industries may be highly variable over time. Many air toxics, for example, are products of incomplete combustion, which can occur when furnaces are temporarily operating at less than their design temperatures. These event loadings are not taken into account in the estimates of air emissions, which are based on normal operating conditions.

B. Pollutant Sources

1. Point Source Discharges

Table 5-3 lists total SPDES wastewater discharges of the pollutants on Table 5-1. The data is for the period October 1989 to September 1990. Pollutants not listed were not reported as discharged during that year. The data were calculated by the DEC using the "25% formula" described above for nondetectables. Table 5-3 includes all wastewater dischargers (municipal and industrial) in the Genesee Basin and those in the Lake Ontario West and Lake Ontario Central Sub-basins whose effluent goes directly to the lake. Therefore it includes the three major municipal wastewater treatment plants along the lake shore, but leaves out dischargers within the West and Central Sub-basins that discharge to smaller streams (whose contributions are relatively minor).

2. Atmospheric Deposition

The Canada Center for Inland Waters (CCIW), in a 1992 report, has estimated atmospheric deposition on Lake Ontario for a large number of chemicals not previously measured. The estimates are for deposition on each of the Great Lakes. Table 5-4 shows estimated atmospheric deposition on the embayment, the embayment basin (all three basins) and the Genesee Basin, calculated based on their area in comparison to the area of Lake Ontario based on the CCIW data.

Locally, atmospheric deposition is measured at Mendon Ponds Park in southern Monroe County and at Brockport in the western part of the county. The Brockport and Mendon Ponds data is shown at the end of Table 5-4. For the one parameter that appears in all 3 sites, lead, the figures are very different from each of the 3 sites. The same is true for total phosphorus and zinc that are common to the 2 County Sites, and to cadmium which is common to the CCIW and Brockport sites. An explanation for this discrepancy should be sought.

3. Air Emissions/Ambient Air Quality

Although atmospheric pollutants are transported to the AOC from a continent-wide area, local atmospheric discharges are important to recognize because each small area contributes to the problem as a whole and because they can be controlled locally.

Permitted discharges to the air are not sampled regularly, as are discharges to water. They are estimated based on limited testing and predictions based on that testing. Air discharges are not reported or filed on a watershed basis, so the data must be retrieved by county. Table 5-5 shows air emissions from a 5-county area. These are best estimates of actual emissions, which in most cases are less than the permitted amounts. The database was searched for all the chemicals on Table 5-1 except for cyanide, which was inadvertently excluded from the search. If a chemical does not appear under "stack emissions" on the table, it was not reported as discharged in any of the five counties. A "0.000" entry in the table indicates that there was at least one discharger of that substance in the county, but the amount discharged was less than .001 ton/yr (2 lbs/yr). A blank entry indicates no dischargers in that county. Of the five counties, Monroe is by far the largest source of all chemicals on the list except dioctyl phthalate (Orleans) and phenol (Allegany).

Evaporative or "fugitive" losses, as opposed to stack emissions, are important sources of air pollutants. These are being estimated for industrial facilities that fall under the "Right-to-Know" provisions of the Superfund Amendments Reauthorization Act of 1986 (SARA). This law requires certain ndustries using more than 10,000 lbs/yr or manufacturing/processing more than 25,000 lbs/yr of certain chemicals to file toxic release forms stating where the chemicals are going. The requirements apply to industries in Standard Industrial Classifications (SIC) 20-39 with ten or more employees. Table 5-5 shows these fugitive losses from Monroe County only. Certain other industries are not included within SIC classifications 20-39 but are responsible for both permitted point source discharges and fugitive emissions. No efficient means exist to quantify the magnitude or impacts of those discharges but they should not be assumed to be insignificant.

The surface area of the five counties on Table 5-5 is 3,214 square miles. The atmospheric deposition on these counties can be compared to the local point sources that are subject to reporting requirements. These local sources appear to be making a minor contribution to some air pollutants that fall on the area and a more significant contribution to others. For example, 2,858 pounds of lead and 12 pounds of arsenic are estimated to be generated annually in the 5-county area from point source air emissions, while the same area receives an estimated 45,000 pounds of lead and 4,300 pounds of arsenic via atmospheric deposition using the CCIW data. Known local PCB emissions are less than 2 lbs/yr, compared to approximately 37 pounds estimated to be deposited from the air. Cadmium sources appear to be more important locally; 500 pounds of cadmium are emitted in the 5-county area, compared to an estimated 3,100 pounds of cadmium deposited. There are no known point source air dischargers of pesticides or dioxin in the 5-county area.

Many sources of air emissions do not appear on the table. Vehicle exhaust and fuel evaporation are important sources of several pollutants, particularly lead and benzene (among AOC priority pollutants). In 1982, mobile sources accounted for 85% of total benzene emissions nationwide (Adler and Carey, 1989.) Evaporation from end uses is another source of air emissions -- for example, the evaporation of pesticide from fields and sprayers, and of paints and coatings when they dry.

Local ambient air quality data can help us understand the potential for airborne pollutants to fall to the ground and be discharged into local waterways. As of November of 1992, there are 3 sources of ambient air quality information that may be useful to consider to help understand current conditions, and to use as a baseline to compare against in the future.

The first is the New York State Air Monitoring System. The pollutant that is monitored by this program that is also of concern to water quality (on Table 5-1) is lead. The data shows that the amount of lead in ambient air has been decreasing. Levels monitored at a site in Rochester known as #2701-18N report annual geometric means of lead as follow:

Year	Annual Geometric Mean Lead
1985	0.35 μ/m3
1987	0.09μ/m3
1988	0.05μ/m3
1989	0.03 μ/m3

The State reports that lead concentrations have been declining statewide. Declines likely are due to the removal of lead additives from gasoline. (NYSDEC 1990).

Some ambient air monitoring data is also being collected at Eastman Kodak Company. This monitoring program was required by the NYSDEC as part of the permit to construct the facility expansion. The monitoring network began operation on 2/28/90 and will continue until the end of 1996. It should be noted that Kodak has begun implementing an emissions reduction program and additional emissions reduction activities are planned to be implemented by mid-1995. Data available for the period 10/1/91 to 12/31/91 from the quarterly report for the program prepared by Eastman Kodak has been reviewed. Chemicals that were sampled for under this program that are also of interest to water quality are dichloromethane (also known a methylene chloride), acetone, hexane, and toluene. These and other chemicals were sampled for in ambient air at 7 different sites in or near the Kodak Park area of Rochester. As an example of the kind of data available that can be used in the long term to compare progress against, Kodak ambient air data on dichloromethane is shown in table 5-6.

Some ambient air monitoring data was also collected at the Xerox Corporation facility in Webster New York near the eastern boundary of the Rochester Embayment for the period June 4, 1990 to August 27, 1990. Chemicals that were sampled for under this program that are also of interest to water quality are dichloromethane (also known as methylene chloride), methyl ethyl ketone, toluene, 111 trichloroethane, arsenic, nickel, and selenium. As an example of the kind of Xerox ambient air data available that can be used for further research, or for future comparison, see Table 5-7 taken from the report of monitoring at Xerox (Radian Corporation, 1990).

4. Landfills, Hazardous Waste Sites

Table 5-8 lists the inactive hazardous waste sites in the drainage basin that have been found to contaminate groundwater, soil or sediment near the site. The summary of Monroe County sites was done by Joe Albert of the Monroe County Department of Health. He used the publication, Inactive Hazardous Waste Sites in New York State (also known as "The Registry") (NYSDEC 1992) completed Superfund Phase II investigations, and other available analytical data at the Health Department. The data from the other counties is taken from "The Registry". The priority pollutants listed are those from Table 5-1. There are three hazardous waste sites that because of proximity to the Embayment or its major tributaries are of special concern. Information on these sites are summarized below.

The Genesee River Gorge in the City of Rochester is of particular interest because of its history and location. It extends from the Upper Falls to the Lower Falls, which form the southern boundary of the Rochester Embayment. The falls provided water power for the early industries. Many of the industries in this area produced and used toxic chemicals and disposed of them in an uncontrolled manner. It should be noted, however, that the early mill industries were generally not large scaleproducers of toxic and/or hazardous wastes. Two deep ravines on the west side were filled with 80-90 feet of waste, and landfilling was conducted along the river banks as well.

Coal gas was manufactured on both sides of the river between 1872 and 1952, producing an array of by-products including coal tar and cyanide (Morrison-Knudsen Engineers, Inc., 1986). Other industries included furniture manufacture, oil and naphtha storage, electric power production, metal fabrication, tool manufacture, dying operations, lantern manufacture, lithography, ink production, laundering (including solvent use), and garbage incineration.

The river gorge from the lower to upper falls was designated a New York State superfund site in 1983. The Phase I Superfund investigation identified 19 factories, 54 underground tanks (condition unknown) and 10 improper waste disposal sites as possible sources of the priority pollutants in the area. (RECRA Environmental, Inc., 1988). In addition, an abandoned mill race on the west side and old sewers that once served the industrial areas were possible areas for waste disposal and migration.

Some wastes in the gorge have entered the bedrock under the river, where they have been detected in several locations. In the early 1970s, benzene, toluene, xylene and an oily substance were found seeping from the face of the Lower Falls. Upstream of the Lower Falls is a tunnel built in 1910 to carry water from the dam at the Middle Falls to the hydropower station at the base of the Lower Falls. (See Fig. 5-1). When RG&E dewatered this tunnel for maintenance in 1985, toxic materials were found to be seeping from its walls in several places. Further upstream, the Rochester Pure Waters District dug a tunnel under the river in 1985 to convey combined sewage to the Van Lare treatment plant. During excavation, a flow of toxic chemicals entered the tunnel through a joint in the shale. Several other contaminant seeps were also found in the tunnel. When the contamination was discovered, measures were taken to prevent the pollutants from entering the river. Excavated material was removed for safe disposal, and water pumped from the tunnel was stored in holding ponds, then pumped to the treatment plant. At one time a pond failed and briefly allowed the seep and water mixture to escape. After the project was completed, the ponds were backfilled. Due to the fact that the closure plan was not approved as submitted by the NYSDEC, a new sampling and risk assessment study is being proposed. (Blasland and Bouck Engineers, 1992).

While some of the contaminant seeps in different parts of the tunnels and the falls have similar constituents, it has not been possible to trace them to a specific source. The Phase I Superfund investigation was only able to assign a probable source to the contaminants in a pool at the base of the Lower Falls and in the RG&E tunnel; these appeared to be associated with coal tar. The City of Rochester subsequently confirmed similar seep constituents for the seeps from the face of the lower falls. This site is discussed further under "Chemical Seeps at Lower Falls" in the next section of this chapter.

The boundaries of the Genesee Gorge NYSDEC Superfund waste site were never exactly defined due to its complexity and extent. In 1991 the entire site was taken off the state registry of inactive hazardous waste sites, after the DEC determined that coal gasification sites were not hazardous under federal regulations (Negreau, 1991). Additionally, for those areas not affected by coal gasification activities, the NYSDEC was unable to demonstrate hazardous waste disposal. Two large areas within the Genesee Gorge had been coal gasification sites. One of them, which is adjacent to RG&E's Beebee Station at the Upper Falls, is part of an urban cultural park being developed by the City of Rochester. Rochester Gas &Electric is removing the coal tar from this area. But wastes from the other disposal areas in the gorge continue to be of concern for the RAP project.

The Inactive 28 acre Old Rochester City Landfill, also known as the Pattenwood landfill is located on the east side of the Genesee River, approximately one half mile south of the Lake Ontario shoreline. A Phase II New York State Superfund investigation was conducted by Engineering Science, Inc., and a report of that investigation was published in February of 1992. The following information comes from that report. The site was operated by the City of Rochester as a municipal landfill from 1956 to 1962 and was a wetland prior to landfilling for industrial and commercial purposes, railroad construction, and waste disposal. Between 1984 and 1988, soils from the site showed the presence of PCB's,and volatile organics. An excavation during the construction of houses in the vicinity of Timrod Drive uncovered buried drums containing low concentrations of PCB's and high concentrations of lead. To evaluate the contamination for the Phase II Superfund study, soil and groundwater samples were collected and analyzed. Nine volatile organic chemicals, 27 semivolatile compounds, and three pesticide compounds were detected in the subsurface soils at the site. The levels of lead at the site were also high. Many of the substances found at the site are those we have listed as a concern for water quality in Table 5-1. Compounds found in the site's groundwater exceeded groundwater standards for drinking for three volatile chemicals, and Endrin, barium, iron, lead, magnesium, manganese, sodium and zinc. The groundwater also had some levels of PCB's. The Phase II investigation notes that "Surface waters and sediments were not analyzed off site to evaluate the extent and impact of downstream contamination." and suggests that "An impermeable cover over the disposal areas would decrease the leaching and downward migration of contaminants."

The Rochester Fire Academy site is a 21-acre site on the west bank of the Genesee River in the City of Rochester. It is located approximately 11.5 miles upstream from the mouth of the Genesee River, and is technically outside the area of concern. Because of its close proximity to the River, further information on the site is included here. The site is used as a training facility by the City of Rochester Fire and Police Departments. Various chemicals supplied by many local hazardous waste generators were burned in the training procedures from 1955 to 1980. The NYSDEC listed this site as a Class 2 designation after findings from the State Superfund Phase I and Phase II studies. The City of Rochester has completed a remedial investigation (1991) and supplemental remedial investigation (1992) of the site. The clean-up feasibility study has been drafted and submitted to the NYSDEC. The reports indicate that the groundwater is contaminated primarily with chlorinated solvents and volatile aromatic compounds. Low levels of some semi-volatile organic compounds, trace levels of PCB's and elevated levels of iron and manganese were also detected. A supplemental Remedial Investigation was started in October of 1991 to further delineate soil contamination and determine aquifer characteristics.To fully evaluate remedial alternatives for the site during the feasibility study, soils treatability studies were done to evaluate soils treatment approaches. The assessment is that the major pathway of contaminant migration is by groundwater flow to the Genesee River. The primary contaminants thought to be migrating to the River from the site are volatile organics with an estimated loading of 77 kg/year and total iron and manganese with a total loading of 278 kg/year. The estimates are based on computer modelling estimates. Actual river water sampling has been performed and did not show a significant difference between upstream and downstream samples. Modelling estimates of PCB loadings are 0.01 kg/year (Malcolm Pirnie 1992).

5. Nonpoint Source Runoff

Data derived from Nationwide Urban Runoff (NURP) studies of the Irondequoit Basin (Kappel *et al.* 1986) were used to estimate stormwater runoff pollutant loadings to the embayment from its watershed. Only the Western, Central, and lower Genesee Basins were deemed similar enough to the Irondequoit Basin to utilize extrapolated NURP results. The upper reaches of the Genesee Basin have a very different type of landscape, with wooded hills and narrow valleys, as opposed to the more gently rolling agricultural landscape of the rest of the study area. Therefore runoff calculations using NURP data were not estimated for the Genesee Basin upstream of Geneseo. Methods used for calculating nonpoint source runoff loadings are outlined in detail in Appendix E.

The results of the runoff estimates are presented in Table 5-9. Table 5-13 also gives an indication of pollutants with large non-point source contributions.

6. Spills

Hazardous material spills and leaks are a historical potential intermittent source of chemical contamination in the drainage basin. The Monroe County Office of Emergency Preparedness compiled reported spill data from the Monroe County Health Department, the NYSDEC, the Nuclear Regulatory Commission and the Rochester Fire Department between *10-1-89* and *7-17-91*. A summary of those reported spills is included in Table 5-10. The most frequent reported spills were of petroleum based products. In many cases, an estimate of the volume of the substance spills was not available. From the information available, however, petroleum based products (11,053 gallons) and solvents (15,444 gallons) had the greatest cumulative quantities of spills.

The Coast Guard keeps track of spills on the Great Lakes. These spills do not appear to be a significant pollutant source. The only ones reported between October, 1989 and September, 1990 in the Rochester area were three sheens of oil or gas on the water, and a spill of one gallon of diesel oil (Cumming, J., pers. comm., 4/17/92).

7. Combined Sewer Overflows

The number of active Combined Sewer Overflows (CSOs) and the frequency of discharge have been greatly reduced as a result of the CSOAP program. The list below shows the combined sewer overflows that have been closed by the Monroe County Pure Waters District since July, 1991 and those that are still in operation (Steinfeldt, P., pers. comm., 10/13/92 and Murphy, S., pers. comm. 10/14/92). The Culver-Goodman Control Structure discharges very infrequently into Irondequoit Bay (last discharge 1986). The remaining active overflows discharge infrequently to the Genesee River. The first five active overflows were built as relief points for the CSOAP system and are expected to remain in operation for the foreseeable future.

Closed since July, 1991	Active November, 1992
Spencer Street West Overflow	Plymouth and Railroad O.
Mill St. and Factory St. O.	Culver-Goodman Control Structure
Front St./Inner Loop O.	Structure 45 - Maplewood Park*
Central Ave. and Inner Loop O.	Structure 243 - Seneca Park*
Water St. and Inner Loop O.	Structure 41 - Lake Ave. near Ambrose St.*
Main St. O.	Water St. and Inner Loop**
Charlotte Pump Station Bypass	
Browncroft Blvd. O. (Cross-Irondequoit Tunnel)	
Beach Ave. O.	
Latta Rd./River St. O.	
Hanford Landing O.	
Hastings St./Ravine Ave. O.	
Cliff St. O.	
South Ave. and Library O.	

* Designed to discharge on average twice per year.
** Scheduled for closure by 12/92.
"O." = Overflow

8. Sanitary Sewer Overflows

In addition to the occasional overflows from combined sanitary and storm sewers in the City of Rochester, there are locations throughout the county where pump stations that pump sewage up hill also have overflow points. At these locations, sanitary sewage is discharged occasionally when a major mechanical/and or electrical failure occurs at the pump station. As pump stations have been upgraded, these relief points have been eliminated. In the Rochester Pure Waters District,as an example, the following summarizes existing sanitary sewer overflow points:

<u>Remaining Sanitary Sewer Overflows - Rochester Pure Water District</u>

Elmwood Avenue Pump Station
Charlotte Pump Station
Boxart Street
Lakeshore Blvd.
Browncroft Blvd.

9. Other

The pollutant sources discussed above do not represent all sources, but only those for which there is a good base of information. Other sources are discussed in section D in connection with individual pollutants.

C. Comparative Importance of Point and Non-point Sources of Pollutants: Genesee River Example

Because the USGS publishes data on river flow and pollutant concentrations at Charlotte Docks near the mouth of the Genesee River each year, it is possible to calculate the total discharge of pollutants from the river and compare this to the input from known discharges to the river. This way the contributions of point and non-point source discharges can be estimated. The USGS also publishes river flow and pollutant measurements for Geneseo, near the center of Livingston County. This allows the Genesee River to be divided into two segments for comparison between the upper and lower basins.

The data that are available from the USGS Water Resources Data Reports are primarily for conventional pollutants and heavy metals, not for organochlorine pesticides or other trace organics. Water quality parameters are measured from about 4 to 10 times per year (usually in spring, summer and fall). Flow is recorded daily. The method used for calculating annual loadings from these data is described in appendix E.

Point source discharges were obtained through the use of SPDES permit compliance data on file at NYSDEC. This information reveals the amount actually discharged, rather than the permitted amount. The Loading Task Group formula (see page 5-2) was used to compute discharges for October 1990 - September, 1991.

Table 5-11 shows total loadings and loadings per square mile for the Genesee River above and below Geneseo. Even though the lower basin is more highly urban and industrial, the upper basin contributes half or more of all the pollutants listed. The area of the upper basin is 58% of the area of the entire basin, so it would be expected to contribute 58% of the pollutants if area were the only factor.

For comparison, the IJC calculated Genesee River loadings as follows for some of the metals on Table 5-11 (Stevens, 1988). The loadings calculated in this study were somewhat lower than the values from 1981 and 1982.

IJC Estimate of Genesee River Loadings

Parameter	Loading (tons/yr) 1981	1982
Cadmium	3	<5
Copper	40	40
Lead	40	30
Zinc	150	260

The Monroe County Health Department also estimated that 359 tons of total phosphate (PO_4) and 46 tons of ortho-phosphate were discharged from the Genesee River to the Rochester Embayment in Water Year 1984 which ran from October 1983 to September 1984 (Monroe Co. Dept. of Health, 1986). These values are not directly comparable to total phosphorus loadings in Table 5-11.

Table 5-12 shows the relative annual inputs of chemicals to the embayment from dredging and from normal river flows. For most parameters, the amount entering the lake from river flows is an order of magnitude higher than the amount entering the lake through dredging. Approximately 15% of the pollutant-containing material settles on the river bottom and must be mechanically moved to the lake; the rest reaches the lake on its own. Arsenic and phosphorus are the notable exceptions; about 55% of the arsenic and 35% of the total phosphorus loaded into the lake appear to be transported in the dredged sediments. A possible explanation for the arsenic result is that it was used as a pesticide in the past and is primarily associated with sediments from eroded soil. Phosphorus loadings to the river have declined substantially since the Pure Waters and CSOAP programs were initiated, but previous discharges of this nutrient may have built up in the sediments. Another concern with phosphorus is that the estimate of river loading is one of the least reliable in this study. There were very few samples taken during high flow periods, and the correlation of phosphorus concentrations with flow was less than for most other parameters (see Appendix E).

Table 5-13 compares the contributions of permitted discharges and dredging inputs to other pollutant sources in the Genesee Basin. For most parameters, SPDES discharges in the Genesee Basin appear to be a relatively small percentage of the discharges to the river from other sources.

However, most of the major wastewater generators in Monroe County no longer discharge to the river or its tributaries. Their effluent is directed into the publicly owned sewer system, treated, and eventually discharged outside or near the limits of the embayment. Although this effluent has little effect on the Embayment itself, it does reach Lake Ontario. Table 5-14 compares the discharges of the Genesee River with those of the three largest municipal treatment plants along the lake. The discharges of pollutants from the river are 10--100 times greater than that of the treatment plants, with the exception of phosphorus. These calculations show the river discharging a little more than twice the amount of the treatment plants. Additional study should be conducted to validate the phosphorus loadings.

Tables 5-11 through 5-15 show the relative importance of non-point sources in Genesee River loadings. In order to explore the contribution of land runoff to those non-point sources, the results from the Nationwide Urban Runoff Program (NURP) study in the Irondequoit Basin (Kappel *et al*, 1986) were used to estimate runoff from the portion of the Genesee Basin downstream (below) Geneseo. Four pollutants were used for this calculation, since their yield per unit area showed a predictable relationship to the amount of impervious surface in the watershed (see Figures 5-2 - 5-5). The results are shown in Table 5-15. Table 5-15, also compares runoff values calculated using NURP data with nonpoint source inputs to the river that were calculated using total river discharges minus SPDES discharges.

For lead and phosphorus, the two methods yield values that are within an order of magnitude, which can be considered comparable given the uncertainty of the methodology. Values for total suspended solids are higher for the calculations based on total Genesee River flow. This result is to be expected due to bank erosion, resuspended sediments from the river bed, and upstream agricultural uses that are more intensive than that in the test watershed in the Irondequoit Basin. The Genesee River is known to carry a higher sediment load than others in the region.

Values for zinc are much higher for the NURP extrapolation; the reason for this may be related to the fact that the Irondequoit Basin streams were sampled during storm events and therefore give a more accurate (and higher) estimate of total pollutant loadings, especially for pollutants that are more highly concentrated in storm flows. However, values for zinc measured by SUNY Brockport in the West Sub-basin (Makarewicz *et al.* 1990) also appear much lower than those measured in the Irondequoit Basin. The West Sub-basin streams were sampled throughout the year, including during storm events. Table 5-16 compares loadings per unit area for the entire Genesee Basin and for selected watersheds in the Western and Central sub-basins.

One major source of pollutants in land runoff is atmospheric deposition. Not all pollutants deposited on the drainage basin reach waterways, as some are retained in the soil, vegetation or groundwater. But it is instructive to compare the estimated atmospheric deposition on watersheds to the estimated loadings from waterways. Table 5-17 shows this comparison for those chemicals that have numbers for both input and output. The input from the air appears to be closest to the output from the Genesee river for lead and mercury. The 1990 study of small streams in the West Basin (Makarewicz *et al.* 1990) compared atmospheric deposition at Brockport and loadings from Salmon and Otis Creeks. The results are also shown on Table 5-17. Nutrient loadings exceeding yields could indicate uptake by biota in the basin and a relative lack of major human pollutant sources.

The NURP study, in 1980-81, found that six times as much lead was being deposited from the air as was being discharged by streams in the Irondequoit Basin. Lead deposition was considerably higher then due to the prevalence of leaded gasoline.

Figures 5-6 through 5-9 visually summarize the importance of various pollutant sources to the Embayment. These figures are meant to show, by the size of the arrows, the relative amounts of pollutants by geographic source.

D. Pollutants Known or Possibly Causing Impairments in the AOC

1. Mirex/Photomirex

Mirex is a persistent chlorinated compound that is resistant to biological and chemical degradation. It is converted to photomirex by sunlight with the loss of one chlorine atom per molecule. Both compounds are insoluble in water but dissolve in fatty tissue and adhere to sediment particles. Mirex was originally used as an insecticide and fire retardant and was produced in Niagara Falls, NY. It is no longer produced or used in New York (NYSDEC, 1989).

There are no known local sources or mirex. The primary source of mirex affecting the Rochester Embayment is probably the site of the former Hooker Chemical Co. in Niagara Falls and the contaminated sediments and dumps associated with it. This firm was the principal producer of mirex from 1959-1967 (Litten, 1980). Mirex-contaminated sediment also exists in the Oswego River due to a one-time experimental use of mirex at Armstrong-Cook in the 1960s (NYSDEC, 1989).

Sources of mirex to Lake Ontario are summarized below (Strachan, 1991). This table does not represent the more recent atmospheric deposition data shown in Table 5-5.

Sources of Mirex to Lake Ontario (%)

Rain and Snow	Dry Fall	Upstream Atmos.	Other Upstream	Tributaries
1	3	0	91	5

Note: "Rain and snow" and "dryfall" refer only to direct deposition on the lake surface. "Upstream atmos." refers to direct deposition on the surface of upstream Great Lakes. Any air pollutants deposited on the land surface of the watershed and washed into the lake are included under "tributaries." "Other upstream" includes tributary input to upstream Great Lakes and direct discharges to those lakes.

Once mirex is in the lake environment, it accumulates in the fatty tissue of fish and their predators. It can be transported around the lake and its basin through the movement of animals and sediments.

2. Dioxin

Dioxins are chlorinated organic compounds with low water solubility that bind to sediment and soil particles and concentrate in fatty tissues. Dioxins bioaccumulate moderately in the aquatic environment. They are by-products of incomplete combustion in the presence of chlorine and are found in fly ash and other products of these processes. They are also by-products of the alkaline treatment of chlorinated phenols (NYSDEC, 1990b, pp. V-26-27).

The principal source of dioxin in the biota of Lake Ontario is the Niagara River drainage basin, where toxic chemicals have been discharged to the environment or stored in a large number of waste sites. Dioxin was probably released as a by-product by a chemical plant on the Niagara River that once produced trichlorophenol for use in pesticides. This manufacturing process was discontinued in the mid-1970s (Environment Canada *et al*. 1991).

There are no known local sources of dioxin. However, since dioxins can be produced by the combustion of chlorine-containing items such as industrial chemicals, plastic, and bleached paper, incinerators and fly-ash disposal sites are possible sources. Research in Indiana showed that dioxins and furans are found in the ambient air of urban areas and appear to have multiple sources, both large and small (Hites, R., pers. comm., 10/5/92).

There are incinerators in the AOC for medical waste, chemical waste, industrial solid waste, and sewage sludge. In addition, there are abandoned fly ash landfills and an old city incinerator site adjacent to the lower Genesee River.

3. Polychlorinated Biphenyls (PCB's)

PCBs are mixtures of chlorinated biphenyls with different degrees of chlorination. They are quite insoluble in water and adhere readily and strongly to sediments, soils, and fatty tissue. Because they are non-flammable and have useful heat exchange and electrical insulation properties, they have been used extensively in the electrical industry in capacitors and transformers. They were also used in lubricating and cutting oil formulations as well as in pesticide formulations, adhesives, plastics, inks, paints, and sealants. The use of PCBs, except in closed systems, has been banned in the United States since the late 1970s (NYSDEC, 1990a, p. 5-3).

The IJC Science Advisory Board determined the sources and fate of PCB in Lake Ontario to be the following (Strachan, 1991):

Sources of PCB in Lake Ontario (%)

Rain and Snow	Dry Fall	Upstream Atmos.	Other Upstream	Tributaries
3	3	1	82	12

Note: "Rain and snow" and "dryfall" refer only to direct deposition on the lake surface. "Upstream atmos." refers to direct deposition on the surface of upstream lakes. Any air pollutants deposited on the land surface of the watershed and washed into the lake are included under "tributaries." "Other upstream" includes tributary input and direct discharge to upstream lakes.

PCB Fate in Lake Ontario (%)

Volatilize (back to atmosphere)	Sediment	Outflow (to St. Lawrence River)
53	30	17

According to the above tables, tributaries contribute 12% of the PCB to Lake Ontario. Most of the tributary input in the AOC is believed to come from atmospheric deposition on the watershed. Elevated PCB levels in fish are found throughout New York State. The large percentage of PCBs that are volatilized from water ensures that PCBs continually cycle between air and water. (Note: the above tables do not reflect more recent atmospheric deposition data as shown in Table 5-4.) PCB sources in the Lake Ontario Basin outside the AOC include sediments in the Buffalo River, dredge spoil deposited at Times Beach, near the mouth of the Buffalo River (NYSDEC, 1989), and the Oswego River. The Oswego River AOC has three permitted PCB dischargers and PCB-contaminated sediments (NYSDEC, 1990a). Once PCBs are in the lake environment, they accumulate in the fatty tissue of fish and their predators, can be transported around the lake and its basin through the movement of animals and sediments.

There are no permitted dischargers of PCB to waterways in the Rochester Embayment AOC drainage basin, but there is one air discharger in Monroe County, emitting 2 lbs/yr. or less.

Other potential sources of PCBs within the basin are related to the once-widespread use of PCB-containing items. Because PCBs were used in electrical equipment, they remain in some older appliances, medical equipment, transformers, capacitors, electric motors, etc. that were made before PCBs were phased out. PCBs may exist at junkyards or scrap processors where these items have been stored or recycled. PCB's were also used in some inks and papers. Of all the PCBs manufactured and used in the U.S., 54% are still in use and 21% are buried in landfills, according to the IJC. PCBs can leak, spill or evaporate from these locations, and can be released during incineration or accidental burning of PCB-containing materials (Virtual Elimination Task Force, 1991).

PCBs in the electrical distribution system are often located outdoors where spills and leaks can directly affect the environment. Beginning in 1985, EPA regulations required utilities to remove PCB-capacitors from accessible locations such as utility poles and PCB transformers from areas near food or feed storage. The equipment is still allowed in closed systems but phaseout is encouraged. The seven largest utilities in New York State must submit biennial reports to the Public Service Commission regarding their PCB-containing equipment (Johnson, R. E., pers. comm., 7/23/92). Table 5-18 shows this information for the large utilities within the basin.

Mineral oil is another fluid used in transformers. Due to past maintenance operations, some of this oil has become contaminated with various levels of PCB's. RG&E is testing the larger transformers and replacing any contaminated oil. The smaller, pole-top transformers are being checked according to a routine maintenance schedule. It will take approximately 20 years to check all 50,000 pole-top transformers (Williams, J., pers. comm., 7/17/92).

In addition to the major utilities, other small utilities, villages, and industries maintain substations and electrical equipment that could contain PCBs. Some PCBs may remain on or near utility poles where equipment leaked or was vandalized in the past.

4. Chlordane

Chlordane is a pesticide that has been banned in New York State since 1985. It was once used for fumigation of homes and for agricultural crops. Residues could remain in building materials, soils and sediments. The fact that chlordane is causing an impairment only in Irondequoit Bay probably reflects the fact that this was the only area where carp were tested for chlordane. (See Table 4-3 for results of fish analysis.)

5. Polynuclear Aromatic Hydrocarbons (PAHs)

Polynuclear aromatic hydrocarbons (PAHs) are a diverse class of compounds consisting of substituted polycyclic and heterocyclic aromatic (benzene) rings. PAHs are formed as a result of incomplete combustion of organic compounds. Among the PAHs are compounds such as benzo(a)pyrene and benzo(a)anthracene. PAHs are present in the environment from both natural sources and human activities. As a group, they are widely distributed in the environment.

PAHs adsorb strongly onto suspended particulates and biota and their transport is determined largely by the patterns of sediment deposition and resuspension in the aquatic system. PAHs dissolved in the water column are believed to degrade by direct photolysis at a rapid rate. The fate of those PAHs which accumulate in the sediment is thought to be biodegradation and biotransformation by benthic organisms.

Benzo(a)pyrene is one of the most toxic PAHs. It has been documented to cause liver tumors in freshwater fish (NYSDEC, 1990b, p. V-33).

Common sources of PAHs include petroleum and derivatives, coal tar and derivatives, bitumen-based paints and coatings, diesel engine exhaust, used crankcase oil, incinerator residues, and fly ash (RECRA Environmental, 1988).

Possible local sources of PAHs are old coal gas production facilities in the Genesee Gorge, nearby landfill sites, and fly ash dumps in the gorge and near the river mouth. As discussed earlier in the description of the chemical seeps at the Lower Falls, PAHs were found seeping into two tunnels under the river, and appear to be traveling in faults and fractures in the rock. A contaminant pool forming from chemical seeps at the Lower Falls during low river flows, contained PAHs and appeared to be derived from coal tar. PAHs can also be released from asphalt and transported to the river via storm sewers. Airborne sources include vehicle exhaust and emissions from stationary sources.

6. Oxygen Depletion

The depletion of dissolved oxygen in the water occurs when organic matter such as sewage decomposes and uses up oxygen (biological oxygen demand, BOD), or when chemical wastes react with oxygen (chemical oxygen demand, COD). Oxygen-demanding substances can remain in sediments for many years, consuming oxygen when the sediments are disturbed.

The dissolved oxygen content in the lower river improved dramatically after Kodak upgraded its facility to include secondary treatment in 1972 (Sutherland, 1975), but CSOs and stormwater discharges continued to lower the oxygen levels periodically and to contribute to sediment oxygen demand. The Wastewater Facilities Plan for the Combined Sewer Overflow Abatement Project (CSOAP) showed that benthic oxygen demand was greatest about two miles upstream from the river mouth, and that this demand was capable of depressing the river's dissolved oxygen content below 5 mg/L during low flows (Erdman Anthony *et al.*1976, figs. IV-10 and IV-42). This projection was one of the justifications for the CSOAP program.

Now, dissolved oxygen is generally adequate in the water of the lower Genesee. But sediment oxygen demand remains due to past discharges from wastewater treatment plants, stormwater discharges, CSOs and other sources. The benefits of CSOAP on sediment oxygen have not been fully realized, since the project was so recently completed. A remaining source of oxygen demanding chemical is the Monroe County Airport. Runoff of airplane deicing fluids (primarily glycol) is a problem. Monroe County is in the process of designing a collection system to insure that deicing fluids will not run off into the Genesee River.

7. Metals

Metals can reach the water system from natural sources such as soil and rock, and from waste discharges, dumpsites, and atmospheric deposition. Because they are elements, they cannot be broken down or destroyed through treatment, but they can be bound in stable compounds that are less bioavailable than others. "Low levels of metals are common in waters across New York state. Cadmium, copper, lead, mercury, nickel and zinc were the most frequently identified pollutants during statewide sampling and analysis of surface waters in 1986" (NYSDEC, 1990a, p. 5-35). Most metals adhere to sediments and are eventually deposited at the bottom of lakes and rivers, where they may be remobilized by benthic organisms or anoxic conditions.

Wastewater discharges of metals to the AOC are listed in Table 5-3. Eastman Kodak is a large point source discharger of cadmium, chromium, copper, lead, mercury, nickel, silver and zinc to the drainage basin. The Van Lare treatment plant, which discharges to the lake, is the only discharger which exceeds Kodak's discharges of copper and nickel. Municipal water systems will be required to add chemicals to the water distribution systems to control pipe corosion. The chemicals proposed for use are zinc phosphorus salts, silicate, and other phosphorus compounds. The use of thse materials may reduce loadings of copper and lead to municipal wastewater teatment systems, but increase loadings of zinc and phosphorus. Very little arsenic or manganese is generated by any permitted discharger. As shown in Table 5-13, non-point sources appear to supply the majority of all of these metals with the exception of silver.

Non-point sources of arsenic are primarily agricultural lands where arsenic-based pesticides were applied in the past. Non-point sources of lead include airborne lead-based fuels and the combustion of waste oil and trash. The corrosion of copper plumbing pipes is responsible for a portion of the copper that is received by wastewater treatment plants.

Municipal wastewater treatment plants also receive a great variety of industrial wastewater. All dischargers to public or private sewers tributary to the Monroe County Pure Waters sanitary sewer system must conform to the Monroe County Sewer Use Law. For some discharges, this means conducting pretreatment. Some metals do enter the municipal wastewater system from industry, however. Those metals which are removed from the water at Van Lare are currently captured in the sludge, which is burned. A portion of the metal content currently returns to the air with burning, and can be deposited on land or in water with precipitation or dryfall. The remainder becomes part of the ash, which is landfilled. The location of the landfill used depends on the hauler. Ash can be stored at the Van Lare in clay lined lagoons site for up to a year before it is hauled. Stored ash, is currently in a confined area with runoff captured and returned to the plant for treatment. The ash has been tested for leachability and has not exhibited hazardous characteristics under Extraction Procedure (EP) and Toxicity Characteristic Leaching Procedure (TCLP) testing. The Monroe County Department of Environmental Services has identified this as a concern and will be working to develop an improved ash-handling system. New federal sewage sludge regulations will be also be issued by the U.S. Environmental Protection Agency in December of 1992 that will result in a reduction of sludge incineration emissions. Municipalities will have 2 years to comply with the new regulations that will require advanced technology to reduce emissions.

A recent study of mercury contamination concluded that more than half of the nation's mercury emissions come from coal fired power plants and municipal waste incinerators. Other sources include mercury vaporized from the biocides in latex paint, other fossil fuels, breakage of fluorescent lamps during disposal, and the incineration of medical and industrial wastes. New York State ranks second after Ohio in total annual mercury emissions, and is in a region of high mercury emissions per square mile (Clean Water Fund/Clean Water Action, 1992). Atmospheric deposition appears to account for most of the mercury discharged by the Genesee River. However, NYSDEC data indicate only three air dischargers emitting less than 2 lbs/yr of mercury to the air in Monroe, Livingston, Allegany, Genesee and Orleans counties. Therefore, it appears that most mercury loadings to the Rochester Embayment are from sources beyond the Embayment watershed. Studies ongoing or planned by federal and/or international agencies should be sought to help address this issue.

Lead can enter water from many sources. This biggest source would appear to be from the air. Estimated amounts of air deposition in the embayment watershed range from 41,675 lbs/year using CCIW data to 178,461 pounds per year calculated using data collected in Brockport. This can be seen in table 5-4. There are also some wastewater discharges of lead. One potential source of lead to waterways is the use of lead paint for the painting of bridges. Agencies conducting bridge painting take precautions to prevent the lead paint from reaching waterways, but some residual loss to the waterways is likely.

Some of the cadmium that reaches waterways comes from vehicle tires. Cadmium is contained in tires and wears off onto road surfaces. Cadmium loading from this source could be estimated based on the average concentration of cadmium in tires, tire wear per lane mile, and lane miles of road in the drainage basin. Ed Olinger at the NY Dept. of Transportation office in Rochester made contacts in October, 1992 to see if calculations had been done on tire cadmium content and wear, but was unable to find such information. This type of research could be conducted in the future.

Inactive hazardous waste sites and dumps are other likely sources of metals contamination. Two of the three landfills cited in section B of this chapter cite metal groundwater contamination. Table 5-8 also gives an indication of other places where metals are known to be problems at past landfill sites.

8. Cyanide

Cyanide is not known to be causing any impairments in the AOC. However, high levels of cyanide are found in both Genesee River and Irondequoit Bay sediments. Cyanide is used in plating industries and was a by-product of coal gas production. It was once a component of commonly-used pesticides, and remains in the soil in some agricultural areas.

Table 5-3 shows that 6,928 pounds per year of cyanide are discharged via wastewater in the Genesee basin and in the portion of the Lake Ontario West and Lake Ontario Central basins that direct their treated wastewater directly to Lake Ontario. Of that, 3383 pounds per year are discharged into the Genesee Basin, 3510 pounds per year directly to Lake Ontario, and the remaining 35 pounds per year to the Lake Ontario Central Basin. We were not able to obtain air loading data in time to include in this document.

9. Fecal Coliform Bacteria

Fecal coliforms are bacteria that live in enormous numbers in the intestines of all humans and most other warm-blooded animals. They are used as an indicator of fecal contamination, indicating the probable presence of pathogenic bacteria such as *salmonella*. Fecal coliform can grow in wet, decomposing organic debris like leaf piles. The sources of the bacteria were discussed in Chapter 4 under "Beach Closings."

Fecal coliform bacteria are used as an indicator of beach water quality. They reach the beaches via streams and the river, where their numbers increase sharply with stormwater runoff. The bacteria get into the stormwater via many pathways including improper connections of sanitary sewers with storm sewers, broken sanitary sewer laterals, rotting organic debris (much of which is natural such as leaf fall and *Cladophora* algae), and the feces of domestic and wild animals, including seagulls who feed on contaminated debris. The large quantity of *Cladophora* that washes up on the beaches is related to an excess of the nutrient phosphorus which causes an overabunance of this kind of algae to grow in the embayment.

10. Ammonia

Ammonia has been of concern in the lower Genesee River during dredging. During dredging, ammonia in the sediments is released to the water column where it can be acutely toxic to fish. Most ammonia toxicity is attributable to the unionized form (NH_3), rather than the ionized form (NH_4^+). The NH_3--NH_4^+ equilibrium is both pH and temperature dependent with the concentration of unionized ammonia (NH_3) rising as either pH or temperature or both increase. NYSDEC standards for total ammonia were revised in 1991 to consider this equilibrium and to ensure concentrations of the unionized fraction (NH_3) were below toxicity thresholds at varying pH and temperature. Standards are also more stringent for higher water quality classifications such as salmonid spawning habitats. (The Genesee River has a relatively high pH.)

The sources of ammonia are complex, since ammonia can be formed from other nitrogen-containing compounds through chemical reactions and bacterial activity. Nitrogenous wastes come from many sources, including sewage, fertilizer, and natural debris such as plant material and manure.

The "nitrogen cycle" refers to the transformations between elemental nitrogen in the air, nitrates, nitrites, ammonia, and complex organic molecules containing nitrogen. Ammonia often (but not always) is highest in places where there is a deficiency of oxygen. That tends to be the case with the sediments in the lower Genesee.

11. Phenols

Phenols are listed as possible sources of fish tainting because in 1981, the EPA measured high values of phenol at the mouths of Sodus Bay, Salmon Creek in Wayne County, and the Genesee River. The source of the high readings is not known. EPA monitoring in subsequent years found no detectable phenol in the river. Table 5-3 shows phenol and total recoverable phenolics from wastewater point sources. The largest wastewater discharger to the drainage basin is Atochem. The Van Lare treatment plant is the largest discharger to the lake. Atmospheric point sources of phenol are highest in Allegany County.

12. Sediment

Suspended solids loadings are nearly all from non-point sources. Information contained in Figure 5-13 indicates that these point-sources account for only 2% of the total suspended solids loading to the Embayment from the Genesee Basin. Figure 5-10 shows an estimate of suspended solids loadings per unit area. This gives an indication of the areas from which the highest amounts of non-point sources of sediment come from. The Canaseraga Creek watershed is the most prominent source area. Intensive agricultural areas on calcareous soils were among the highest contributors to suspended solids loadings, according to the Genesee River Pilot Watershed Study (Hetling et al. 1978).

Table 5-20 shows sediment loadings from cropland and streambank erosion that the Soil Conservation Service estimated for the watersheds of the Genesee Basin in 1974. The Canaseraga

Creek watershed had the highest total loading, three quarters of which was from cropland. Black Creek (Genesee County), Oatka Creek, the middle Genesee (Mt. Morris to Henrietta) and Conesus Lake watersheds followed in order of total sediment load. All received the majority of their sediment from cropland erosion. Upper Honeoye Creek had the highest loading per acre, 80% of which was from cropland. Several of the creeks, primarily in the upper Genesee Basin, had a greater sediment load from bank erosion than from cropland. Using data provided in the March 1975 SCS Report entitled "Erosion and Sediment Inventory", it is estimated that 480,000 tons per year of sediment enter the Genesee River from stream and river bank erosion in the stretch from Mt. Morris to Rochester.

The Pilot Watershed Study found that in 1974-75 the suspended solids loadings at Mt. Morris were 74-79% of the suspended solids loadings at the mouth of the Genesee River. The present study found that the suspended solids loadings at Geneseo were approximately 54% of the loadings at the mouth. Sample sites for both studies were below the confluence of Canaseraga Creek with the Genesee. The results seem to indicate either that some of the erosion in the upper basin has been controlled since the mid-1970s, or that more sediment is now being generated in the lower basin. Both trends are probably occurring, since total loadings at the mouth of the Genesee have not changed a great deal (1,027,000 tons in 1975; 551,000 tons in 1976; 626,000 tons in water year 1990). Bear in mind that the methods for computing loadings in the two studies differed. (Precipitation can also affect sediment loadings. Precipitation at Rochester was 30.6" in 1975, 34.3" in 1976, and 36.0" in water year 1990, but data on amounts, intensity and locations in other parts of the basin would be needed in order to tell whether this was a significant factor in the differences.)

In urban and suburban areas, as in rural areas, suspended solids come from unprotected soil and streambank erosion; however, the causes of those conditions are different. In urban and suburban areas, unprotected soil is more likely to be associated with construction sites than with agriculture. Streambank erosion also can be accelerated by real estate development due to the increase in impervious surfaces, which cause increased storm flows in local streams. Numerous studies in individual watersheds have shown construction sites to be a significant source of sediment in urban areas.

The NURP study found that sediment yields from watersheds in the Irondequoit Basin increased with increasing percentages of impervious surface (see Figs. 5-2 - 5-5). The highest sediment yields came from the three small study sites: Cranston (moderate-density residential), Southgate (commercial/residential), and East Rochester (high-density residential). Sediment yields from those sites ranged from 0.1 to 0.8 tons/acre per year -- considerably less than the 4 tons/acre and up that are typical for row crops and construction sites, but higher than the yields from low density residential and low-intensity agricultural land (woodlots, hayfields etc.).

Localized sediment problems in smaller streams in the basins are important and will be addressed in the basin plans. But in terms of solids loadings to the embayment itself, the Genesee River is by far the most important contributor. The sources of sediment in the river appear to be: 1) cropland erosion, 2) streambank erosion, and 3) runoff from developed and developing areas.

13. Phosphorus

Calculations for the Genesee Basin earlier in this chapter show that approximately 10% of the total phosphorus discharged by the river is from permitted point sources. This ratio is less than that of 15 years ago, when the Genesee Basin Pilot Watershed Study found that 15% of the total phosphorus came from point sources in 1975 and 23% in 1976. The total amount of phosphorus discharged by the river decreased from over 800 tons in 1975 and over 500 tons in 1976 to less than 400 tons in 1989-90. The decrease in point source and total loadings is consistent with the efforts to remove direct wastewater discharges from the river.

The IJC has calculated total phosphorus loadings to Lake Ontario from sources within its basin (excluding the phosphorus contained in Lake Erie water entering from the Niagara River). Major sources listed from the AOC were the Genesee River, the Van Lare wastewater treatment plant, and the Northwest Quadrant wastewater treatment plant. These sources together accounted for an average of 15% of the phosphorus loading to the lake in Water Years 1983 through 1985 (Rathke and McRae, 1989, Vol. III, Tables 3.0-8, 3.0-13 and 3.0-19).

Point source phosphorus loadings from 1989-90 are shown in Table 5-3. The largest dischargers to the Embayment watershed are the Gates-Chili-Ogden wastewater treatment plant and the Kodak wastewater treatment plant. The largest discharger to the lake is the Van Lare WWTP.

Figure 5-11 and 5-12 show the predictions of the Pilot Watershed Study concerning non-point phosphorus sources. The most important sources of particulate phosphorus appear to be the areas around the Genesee Gorge in Livingston County and downstream of Avon. Soluble phosphorus sources for the most part increase downstream. As explained in the study, the numbers indicating phosphorus loading per unit area overestimate the amount actually detected through stream sampling, but the maps are useful for showing the patterns of source areas. The Pilot Watershed Study (Hetling et al. 1978) finds that the highest phosphorus loadings per unit area came from intensive agricultural lands on calcareous soils, and from cultivated mucklands.

The NURP study in the Irondequoit Basin found that non-point phosphorus loadings generally increased with an increase in impervious surfaces (see Appendix E), with a high density residential area having the greatest phosphorus yields during storms. An active construction site that was monitored had similarly high phosphorus loadings. Atmospheric phosphorus deposition on the watershed equalled 65% of the annual yield measured in Irondequoit Creek (Kappel *et al.*1986).

In 1990, SUNY Brockport studied the pollutant loadings to Long Pond in Greece, which is considered hyper-eutrophic. They found that 89% of the phosphorus loadings to Long Pond came from Northrup Creek, and 56% of the loadings to the creek were from the Spencerport wastewater treatment plant (Makarewicz, *et al.* 1990). Therefore, approximately half of the annual phosphorus inputs to the pond were due to the treatment plant effluent. During summer low flows, the effluent contributed nearly 100% of the phosphorus entering the pond.

In both Northrup and Buttonwood Creeks, water quality of point sources entering the creek was measured in July and August. The highest phosphorus concentrations other than the treatment plant effluent came from pipes draining lawns, golf courses and housing developments. A plot of phosphorus concentrations along both creeks shows increases near lawns, a golf course and a cattle pasture. Though these phosphorus sources are important during the summer algae season, they are a minor portion of total annual phosphorus loads. For the streams in the Irondequoit Basin and the West Basin that have been sampled year round, between 35 and 94% of phosphorus discharges were found to occur during snowmelt and spring runoff (Makarewicz *et al.* 1990; Kappel *et al.* 1986).

The Makarewicz & Kappel studies also computed the phosphorus loadings per unit area; this is a useful way of determining where the problem areas are, as shown in Table 5-20. "Diversion" refers to the diversion of treated wastewater from the Irondequoit Basin to the Van Lare WWTP on Lake Ontario.

14. Litter

Litter reaches waterways through direct littering and dumping from shore or boats, and through the transport of litter via storm sewers and stream flows. Litter on the bottom of the Genesee River can be brought up during dredging and drift onto nearby beaches.

Littering behavior is encouraged by areas that are not kept clean, since people will throw trash where they see other trash.

15. Dead Fish

The annual die-off of Pacific salmon and trout in the Genesee River is a natural occurrence that results in aesthetic problems of odors and unsightliness. The abundance of the fish is a result of the NYSDEC stocking program. The periodic die-offs of alewives in Lake Ontario are due to population explosions and crashes that these fish experience. The two phenomena are related because the salmonids are stocked partly to reduce the numbers of alewives so that population crashes will be less likely. Recently the population of alewives in the lake has been declining to the point where it is feared they might not supply adequate prey for the usual numbers of stocked game fish. Zebra mussels complicate the picture by consuming plankton and possibly restricting the amount of food available to other organisms such as alewives. Reductions in phosphorus in Lake Ontario, which spur plankton growth, may also be contributing to the reduction of the alewife population. The management of trophic relationships between several non-native species in Lake Ontario is a complicated task that is not always predictable.

Locally, fish cleaning by anglers in the lower Genesee creates dead fish odors in the area. The City of Rochester has established a fish cleaning station in the area that is helping to alleviate this problem.

16. Chemical Seeps at Lower Falls

The chemical seeps at the Lower Falls allow pollutants to directly enter the Genesee River. The seeps were investigated by the Monroe County Environmental Management Council (Landfill Review Committee, 1979) and sampled as part of the sediment toxics survey (Monroe Co. Dept. of Health, 1986). They were also studied as part of the Phase I investigation of the Genesee Gorge inactive hazardous waste site under the State Superfund (RECRA Environmental, Inc., 1988). Seeps were sampled by the City of Rochester in 1988 (Malcolm Pirnie, 1988). The seeps are on the face of the Lower Falls on the western side. Those near the top of the falls contain high levels of benzene, toluene and xylene (BTX). A separate seep further down contained an oily, creosote-like substance, and a contaminant pool at the base of the falls contains PAHs (see Tables 5-21 and 5-22). All of the seeps are in the Grimsby sandstone formation. As discussed above under "inactive hazardous waste sites," wastes are traveling through the fractured rock under the river, and chemicals similar to those at the Lower Falls (including BTX and PAHs) have been found in the RG&E tunnel upstream of the falls in the same sandstone formation. The specific sources of each type of contamination are not known. However, both the RECRA Environmental and the City of Rochester studies find that the most probable source of the contaminants at the base and face of the lower falls, and in the RG&E tunnel are from coal tar.

Other possible sources for the seeps include chemical storage areas or dumped material just west of the Lower Falls. Several industries, including a furniture manufacturer, were once located at the outlet of a gorge known as "Deep Hollow" that emptied immediately upstream of the falls. This industrial area was abandoned, and from the 1930s until the mid-1970s it was used as a dumping ground. The hollow was filled and the factory sites covered over (Landfill Review Committee, 1979). Included in the debris dumped in the hollow were construction and demolition debris and 50 ft. of old auto bodies. Seepage within the former gorge could be bringing buried materials to the face of the falls. An abandoned mill race that ends adjacent to the Lower Falls on the west side could be a contributing factor as well.

17. Physical Disturbances

Physical disturbances include filling and draining of wetlands, removal of riparian vegetation, and development near shorelines. In the 19th century, logging, agriculture and water-powered industry were the primary causes of disturbance. More recently, residential, commercial and recreational development have spread throughout the area and are continuing rapidly. Public projects have had major impacts as well. The opening of Irondequoit Bay and the construction of the Lake Ontario Parkway are examples. Figures 5-13 and 5-14 show how wetlands along the last few miles of the Genesee were removed for marina construction and river widening between 1952 and 1969, showing the effects of both public and private projects.

E. Other Persistent Toxics

The pollutants discussed in the previous section were those that have been linked to impairments in the AOC. There may also be a need to reduce the discharge of persistent toxics due to potential concerns for human health. Work is being done as part of the Stage II RAP to identify all pollutants of concern. These will be addressed further in the Stage II RAP.

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FIGURE 5-1. GENESEE GORGE

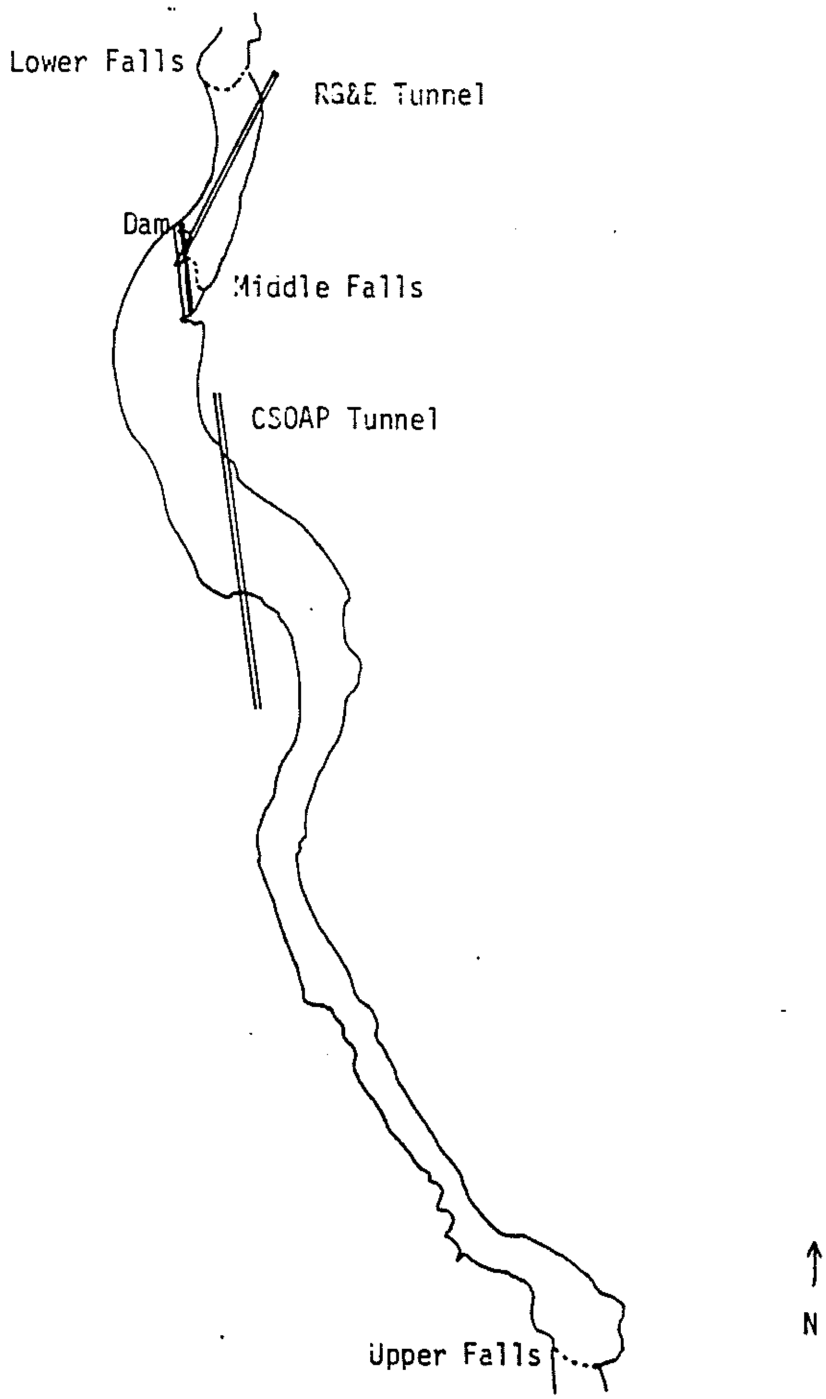
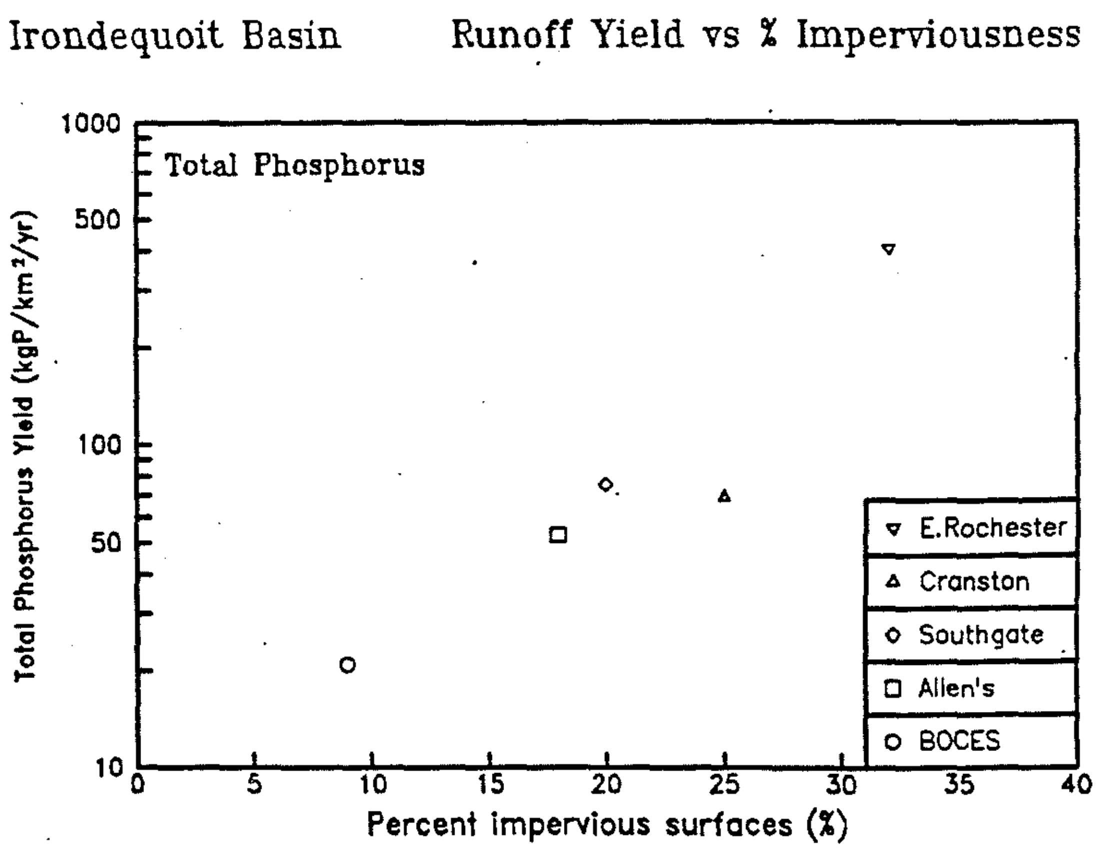


FIGURE 5-2. RUNOFF YIELD OF PHOSPHORUS
IRONDEQUOIT BASIN, 1980-81



Results from Nationwide Urban Runoff Program study (NURP). Graph by Monroe Co. Health Dept. Environmental Lab.

FIGURE 5-3. RUNOFF YIELD OF SUSPENDED SOLIDS
IRONDEQUOIT BASIN, 1980-81

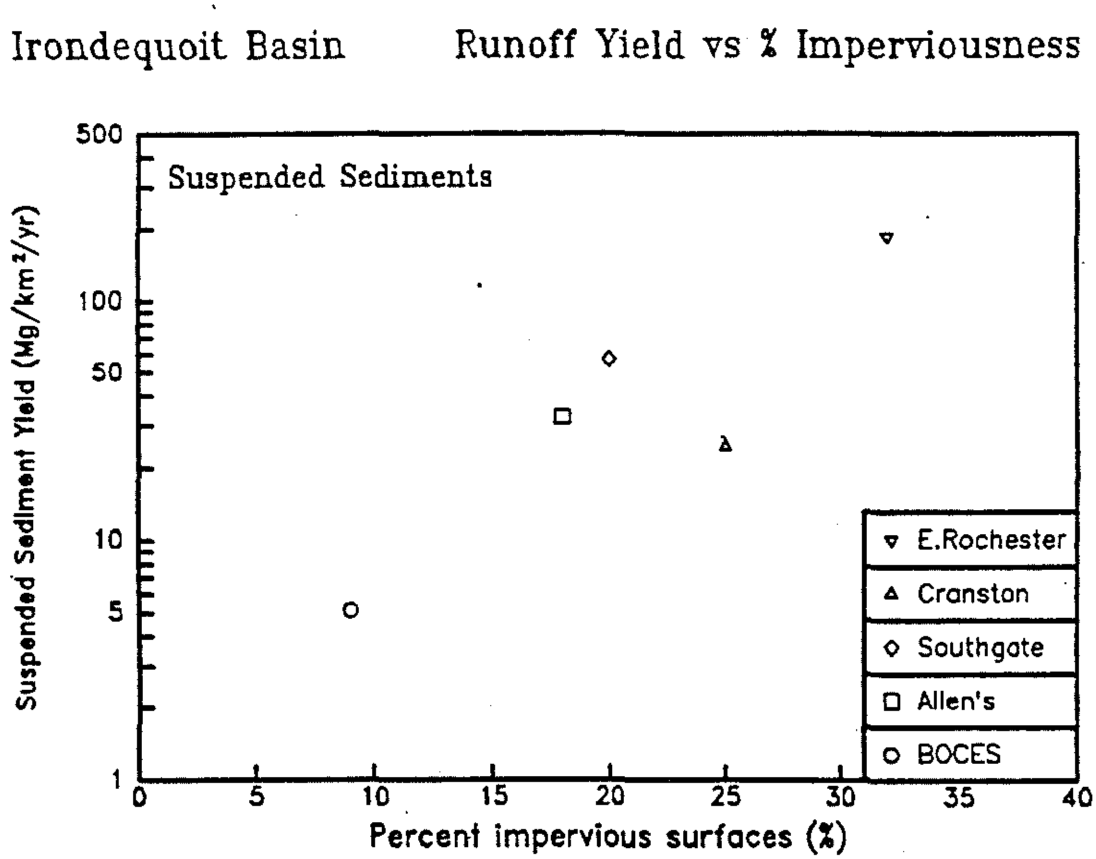


FIGURE 5-4. RUNOFF YIELD OF LEAD
IRONDEQUOIT BASIN, 1980-81

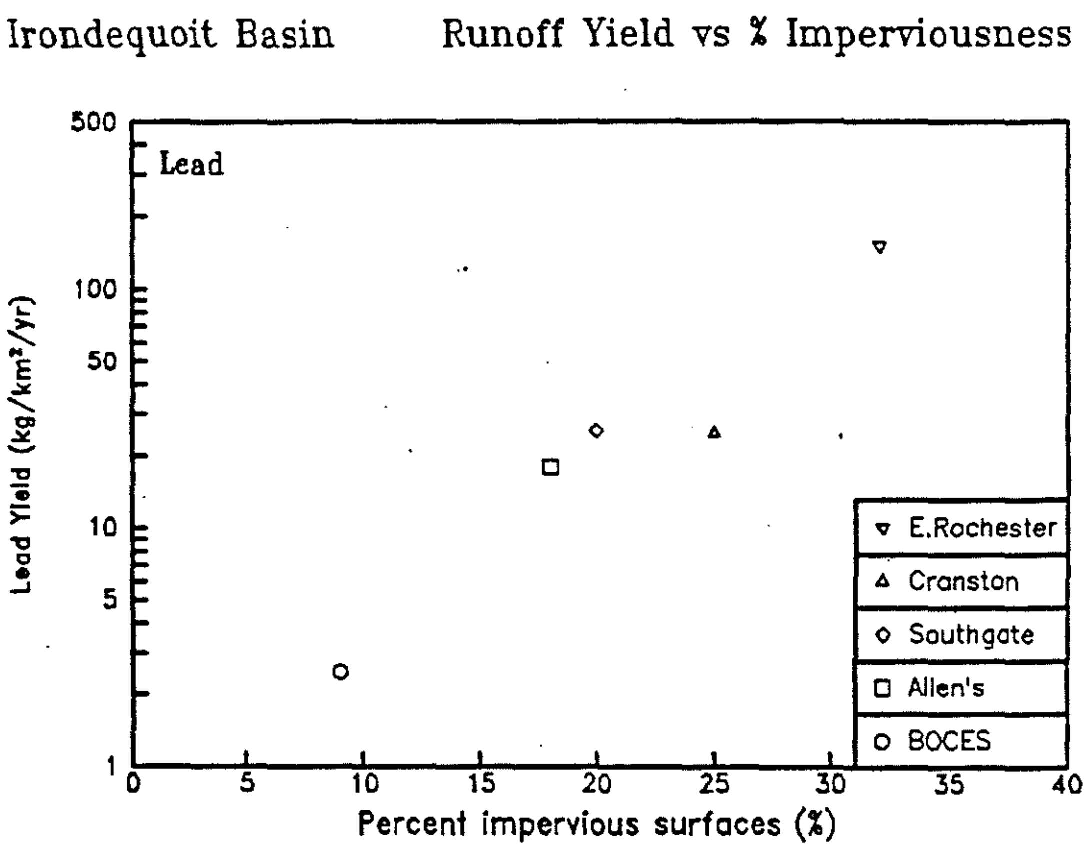
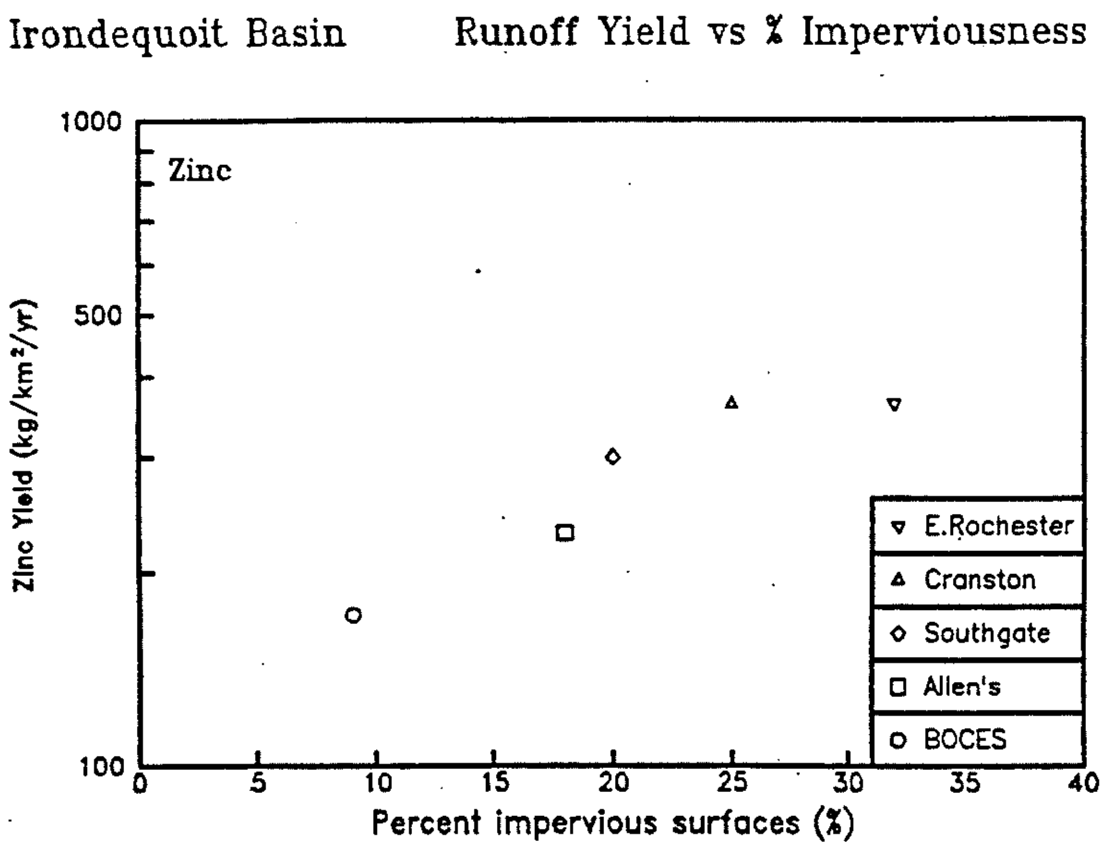
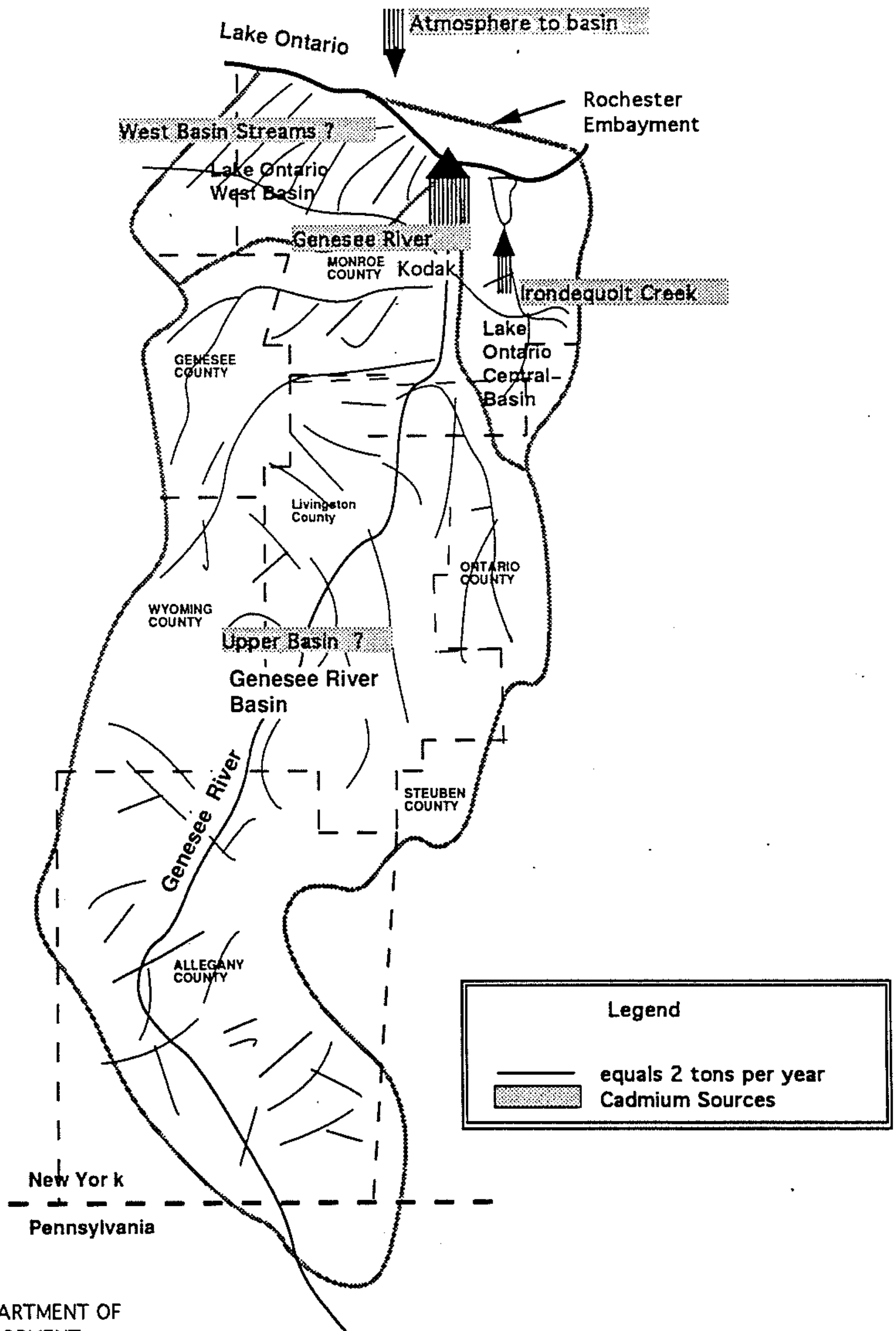


FIGURE 5-5. RUNOFF YIELD OF ZINC
IRONDEQUOIT BASIN, 1980-81



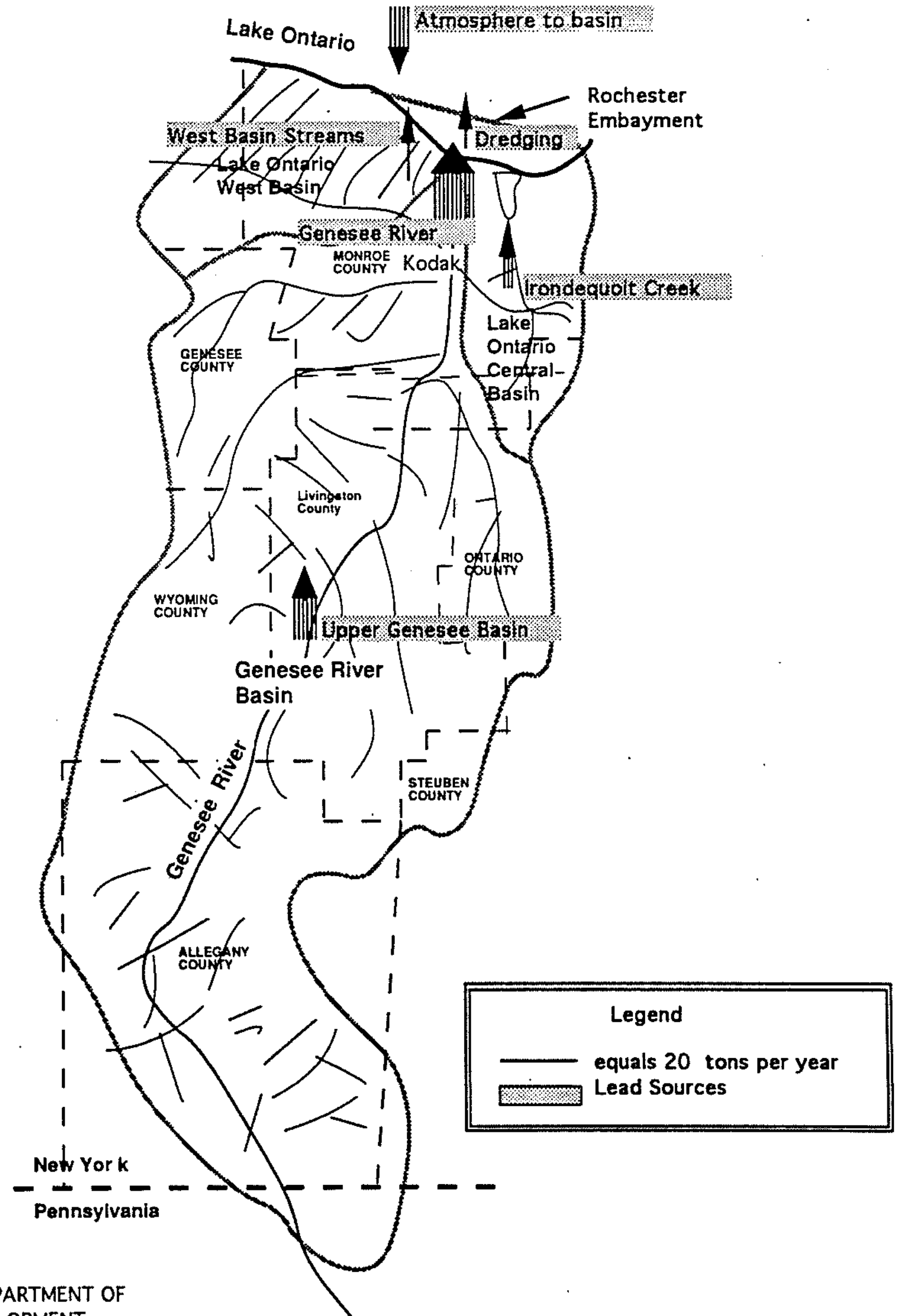
CADMIUM SOURCES

to the Rochester Embayment



MONROE COUNTY DEPARTMENT OF
PLANNING AND DEVELOPMENT

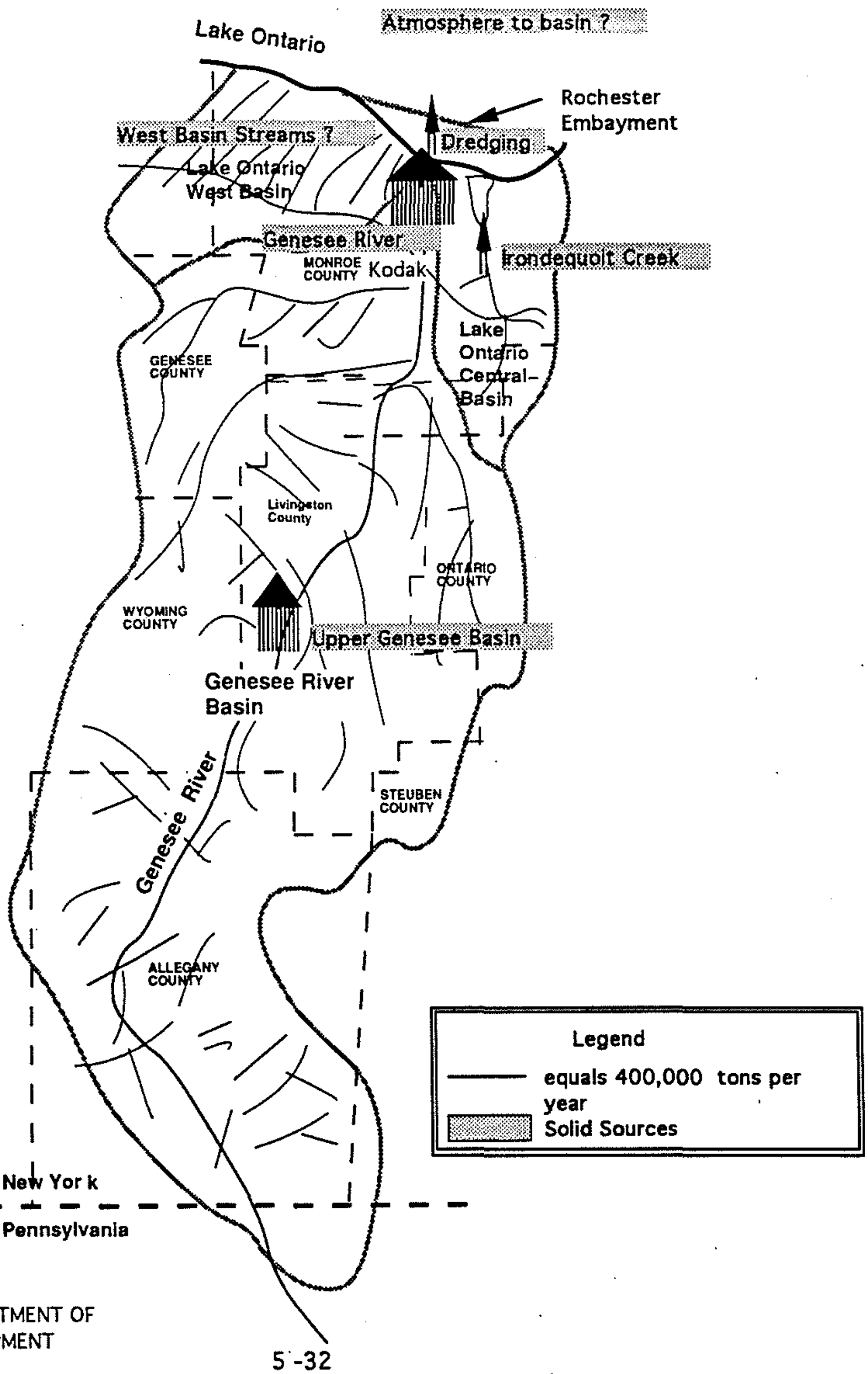
LEAD SOURCES
to the Rochester Embayment



MONROE COUNTY DEPARTMENT OF
PLANNING AND DEVELOPMENT

SOLIDS SOURCES

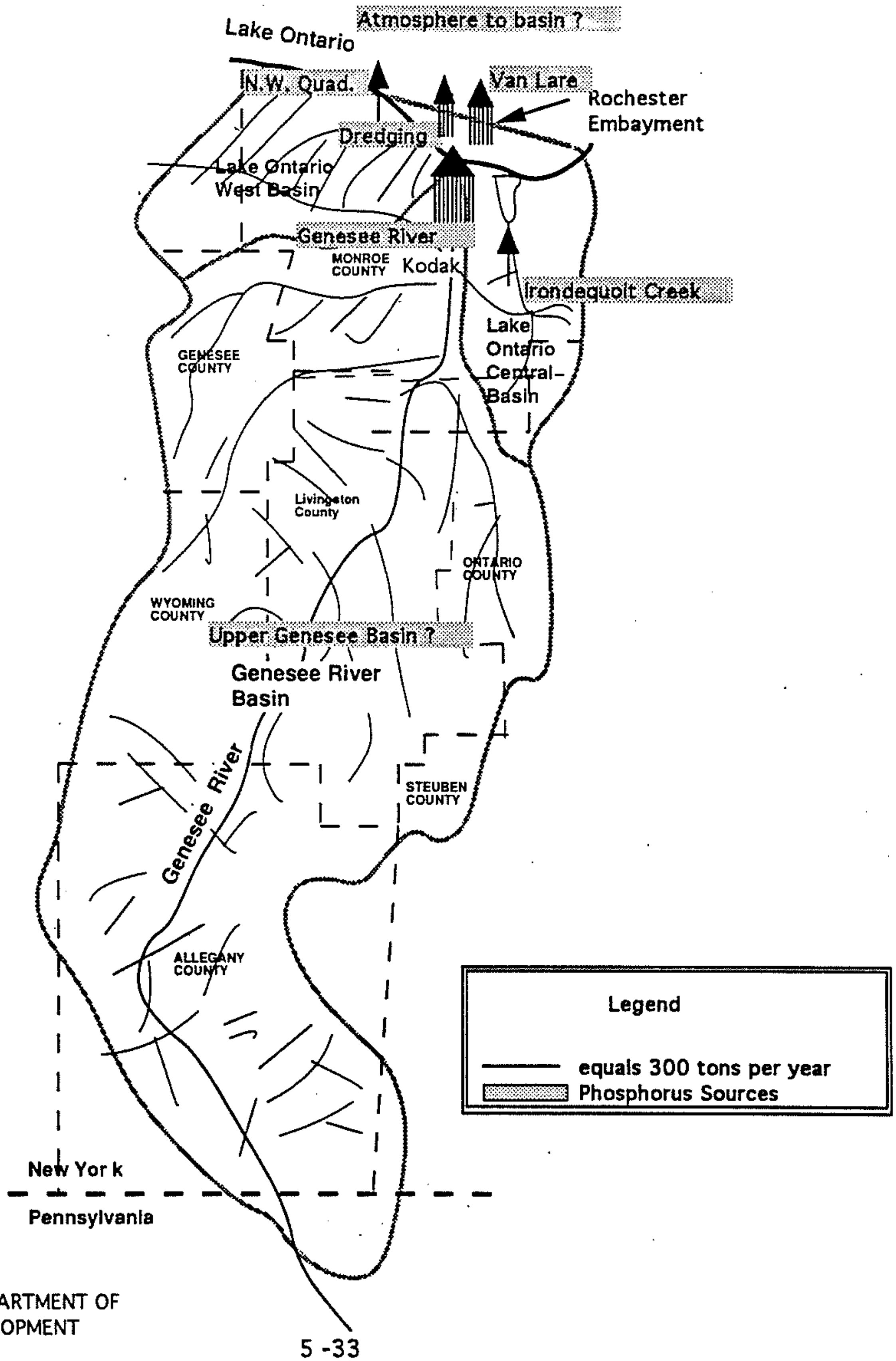
to the Rochester Embayment



MONROE COUNTY DEPARTMENT OF PLANNING AND DEVELOPMENT

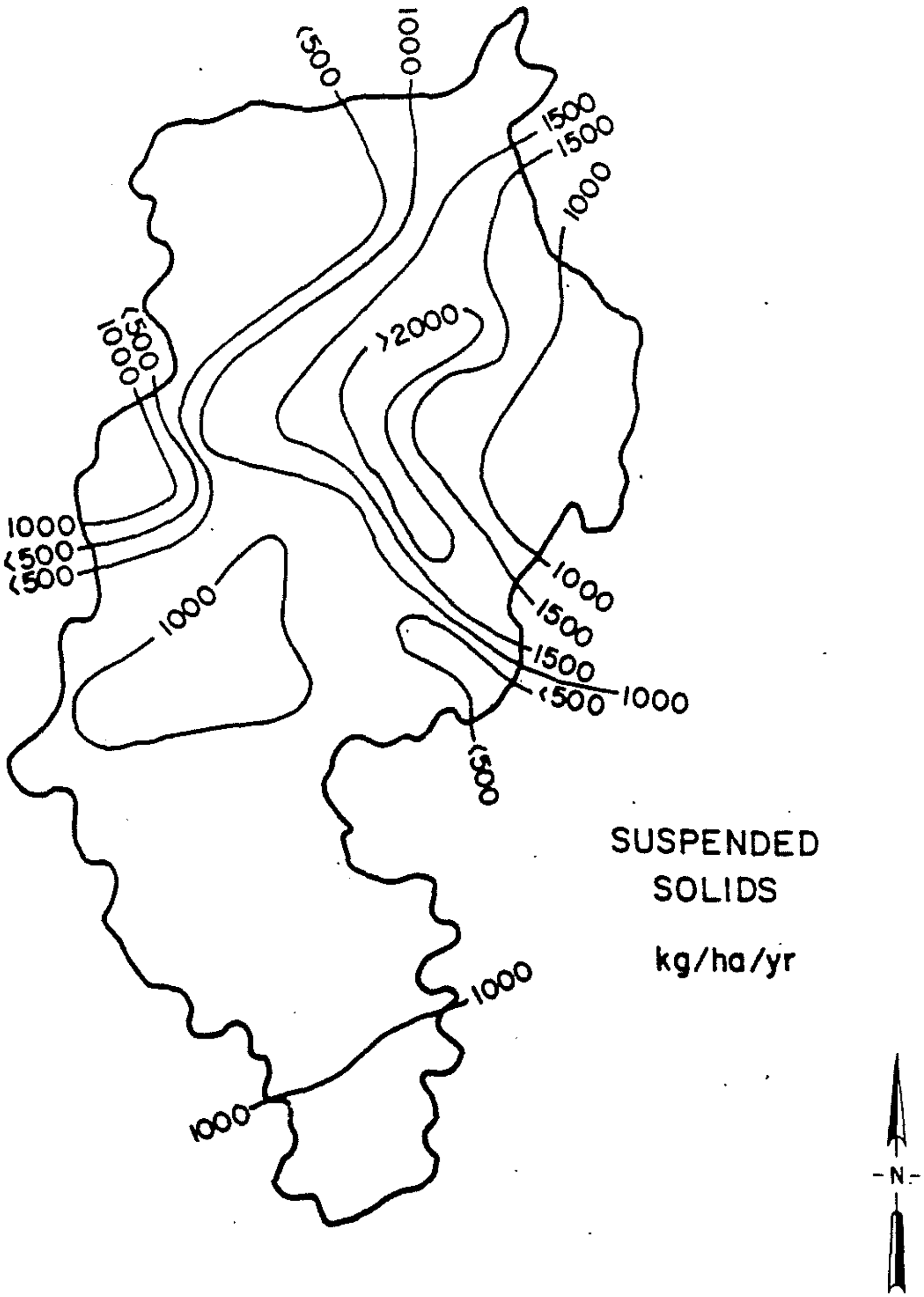
PHOSPHORUS SOURCES

to the Rochester Embayment



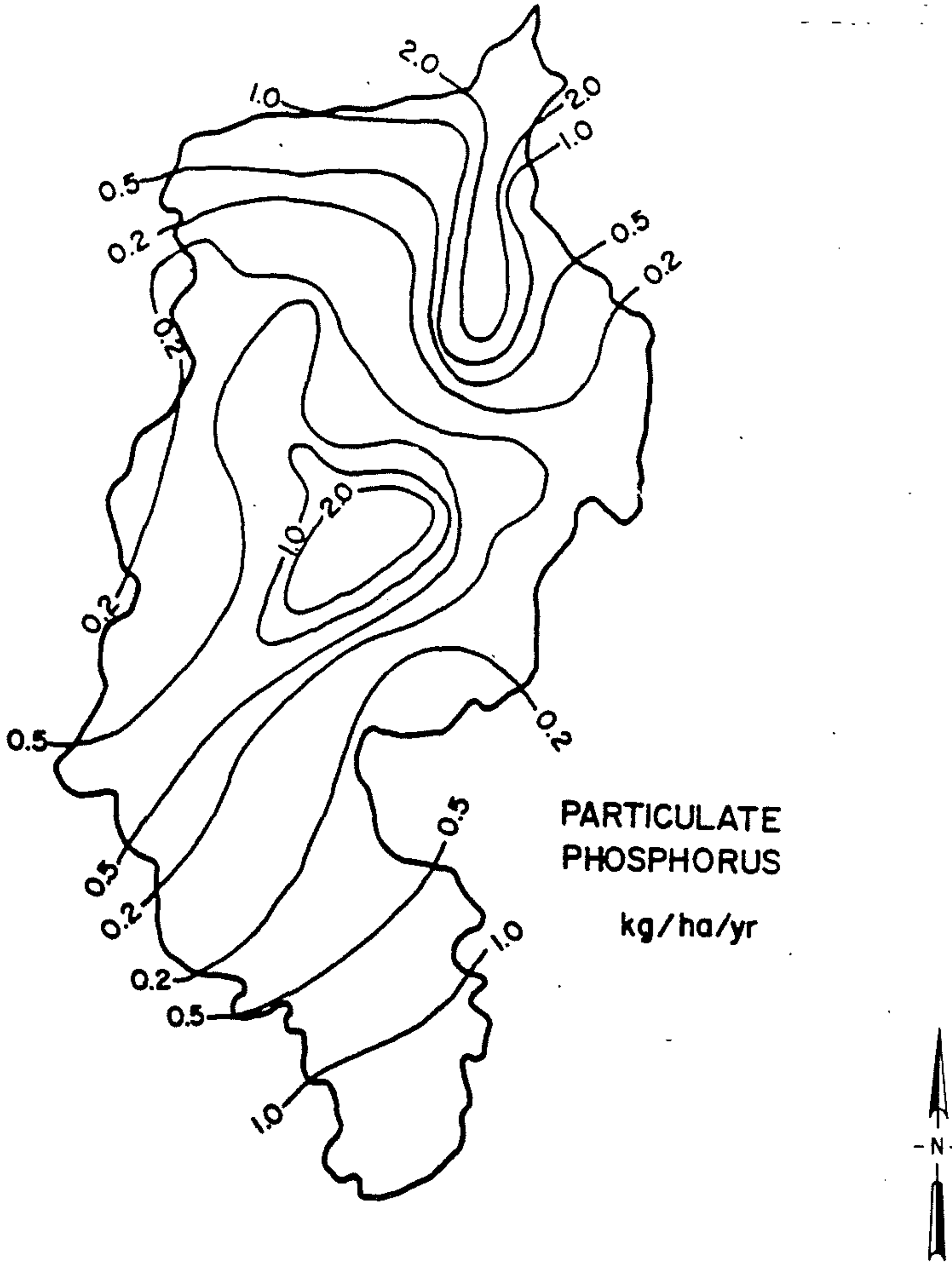
MONROE COUNTY DEPARTMENT OF
PLANNING AND DEVELOPMENT

FIGURE 5-10
SUSPENDED SOLIDS SOURCE AREAS IN GENESEE BASIN



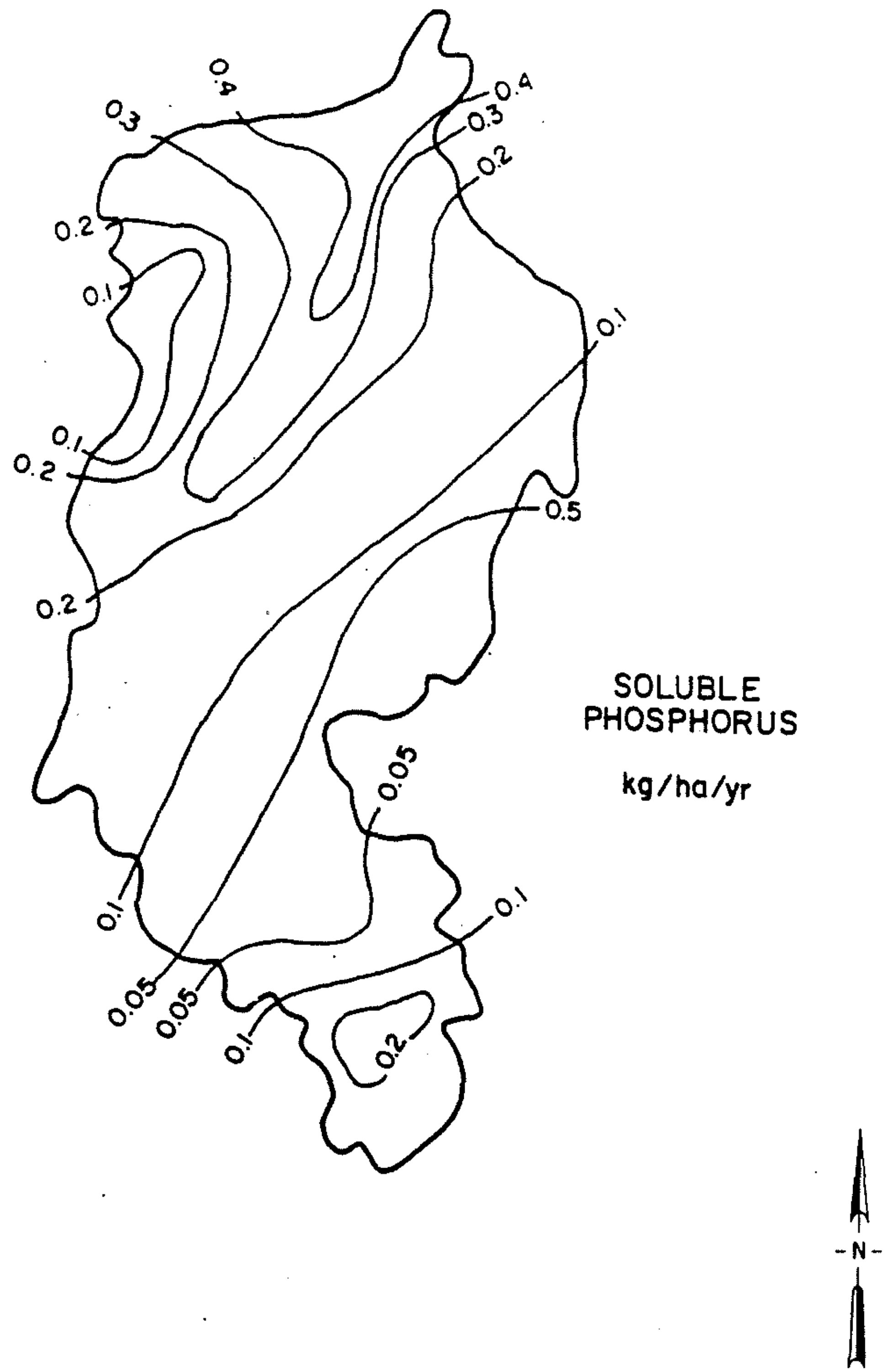
Source: Heltling, L. J., Carson, G. A., Boulton, P. W., and Rafferty, M. R. (1978). Genesee River pilot watershed study: summary pilot watershed report. Submitted to IJC International Reference Group on Pollution from Land Use Activities. Albany: NYSDEC.

FIGURE 5-11
PARTICULATE PHOSPHORUS SOURCE AREAS IN GENESEE BASIN



Source: Heltling, L. J., Carson, G. A., Boulton, P. W., and Rafferty, M. R. (1978). Genesee River pilot watershed study: summary pilot watershed report. Submitted to IJC International Reference Group on Pollution from Land Use Activities. Albany: NYSDEC.

FIGURE 5-12
SOLUBLE PHOSPHORUS SOURCE AREAS IN GENESEE BASIN



Source: Heltling, L. J., Carson, G. A., Boulton, P. W., and Rafferty, M. R. (1978). Genesee River pilot watershed study: summary pilot watershed report. Submitted to IJC International Reference Group on Pollution from Land Use Activities. Albany: NYSDEC.

FIGURE 5-13
LOWER GENESEE RIVER AREA, 1952

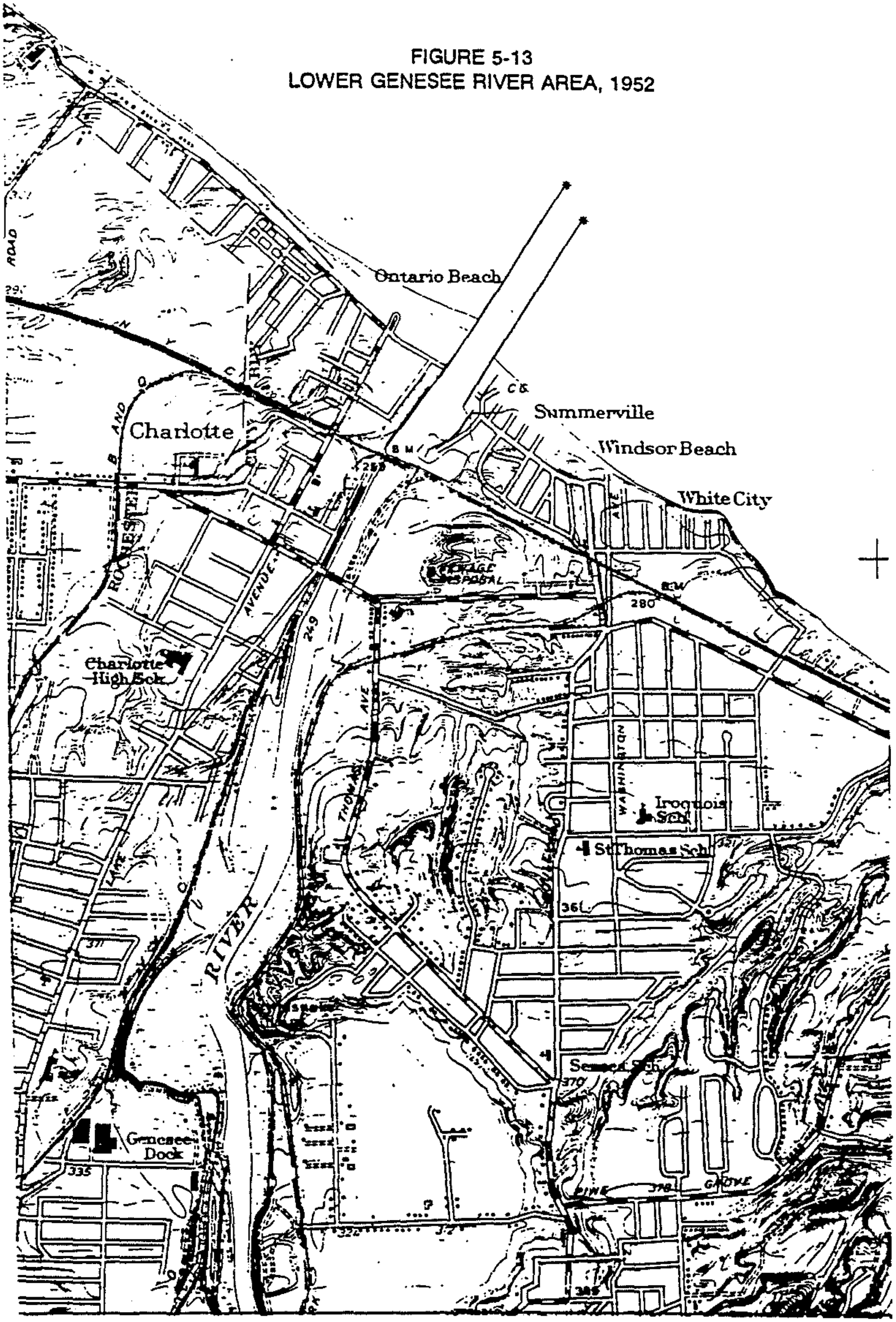


FIGURE 5-14
LOWER GENESEE RIVER AREA, 1969

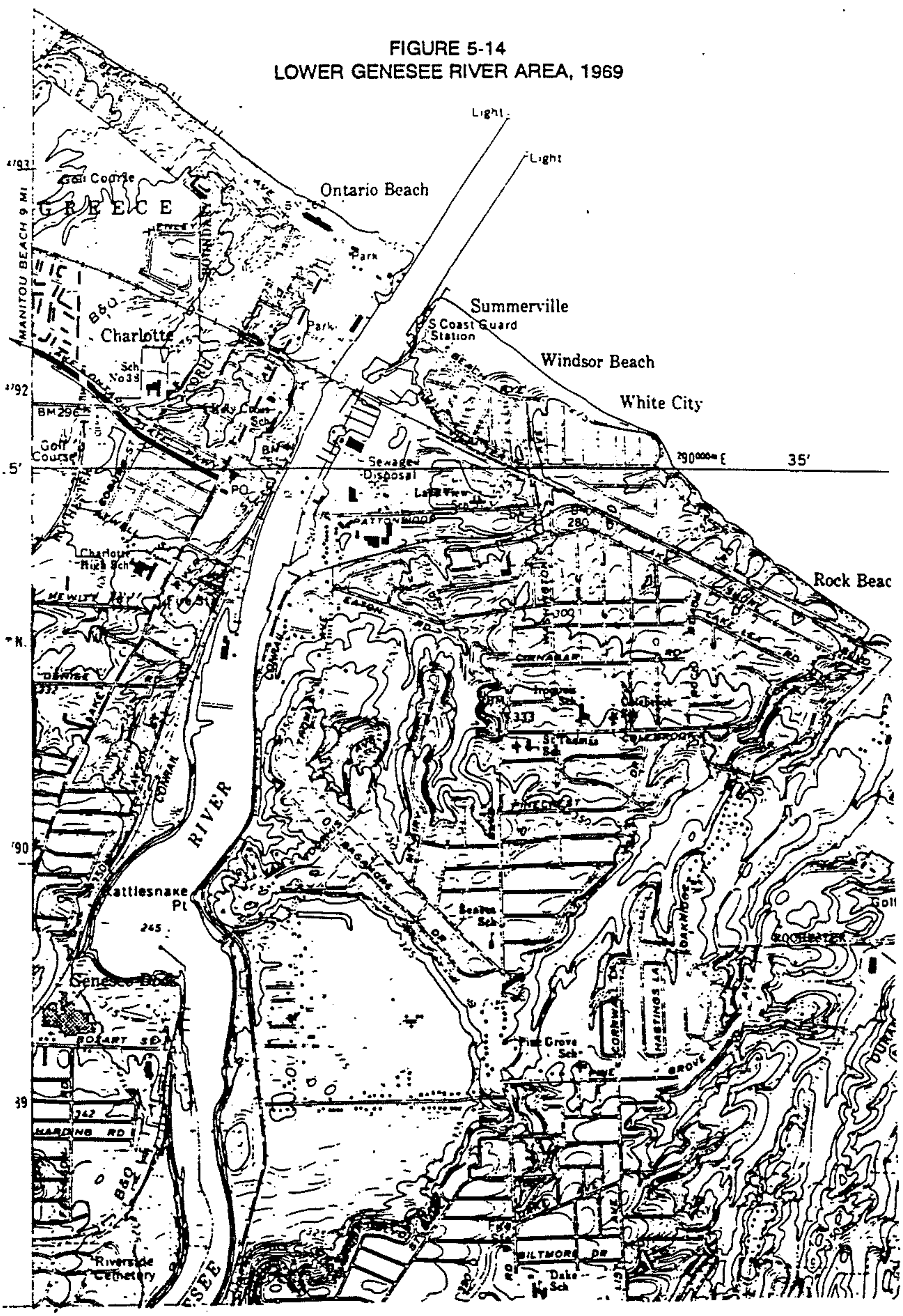


TABLE 5-1. PRIORITY POLLUTANTS FOR THE ROCHESTER EMBAYMENT

Inorganics	Organics	
Metals	**Pesticides**	**Other organics (cont.)**
Aluminum	Aldrin	Di-n-octyl phthalate
Arsenic	Chlordane[1,2]	Dioxin (2,3,7,8-TCDD)[1,2,3]
Barium	Dieldrin[2,3]	Fluoranthene
Cadmium[1]	DDT and metabolites[2,3]	Furan (2,3,7,8-TCDF)
Chromium	Endosulfan, total	Haptanone
Cobalt	Endrin	Hexachlorobenzene[2,3]
Copper[1]	Heptachlor & Hep. epoxide	Hexachlorobutadiene
Iron[1]	Hexachlorocyclohexane (BHC), total	Hexane
Lead[1]		Methylene chloride
Manganese	Methoxychlor	Methyl ethyl ketone
Mercury[2,3]	Mirex and photomirex[1,2,3]	Octachlorostyrene[2]
Molybdenum	Toxaphene [3]	Pentachlorobenzene
Nickel	**Other organics**	Pentachlorophenol
Selenium	Acetone	Phenol[1]
Silver	Benzene	PCB (Polychlorinated biphenyls)[1,2,3], total
Strontium	Benzo (a) anthracene	Pyrene
Vanadium	Benzo (a) pyrene	1,2,3,4-Tetrachlorobenzene
Zinc[1]	Benzo (b) fluoranthene	1,2,4,5-Tetrachlorobenzene
	Benzo (k) fluoranthene	Tetrachloroethene (or -ethylene)
Other inorganics	Bis (2-ethylhexyl) phthalate	2,3,4,5-Tetrachlorophenol
Alkylated lead	Carbon tetrachloride	2,3,5,6-Tetrachlorophenol
Cyanide[1]	Chloroform	Tetrahydrofuran
Phosphorus[1]	Chlorinated dibenzofurans[3]	Toluene
Sediment[1]	2-Chlorotrifluorotoluene	1,2,3-Trichlorobenzene
	4-Chlorotrifluorotoluene	1,2,4-Trichlorobenzene
	Chrysene	1,3,5-Trichlorobenzene
	1,2-Dichlorobenzene	1,1,1-Trichloroethylene
	1,3-Dichlorobenzene	Trichloroethene (or -ethylene)
	1,4-Dichlorobenzene	2,4,5-Trichlorophenol
	Dichlorobromomethane	2,4,6-Trichlorophenol
	2,4-Dichlorotrifluorotoluene	2,3,6-Trichlorotoluene
	3,4-Dichlorotrifluorotoluene	2,4,5-Trichlorotoluene

1 Known or suspected of causing use impairments in the Rochester Embayment.
2 Exceeds standards or criteria for Lake Ontario.
3 IJC critical pollutant.

Table 5-2
PRELIMINARY LIST OF HIGH PRIORITY POLLUTANTS

The Priority Pollutant Task Group of the RAP Technical Group began work on October 2, 1992 to identify the highest priority pollutants from the list identified in Table 5-1. To date, that group has identified 20 chemicals deemed to be of highest priority. At this time (6-8-93) the Priority Pollutant Task Group is going through a process to prioritize these top 20 pollutants. Until that is done, the following list, in no particular order, is outlined below. The prioritized list will be included in the Stage II RAP.

Dioxin
Furan
Mirex
PCB
DDT & Metabolites
Aldrin
Dieldrin
Heptachlor & Epoxide
Chlordane
Toxaphene
Mercury
Benzo (a) Pyrene (PAH's)
Hexachlorobenzene
Alkylated Lead
Phosphorus
Cadmium
Silver
Cyanide
Methylene Chloride (also known as dichloromethane)
Phthalates (Bis-2-ethylhexyl and Di-n-octyl)

NOTE: This is not a permanent list. This will change with new information. The process is flexible and is intended to respond to new information. This table will be revised during the development of the Stage II RAP, and included in the Stage II RAP.

Table 5-3
Wastewater Discharges of Selected Pollutants
Genesee River Basin and Direct Dischargers to Rochester Embayment of Lake Ontario
October 1990 to September 1991

Pollutant Name	Annual Load-Pounds/Year
Phosphorus, Total	392,051
Arsenic, Total	2.1
Cadmium, Total	542
Chromium, Hexavalent	.012
Chromium, Total	2,943
Copper, Total	12,747
Cyanide	6928.72
Iron, Total	130,895
Lead, Total	4,100
Manganese, Total	1.5
Nickel, Total	7,950
Silver, Total	7,536
Zinc, Total	48,512
Aluminum, Total	5,792
Selenium, Total	14.6
Dichlorobromomethane	17.6
Chloroform	514
Phenolics, Total Recoverable	166.3
Toluene	3.9
Benzene	16
Benzene, Tolune, Xylene in Combination	8
Methylene Chloride	4,735
Tetrachlorolthylene	2.3
1, 1, 1-Trichloroethane	4.4
1, 3-Dichlorobenzene	0 *
Di-N-Octyl Phthalate	0 *
Phenol, Single Compound	0 *
Bis (2-Ethylhexyl) Phthalate	71.8
Trichloroethylene	24.9
PCB 1248	0 *
Phenols	2011
Mercury, Total	25.9
Silver, Iońic	0 *
Total Suspended Solids	26,553,912

*This substance is a permitted discharge at one or more facilities, and analysis was conducted with results below the detection limit.

Source: State Pollution Discharge Elimination System (SPDES) data. Calculations done by R. Draper using following guidelines: If 25% or greater of the reported values are quantifiable, the remaining values reported at less than minimum detection limit (MDL) would be utilized as one half (1/2) the minimum detection limit in the loadings calculation. If less than 25% of the reported values were quantifiable, the remaining values reported at less than MDL would be utilized as zero in the loadings calculation.

TABLE 5-4 ATMOSPHERIC DEPOSITION

Parameter	Deposition on Lake Ontario Lbs/yr	Dep. on Embayment Lbs/yr	Dep. on Genesee Basin Lbs/yr	Dep. on Embayment Watershed Lbs/yr
ORGANOCHLORINES				
PCBs	92.6	0.43	30	37
alpha HCH	192	0.89	63	77
gamma HCH	94.8	0.44	31	38
HCB	2.4	0.01	0.79	0.97
Dieldrin	2.98	0.01	0.97	1.20
DDT & metabolites	20.9	0.10	6.81	8.39
Heptachlor	0.82	0.00	0.27	0.33
Heptachlor Epoxide	3.90	0.02	1.27	1.57
Chlordane	7.74	0.04	2.52	3.11
Toxaphene	10.4	0.05	3.38	4.16
Endosulfans	59.5	0.28	19	23.92
Atrazine	6613	30.63	2155	2657
Alachlor	21289	98.60	6939	8553
Trifluralin	525	2.43	171	211
PAHs				
Fluorine	95	0.44	31	38.09
Phenanthrene	205	0.95	67	82.39
Fluoranthene	276	1.28	90	110.74
Pyrene	198	0.92	65	79.73
Benzanthracene	48.5	0.22	16	19.49
Chrysene	90.4	0.42	29	36.32
Benzo (k) fluoranthene	110	0.51	36	44.30
Benzo (b) fluoranthene	130	0.60	42	52.27
Benzo (a) pyrene	68.4	0.32	22	27.46
Benzo (e) pyrene	88	0.41	29	35.44
Benzo (ghi) perylene	123	0.57	40	49.61
Acenaphthene	37	0.17	12	15.06
Indeno (c.d) pyrene	119	0.55	39	47.84
Acenaphthylene	19.8	0.09	6	7.97

Surface areas: Lake Ontario 7,340 sq. mi.; Embayment 35 sq. mi.; Genesee Basin 2,463 sq. mi.; Embayment Watershed 3,000 sq. mi.

Table 5-4 Cont.

POLYCHLORINATED DIOXINS AND FURANS (wet deposition only)

Parameter	Deposition on Lake Ontario Lbs/yr	Dep. on Embayment Lbs/yr	Dep. on Genesee Basin Lbs/yr	Dep. on Embayment Watershed Lbs/yr
TCDD	0.0115	0.00005	0.0037	0.0046
PeCDD	0.0152	0.00007	0.0050	0.0060
HxCDD	0.0617	0.00029	0.0201	0.0245
HpCDD	0.9261	0.00429	0.3018	0.3676
CCDD	2.073	0.00960	0.6755	0.8228
TCDF	0.2205	0.00102	0.0719	0.0875
PeCDF	0.1147	0.00053	0.0374	0.0455
HxCDF	0.4190	0.00194	0.1365	0.1663
HePCDF	0.0926	0.00043	0.0302	0.0368
CCDF	0.0220	0.00010	0.0072	0.0088
TRACE METALS				
Mercury	1252	6	408	497
Lead	104980	486	34215	41675
Cadmium	7195	33	2345	2856
Arsenic	10099	47	3291	4009

SOURCE: Eisenreich, S. J. and Strachan, W. M. J. (1992). Estimating atmospheric deposition of toxic substances to the Great Lakes: an update. Burlington, ONT: Canada Centre for Inland Waters.

Table 5-4 Cont.

LOCAL MEASUREMENTS AT BROCKPORT, NY

Parameter	Mean Monthly Loading mg/sq meter	Dep. on Embayment Lbs/yr	Dep. on Genesee Basin Lbs/yr	Dep. on Embayment Watershed Lbs/yr
Total Phosphorus	3.45	8256	581015	707692
Cadmium	0.18	431	30314	36923
Lead	0.87	2082	146517	178461
Manganese	1.50	3590	252615	307692
Zinc	6.39	15292	1076140	1310768

SOURCE: Makarewicz, J. C., Lewis, T.W., and Brooks, A. (1990). Chemical analysis and nutrient loading of Salmon Creek, Otis Creek, Black Creek, Spencerport Sewage Treatment Plant, and precipitation falling in Western Monroe County. Brockport, NY: SUNY Brockport. P. 49.

MENDON PONDS ATMOSPHERIC DEPOSITION COLLECTOR 1990

Parameter	Mean Monthly Loading mg/sq meter	Dep. on Embayment LBS/yr	Dep. on Genesee Basin LBS/yr	Dep. on Embayment Watershed LBS/yr
Total Phosphorus	3.120	7484	526634	641455
Lead	0.455	1091	76780	93520
Zinc	1.711	4105	288875	351858

SOURCE: Monroe County Health Department, Environmental Health Laboratory, Unpublished Data.

TABLE 5-5. AIR EMISSIONS

Parameter	Stack Emissions by County (lbs/yr)						Fugitive Losses (SARA) Monroe Co. (lbs/yr)
	Allegany	Livingston	Genesee	Monroe	Orleans	5 County Total	
Aluminum	0	6		5788		5794	
Arsenic				12		12	
Barium	0	0				0	0
Cadmium				2		2	0
Chromium						0	500
Chromium (hexavalent)	0	0		216		216	
Cobalt				0		0	0
Copper	0			172		172	2900
Copper compounds*						0	500
Iron	480	158	2038	7042		9718	
Lead	0	32	0	2858		2890	
Manganese				6		6	0
Manganese compounds*						0	14
Mercury (organic)				0		0	
Molybdenum				6		6	
Nickel (metal)				116		116	500
Nickel compounds*						0	96
Selenium				280		280	0
Silver				29338		29338	
Zinc				11002		11002	68
Zinc compounds*						0	720
Acetone	12	22	1316	3630950	2020	3634320	450000
Benzene	754			3846	40	4640	
Dioctyl phthalate		0		2662	7998	10660	
Carbon tetrachloride				8832		8832	6700
Chloroform				7336		7336	
O-dichlorobenzene				110	0	110	
M-dichlorobenzene				4		4	
Methyl amyl alcohol				24560		24560	
Hexane	2	1926		76148		78076	
Methylene chloride		98		8295278	338	8295714	840000
Methyl ethyl ketone		24620	3532	545852	2134	576138	42000
Phenol	952	6		190		1148	82
Phosphoric Acid (PO4)*						0	18000
PCB				0		0	
Tetrachloroethylene			16	13972		13988	
Tetrahydrofuran				188236		188236	
Toluene	96030	4058	5332	4757570	504	4863494	150000
124 trichlorobenzene				0		0	
Methyl chloroform	3420	4262	69838	4022532	69838	4169890	
Trichloroethylene		82	39532	383056		422670	24000

* Recorded only for fugitive emissions.

Table 5-6
KODAK AMBIENT AIR MONITORING STATISTICAL RESULTS [ppbv]
Fourth Quarter 1991
Dichloromethane
MDL : 0.13 [ppbv] (0.45 ug/m3)

Location	Number of Samples	Arithmetic Mean	Median	Running*** Annual Average
School 41	15	2.0	0.78	3.5
Rand Street	15	2.1	1.5	7.8
Koda Vista	15	20	6.7	17
Merrill Street**	15	39	49	21
Irondequoit	15	3.3	3.3	4.3
Ridgeway Ave.	14	0.18	ND	0.23
Hanford Landing Road	15	17	13	20
Trip Blank	7	0.43	ND	0.31

Notes: ppbv - Parts per billion by volume.
ug/m3 - Micrograms per cubic meter.
MDL - Method detection limit, based on standard sample dilution. The minimum concentration that can be measured and reported with 99 percent confidence to be greater than zero, assuming a baseline level of zero.
ND - Not detected.
* - Result is below MDL.
** - Merrill Street statistics calculated from data presented in Table A - 4.
*** - Running Annual Averages were calculated for the time period January 1, 1991 - December 31, 1991.

1. In cases where the compound was not detected in one of the samples, one-half of the MDL was used for all calculations.

2. Trip blank canisters collected before 12/20/91 were diluted with ultra high purity air by a factor of approximately 2.3 prior to analysis. The trip blank results presented in this report have not been dilution corrected. Trip blanks are evacuated, certified canisters which are never opened in the field. They accompany field samples to help determine if systematic field sample contamination is occurring during transport. Once returned to the laboratory, the trip blanks were analyzed using the same methods as for field samples.

Source: Eastman Kodak Company. Quarterly Report for the Kodak Park Ambient Air Monitoring Program, October 1-December 1, 1991. Page 4-8 and page 2-5.

TABLE 5-7
XEROX AMBIENT AIR MONITORING PILOT PROGRAM
SUMMARY OF ARITHMETIC MEANS (ppbv)
OVERALL SUMMARY: VOLATILES

	Site #1	Site #2	Site #3	Site #4	Site #5	Site #6	Agency Guideline[a]	National UATMP[b]
1,3-butadiene	0.053*	0.055*	0.055*	0.055*	0.055*	0.059*	33	0.21
dichloromethane	5.0	2.7	2.6	8.7(4.2)[c]	4.2	3.5	7.8[d]	0.60
methyl ethyl ketone	1.7*	3.0	1.6*	3.0	2.0	2.0	670	NA
styrene	0.31*	0.26*	0.26*	2.1	0.25*	0.30*	170	1.1
toluene	2.1	2.4	1.4	13	6.5	3.4	2600	4.6
1,1,1-trichloroethane	0.50	0.59	0.70	0.62	0.43	0.43	7100	NA

* Result is below the Method Detection Limit.

a Ambient Guideline Concentrations from NYSDEC, for acceptable annual average (NYS Air Guide - 1, September 1989).

b Data from USEPA Urban Air Toxics Monitoring Program (UATMP), 1989.

c Value in parentheses excludes 58 ppbv value of 7/28/90. Median concentration, including 58 ppbv result, is 2.5 ppbv.

d The current AGC value for DCM is 340 ppbv; however, the proposed value (7.8 ppbv) has been intensively reviewed and is frequently regarded as the adopted value.

Source: Radian Corporation, prepared for Xerox Corporation. Xerox Ambient Air Monitoring Pilot Program Final Report November, 1990.

tablela.es
xeroxaa

TABLE 5-8. INACTIVE HAZARDOUS WASTE SITES IN ROCHESTER EMBAYMENT DRAINAGE BASIN
Containing AOC Priority Chemicals

WASTE SITE NAME and LOCATION	REGISTRY I.D. and SITE CLASSIF.	DRAINAGE BASIN or Nearest WATERWAY	AOC PRIORITY CHEMICALS IDENTIFIED	
MONROE COUNTY (based on registry, Phase II investigations and other analytical data)				
A. C. Rochester 1000 Lexington Ave. Rochester	828064 2	Genesee River	Benzene Tetrachloroethene 1,1,1-Trichloroethane Trichloroethene	Toluene
Autohaus of Rochester 99 Marsh Rd. Perinton	828084 2	Irondequoit Creek (Central basin)	Acetone Benzene Methyl ethyl ketone	Methylene chloride Tetrachloroethylene 1,1,1-trichloroethane Trichloroethene
Bausch & Lomb Frame Center 465 St. Paul Rd. Chili	828061 2	Black Creek (Genesee Basin)	Benzene Toluene 1,1,1-trichloroethane Trichloroethene Benzo(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(a)pyrene Chrysene Fluoranthene Pyrene	Cadmium Chromium Lead Mercury Nickel Silver Vanadium Zinc
Formerly Black & Decker Also formerly General Electric Currently Kleenbrite 200 State St. Brockport	828003 2	Brockport Creek (West Basin)	Trichloroethene Chromium Iron Nickel	
Brighton Town Landfill Browncroft Blvd. Brighton	828031 2a	Irondequoit Creek (Central Basin)	4,4'-DDD Acetone Benzo(k)fluoranthene Bis(2 ethylhexyl)phthalate Chrysene Di-n-octyl phthalate	Barium Chromium Copper Lead Zinc
Brockport Landfill Canal Rd. Sweden	828038 2	Brockport Creek (W. Basin)	Acetone Benzene Di-n-octyl phthalate Trichloroethene Toluene Aluminum Arsenic Barium	Cadmium Cobalt Copper Iron Lead Manganese Vanadium Zinc

Table 5-8. Continued

WASTE SITE NAME and LOCATION	REGISTRY I.D. and SITE CLASSIF.	DRAINAGE BASIN or Nearest WATERWAY	AOC PRIORITY CHEMICALS IDENTIFIED	
Burroughs/Unisys Site 1225 Ridgeway Ave. Rochester	828075 2	Trib. of Genesee River	Acetone Methyl ethyl ketone	
Carter St. SW corner Carter St. & Ridge Rd. Rochester	828051 Delisted	Storm sewers (W. Basin)	Lead	
Chemical Sales Corp. 150 Lee Rd. Gates	828086 2	Erie Canal	Acetone Hexane Methylene chloride Methyl ethyl ketone	Tetrachloroethylene Toluene 1,1,1-trichloroethane Trichloroethene
Clarkson Landfill Redman Rd. Clarkson	828036 Delisted	Moorman Creek (trib. of West Ck) West Basin	4,4'-DDD 4,4'-DDT Benzene Bis(2 ethylhexyl)phthalate Methylene chloride	Aluminum Barium Lead Manganese Mercury
Davis Howland Oil Corp. 200 Anderson Ave. Rochester	828088 2a	Genesee Basin	Acetone Methylene chloride Methyl ethyl ketone	Toluene 1,1,1-trichloroethane Cadmium Lead
Dearcop Farm Dearcop Dr./Varian Lane Gates	828016 2	Erie Canal	Benzene Trichloroethene Aluminum Arsenic Cadmium	Lead Manganese Silver
Former Dollinger Corp. Currently American Filtrona Corp. 1 Townline Circle Brighton	828078 2	Red Creek (GenBasin)	Trichloroethene	
Eastman Kodak Co., Kodak Park East 1669 Lake Ave. Rochester	828071 2	Genesee River	Acetone Benzene Methylene chloride	
Eastman Kodak Co., KPM 1669 Lake Ave. Rochester	828082 2	Paddy Hill Creek (W. Basin)	Acetone Methylene chloride Methyl ethyl ketone Toluene	

Table 5-8. Continued

WASTE SITE NAME and LOCATION	REGISTRY I.D. and SITE CLASSIF.	DRAINAGE BASIN or Nearest WATERWAY	AOC PRIORITY CHEMICALS IDENTIFIED	
Eastman Kodak Co., KPW 1669 Lake Ave. Rochester	828074 2	Genesee River	Acetone Benzene Chloroform Hexane	Methylene chloride Methyl ethyl ketone Toluene Silver
Emerson St. Landfill Emerson St. Rochester	828023 3	Erie Canal Storm sewers (W. Basin)	Chlordane 4,4'-DDT Acetone Benzene Bis(2 ethylhexyl)phthalate Di-n-octyl phthalate Toluene	Trichloroethene Aluminum Chromium Iron Lead Manganese Zinc
Erdle Perforating 100 Pixley Industrial Pkwy. Gates	828072 2	Little Black Creek (G. Basin)	Trichloroethene Tetrachloroethylene	
Flynn Road Landfill Flynn Road Greece	828029 2a	Northrup Creek (W. Basin)	4,4-DDT Acetone Benzene Toluene Benzo(a)pyrene Fluoranthene	Pyrene Arsenic Cadmium Lead Mercury
Gates Dump - Hinchey Rd. Hinchey Rd. Gates	828047 Delisted	Erie Canal	Aldrin Endosulfan Methoxychlor Cyanide Benzo(a)anthracene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene	Chrysene Pyrene Cadmium Chromium Copper Lead Mercury Zinc
General Circuits 95 Mt. Read Blvd. Rochester	828085 2	Genesee River	Acetone Tetrachloroethylene Trichloroethene Toluene	
Genesee Gorge Upper Falls to Lower Falls	828044 Delisted	Genesee River	Benzene Benzo(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(a)pyrene Bis(2-ethylhexyl)phthalate Dibenzofuran Fluoranthene Hexachlorobutadiene	Tetrachloroethene Trichloroethene Toluene Arsenic Barium Cadmium Chromium Lead Mercury Zinc

Table 5-8. Continued

WASTE SITE NAME and LOCATION	REGISTRY I.D. and SITE CLASSIF.	DRAINAGE BASIN or Nearest WATERWAY	AOC PRIORITY CHEMICALS IDENTIFIED	
Genesee Scrap & Tin 80 State St. Rochester	828081 2	Genesee River	PCBs	
Golden Rd. Disposal Site Golden Road Chili	828021 2	Little Black Creek (G. Basin)	Benzene 1,1,1-trichloroethane Tetrachloroethylene Toluene	Arsenic Barium Chromium Lead Manganese Zinc
High Acres Landfill Perinton Pkwy. Perinton	828014 3	Thomas Creek (Central Basin)	Acetone Benzene Phenol Toluene	Cyanide
Former Jarl Extrusions, Inc. (Alcan Aluminum Corp.) 860 Linden Ave. Pittsford	828005 2	Irondequoit Creek (Central Basin)	Aluminum Chromium Copper Iron	Lead Nickel Zinc
Little League Lynden Road Perinton	828026 3	Thomas Creek (C. Basin)	Cyanide Acetone Chloroform PCBs	Aluminum Cadmium Copper Iron Lead Zinc
Monarch Sand and Gravel Ridge Road Parma	828019 2a	Buttonwood Creek (W. Basin)	Dieldrin DDT DDE DDD Bis(2 ethylhexyl)phthalate Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene Fluoranthene Pyrene	Aluminum Arsenic Cadmium Copper Iron Lead Manganese Vanadium Zinc
NYSDOT Pittsford Monroe Ave. Pittsford	828056 Delisted	West Brook (C. Basin)	Pyrene Toluene	
NYSDOT Pittsford Linden Ave. Pittsford	828045 2a	Irondequoit Creek (C. Basin)	Endosulfan Acetone Benzene Methylene chloride Toluene Fluoranthene	Phenanthrene Pyrene Chromium Iron Lead Manganese

Table 5-8. Continued

WASTE SITE NAME and LOCATION	REGISTRY I.D. and SITE CLASSIF.	DRAINAGE BASIN or Nearest WATERWAY	AOC PRIORITY CHEMICALS IDENTIFIED	
Ogden Landfill Lyell St. Ogden	828039 Delisted	Erie Canal	Iron Manganese	
Old Rochester City Landfill Pattonwood Dr. Irondequoit	828009 2a	Genesee River	Benzene PCBs Toluene Lead	
Olin Chemicals McKee Road Rochester	828018A	Erie Canal	Benzene Carbon tetrachloride Chloroform Dibromochloromethane 1,2 dichlorobenzene 1,3 dichlorobenzene	1,4 dichlorobenzene Methylene chloride Tetrachloroethylene Toluene 1,1,1-trichloroethane
Parma 6 Ridge Rd. at Manitou Rd. Parma	828050 Delisted	Smith Creek (W. Basin)	Toluene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene	Pyrene Arsenic Selenium
Tom Paxton Chevrolet 3722 Scottsville Rd. Wheatland	828073 2a	Genesee River	Acetone Benzene Toluene	
Pittsford Town Dump Marsh Road Pittsford	828048 Delisted	Erie Canal, Irondequoit Creek (C. Basin)	Cyanide Arsenic Barium	Lead Manganese Zinc
Railroad Car Shops Despatch Drive East Rochester	828046 2a	Irondequoit Creek (C. Basin)	Bis(2 ethylhexyl)phthalate Methylene chloride Aluminum Barium Chromium Iron	Lead Mercury Nickel Vanadium Zinc
R. D. Specialties Salt Road Webster	828062 2	Four Mile Creek (C. Basin)	Chromium	
George A. Robinson & Co., Inc. 477 Whitney Rd. Perinton	828065 2	Trib. of Irondequoit Creek (C. Basin)	Trichloroethene	

Table 5-8. Continued

WASTE SITE NAME and LOCATION	REGISTRY I.D. and SITE CLASSIF.	DRAINAGE BASIN or Nearest WATERWAY	AOC PRIORITY CHEMICALS IDENTIFIED	
Rochester Fire Academy 1190 Scottsville Rd. Chili	828015 2	Genesee River	Benzene Bis(2 ethylhexyl)phthalate Chloroform Methyl ethyl ketone PCBs Tetrachloroethylene Toluene Benzo(a)pyrene Benzo(b)fluoranthene	Benzo(k)fluoranthene Chrysene Pyrene Cadmium Copper Lead Silver Zinc
Roehlen Engraving 701 Jefferson Rd. Henrietta	828077 2	Red Creek (G. Basin)	Methylene chloride Trichloroethene	Chromium Lead
Rush Landfill Route 251 Rush	(Not an active haz. waste site)	Genesee River	Benzene PCBs Phenol Toluene Cyanide	Aluminum Chromium Iron Lead Manganese Vanadium Zinc
Scobell Chemical 1 Rockwood Place Brighton	828076 2	Grass Ck. (trib. of Irondequoit Bay) C. Basin	Tetrachloroethylene Toluene	
Scottsville Rd. - Chili 2 Scottsville Road Chili	828022 2a	Genesee River	Acetone Barium Chromium Copper Iron	Manganese Mercury Nickel Silver Zinc
Sigismondi Landfill Linden Ave. Pittsford	828011 2a	Irondequoit Creek (C. Basin)	1,1,1-trichloroethane Chromium Lead	
Stuart-Oliver-Holtz 39 Commerce Dr. Henrietta	828079 2	Red Creek (G. Basin)	Methylene chloride Tetrachloroethylene 1,1,1-trichloroethane	Trichloroethene
Sweden-3 Chapman Beadle Rd. Sweden	828040 2	Black Creek (W. Basin)	4,4'-DDT Acetone Benzene Bis(2 ethylhexyl)phthalate Methylene chloride Tetrachloroethylene Trichloroethene	Toluene Cyanide Cadmium Chromium Lead Mercury

Table 5-8. Continued

WASTE SITE NAME and LOCATION	REGISTRY I.D. and SITE CLASSIF.	DRAINAGE BASIN or Nearest WATERWAY	AOC PRIORITY CHEMICALS IDENTIFIED	
Taylor Instruments 95 Ames St. Rochester	828028A 4	Genesee River	Mercury	
Former 3M/Dynacolor Currently Brockport Cold Storage 98 Spring St. Brockport	828066 2a	Brockport Creek (W. Basin)	Cyanide Cadmium Silver Zinc	
Trimmer Rd. Landfill Trimmer Road Parma	828012 Delisted	Buttonwood Creek (W. Basin)	Acetone Benzene Bis(2 ethylhexyl)phthalate Chloroform	Arsenic Barium Iron Manganese
Village of Spencerport Dump Trimmer Rd. Ogden	828025 3	ButtonwoodC reek (W. Basin)	Beta BHC Iron Manganese	
Xerox Landfill 800 Phillips Rd. Webster	828013 4	Four Mile Creek (C. Basin)	Acetone Chloroform Carbon tetrachloride Tetrachloroethylene	1,1,1-trichloroethane Toluene Arsenic Selenium
Xerox - Salt Rd. 800 Phillips Road Webster	828067 2	Four Mile Creek (C. Basin)	Tetrachloroethylene Trichloroethene Toluene	
Xerox - Bldg. 201 800 Phillips Rd. Webster	828080 2	Mill Creek (C. Basin)	Tetrachloroethylene 1,1,1-trichloroethane Trichloroethene Arsenic	Chromium Nickel Selenium
Xerox - Henrietta 1350 Jefferson Rd. Henrietta	828069 2	Allen Creek (C. Basin)	Methylene chloride Tetrachloroethylene 1,1,1-trichloroethane	
Xerox - Nursery Area San Jose Blvd. Webster	828083 2	Four Mile Creek (C. Basin)	Tetrachloroethylene Trichloroethene 1,1,1-trichloroethane Toluene	
Xerox - Bldg. 209 800 Phillips Rd. Webster	828068 2	Four Mile Creek (C. Basin)	Tetrachloroethene Trichloroethene 1,1,1-trichloroethane	
ORLEANS COUNTY (based on registry only) All in West Basin.				

Table 5-8. Continued

WASTE SITE NAME and LOCATION	REGISTRY I.D. and SITE CLASSIF.	DRAINAGE BASIN or Nearest WATERWAY	AOC PRIORITY CHEMICALS IDENTIFIED	
Haight Farm 4899 Upper Holley Rd. Clarendon	837006 2	Sandy Creek	Trichloroethene Other solvents	
FMC Corp. Dublin Rd. Shelby	837001 2	Erie Canal	DDT Arsenic Mercury Lead	Other pesticides
McKenna Landfill N. of Yeager Rd. Albion	837003 2	Erie Canal	Benzene Barium Manganese	Cleaning solvents Other industrial waste
GENESEE COUNTY (based on registry only) All in Genesee Basin				
Lehigh Valley RR Derailment Gulf Rd. & Lehigh Valley RR crossing LeRoy	819014 2	Oatka Creek	Trichloroethene Cyanide	
Route 19 Drum Disposal (McGinnis) Route 19 LeRoy	.819009 2a	Oatka Creek	Solvents	
WYOMING COUNTY (based on registry only) All in Genesee Basin				
ETE Sanitation and Landfill Broughton Rd. Gainesville	961005 2a	Cotton Creek (trib. of Oatka)	Carbon tetrachloride Lead	
Warsaw Village Landfill Industrial St. Warsaw	961006 2a	Oatka Creek	Toluene Lead Plating wastes	
Robeson Industries, Inc. Buffalo Rd. Castile	961008 2	Oatka Creek	1,1,1-trichloroethane	
LIVINGSTON COUNTY (based on registry only) All in Genesee Basin				
Atochem N. America Formerly Lucidol Route 63 Piffard	826006 2a	Genesee River	Ash Sludges Chloroformates	

Table 5-8. Continued

WASTE SITE NAME and LOCATION	REGISTRY I.D. and SITE CLASSIF.	DRAINAGE BASIN or Nearest WATERWAY	AOC PRIORITY CHEMICALS IDENTIFIED	
Enarc-O Machine Products 1175 Bragg St. Lima	826011 2	Honeoye Creek	1,1,1-trichloroethane Trichloroethene Other solvents	
Foster-Wheeler Corp. RD #3 N. Dansville	826001 2a	Cana-seraga Creek	Chloroform Methylene chloride Bis(2 ethylhexyl)phthalate	PCBs Waste paint
Jones Chemical 100 Sunny Sol Blvd. Caledonia	826003 2	Spring Creek	Methylene chloride Tetrachloroethylene	1,1,1-trichloroethane Trichloroethene
Tenessee Gas Pipeline Station 233 Dow Rd. & Federal Rd. York	826014 2a	Bidwells Creek	PCBs	
ONTARIO COUNTY (based on registry only) All in Central Basin				
Genesee Sand & Gravel 748 Phillips Rd. Victor	835005 2a	Trib. of Irondequoit Creek	Phenols Volatile organics Heavy metals	Waste paint Flammable liquids
ALLEGANY COUNTY (based on registry only) All in Genesee Basin				
Sinclair Refinery Brooklyn Ave. Wellsville	902003 2	Genesee River	PCBs Lead Nickel	Pesticides Petroleum
Wellsville-Andover Landfill Snyder Hill Rd. Wellsville and Andover	902004 2	Duffy Hollow Ck. (trib. of Chenunda)	Cyanide Methylene chloride Chromium Zinc	VOCs SVOCs Metals Resins, solvents
Deming Electroplating Route 305 New Hudson	902007 2a	Black Creek	Cadmium Lead	Heavy metal sludges
W. Almond Pesticide Storage Site N. of County Rt. 2A W. Almond	902010 2	Angelica Creek	DDT Dieldrin Chlordane Cyanide	Arsenic Mercury Lead

Table 5-8. Continued

WASTE SITE NAME and LOCATION	REGISTRY I.D. and SITE CLASSIF.	DRAINAGE BASIN or Nearest WATERWAY	AOC PRIORITY CHEMICALS IDENTIFIED	
Cuba Municipal Waste Disposal Jackson Hill Rd. Cuba	902012 2a	Black / Van Campen Creeks	Cyanide PCBs	Chlorinated solvents Paint sludges
Friendship Foundries 10 Howard St. Friendship	902015 2	Van Campen Creek	PCBs	Ignitable liquid waste solvents

Site Classification:

2 = Significant threat to public health or environment; action needed.
2a = Temporary classification assigned to sites that have inadequate and/or insufficient data for inclusion in any of the other classifications.
3 = Does not present a significant threat to the public health or the environment; action may be deferred.
4 = Site is properly closed; requires continued management.

Sources:

New York State Depts. of Environmental Conservation and Health. (1992, April). Inactive hazardous waste disposal sites in New York State. Volumes 8 and 9. Albany, NY.

Phase II investigations and other data for individual waste sites in Monroe County.

TABLE 5-9. CALCULATED NONPOINT SOURCE RUNOFF

Parameter	Loading (tons/yr)			
	West Sub-basin	Lower Genesee Basin[1]	Central Sub-basin[2]	Upper Genesee Basin
Total susp. solids	25,000	81,000	20,000	no estimates
Total phosphorus	28	86	24	
Total lead	3.5	8.6	4.3	
Total zinc	119	391	116	

[1] From Geneseo to river mouth. (Includes runoff from small area between Charlotte Docks and river mouth not included on Table 5-16).

[2] A large part of this sub-basin is the Irondequoit Bay watershed. Estimated loading from the NURP study (Kappel *et al*, p. 26) was used for the Irondequoit Bay watershed. Runoff from the Durand area and the Mill Creek/Four-mile Creek area of this sub-basin was calculated.

See chapter appendix for discussion of methods.

RUNOFF

Table 5-10 MONROE COUNTY REPORTED SPILL RECORDS
For the Period 10/1/89 through 7/17/91

Substance Spilled	# of spills	total gallons/lbs. spilled	# of spills w/ known quantity
Oil	27	26	1
Motor Oil	11	21	3
Hydraulic Oil	20	27	15
Hydraulic Fluid	16	unknown	
Home Heating Oil	11	154	4
Fuel Oil	22	unknown	
Diesel Oil	54	1233	not counted
Waste Oil	16	230	12
Waste Motor Oil	4	145	3
Used Motor Oil	13	unknown	
Transformer oil	3	8	1
PCB Oil	1	unknown	
Cutting Oil	9	473	6
#6 fuel oil	4	4	1
#2 fuel oil	32	4033	22
Machine lub oil	6	33	4
Kerosene	3	unknown	
Jet Fuel	7	60	2
Gasoline	166	357	not counted
Petroleum Products	241	4236	not counted
N-Butyl Alcohol	1	1700	1
Methyl ethyl ketone	2	1	1
Ethylene glycol	7	111	not counted
Acetone	5	220	not counted
Nitrogen compounds	7	1	1
Mercury	1	unknown	
Fertilizer	2	400	1
Zinc Dust	3	21.6	2
Suspect Phosphorus	1	1	1
Silver Rich Water	2	5	1
Silver Recovery Matls.	5	24	4
Photo Finish Proc.	3	38	2
Barium Chloride	5	unknown	
Methylene Chloride	10	2127	7
Hexane	3	595	2
Heptane	2	625	2
Dieldrin	2	5	1
Dichloromethane	1	2222	1
Xylene	5	75	2
Vinylidine Chloride	2	38	2
Turpentine	2	unknown	
Trichloroethylene	4	50	1
Trichlorethane	2	25	1
Transmission fluid/oil	5	13	2
Toluene	5	76	4
Tetrachloroethylene	1	25	1
Pesticide	2	45	2
Atrazine	2	unknown	
111 Trichloroethane	3	1000	1
Solvents	26	15444	15

Source: Database computer file provided by Monroe County Office of Emergency Preparedness.

TABLE 5-11. GENESEE RIVER LOADING ESTIMATES
October 1989 - September 1990
(See Appendix E for Loading Estimate Methodology)

Parameter	At Geneseo tons/yr (upper basin)	At Rochester tons/yr (entire basin)	Geneseo to Rochester tons/yr (lower basin)	Load per sq. mi. per yr (upper basin)	Load per sq. mi. per yr (lower basin)	% from upper basin
Arsenic (dissolved)	NA	2.7	- -	--	2 lbs (entire basin)	- -
Barium (dissolved)	NA	116	- -	--	94 lbs (entire basin)	- -
Cadmium (tot. recov.)	Mostly ND	2.6	- -	--	2 lbs (entire basin)	- -
Copper (tot. recov.)	20	30	10	28 lbs	19 lbs	67
Lead (tot. recov.)	12	20	8	17 lbs	15 lbs	60
Manganese (tot. recov.)	300	400	100	420 lbs	190 lbs	75
Mercury (tot. recov.)	Mostly ND	492	- -	--	400 lbs (entire basin)	- -
Nickel (tot. recov.)	14	24	10	20 lbs	19 lbs	58
Zinc (tot. recov.)	56	111	55	79 lbs	105 lbs	50
Total suspended solids	338,000	626,000	288,000	240 tons	280 tons	54
Total Phosphorus	NA	368	- -	--	300 lbs (entire basin)	- -

NA = not analyzed. ND = not detected.

Area of basin above Geneseo (including Canaseraga basin): 1424 sq. mi. Area of entire Genesee basin: 2464 sq. mi. Area of basin below Geneseo: 1043 sq. mi. Area of upper basin is 58% of entire basin. **Sources**: USGS Water Resources Data Reports. Loadings were correlated with flow, then calculated based on daily flows for the water year 1990.

RIVLOAD

TABLE 5-12
POLLUTANT LOADINGS FROM DREDGING

Parameter	River Loading tons/yr	Dredge Loading tons/yr
Arsenic	2.7	1.5
Barium	116	11
Cadmium	2.6	0.13
Chromium	Mostly ND	1.7
Copper	30	4
Cyanide	NA	0.13
Manganese	400	100
Mercury	0.25	0.015
Lead	20.2	2.2
Nickel	23.5	3.4
Silver	ND	1.1
Zinc	111	13
Total susp. solids	626,000	Total solids 23,000
Total phosphorus	368	132

NA = not analyzed. ND = not detected.

Notes:

Values for most metals in the river are "total recoverable" values. This includes most pollutants that are dissolved and that are attached to suspended sediments. Arsenic, barium, chromium and silver are only measured in the dissolved form. No dissolved silver has been detected since 1987.

Values for metals and cyanide in sediment are "total" values.

Sources:

USGS Water Resources Data Reports.

US Army Corps of Engineers dredging data.

Aqua Tech Environmental Consultants, Inc. (1990). Sediment analysis: Rochester harbor, Irondequoit Bay, New York. Prepared for U.S. Army Engineer District, Buffalo, NY.

Methods:

River loadings. Loadings were correlated with flow using data from 1986-90 or 1988-90 to generate regression equations. Loadings for water year 1990 were then calculated based on daily flows.

Dredge loadings. Loadings were determined as follows:

```
mg pollutant/kg dry solids x kg dry solids/100 kg wet sample
      (concentration)      x        (% solids)

x kg wet sample/kg H2O x 1000 kg H2O/M3 x .765 M3/CY x 2.205 lb/kg
x  (specific gravity)  x             (conversion factors)

x .0005 tons/lb x CY dredged = tons pollutant
               (volume dredged)
```

Concentrations used were averages for 11 samples. Results were halved because the harbor was not dredged in 1989; therefore the amount dredged in 1990 was assumed to be two years' deposition.

DREDLOAD

TABLE 5-13
ESTIMATED SOURCES OF LOADINGS TO ROCHESTER EMBAYMENT
FROM GENESEE BASIN
October 1989 - September 1990

Parameter	SPDES Wastewater Discharges tons/yr	Other Sources	Dredge Spoil tons/yr
Arsenic	0	2.7[2]	1.5
Cadmium	0.25	2.34	0.13[3]
Copper	2	28	4
Lead	1.4	18.8	2.2
Manganese	0.05	400	100
Mercury	0.013	0.24[4]	0.015
Nickel	1.1	22.9	3.4
Silver	3.3	--[2]	2.2
Zinc	16	95	13
Total suspended solids	13,277	626,000	Total solids 23,000
Total phosphorus	44	328	132

1 Other sources were determined by subracting SPDES discharges from total calculated river discharge.

2 Arsenic and silver in water are measured only in the dissolved form. Other metals on this table are measured as "total recoverable." No dissolved silver has been detected since 1987.

3 Cadmium was only detected at one of the ten sample points. Two samples were taken at this point and both showed cadmium at 0.5 mg/kg. The loading value of 0.13 tons/yr assumes that cadmium was present at half the detection limit at sites where it was not detected.

4 This value assumes that mercury was present at half the detection limit at those sites where it was not detected.

GENSOURC

TABLE 5-14.
COMPARISON OF POLLUTANT LOADINGS FROM WASTEWATER TREATMENT PLANTS DISCHARGING TO LAKE ONTARIO AND LOADINGS FROM GENESEE RIVER

Parameter	Genesee River Discharge tons/yr	WWTP Discharge tons/yr
Arsenic	2.7	ND
Cadmium	2.6	0.02
Chromium	Mostly ND	0.32
Copper	30	4.4
Manganese	400	ND
Mercury	0.25	ND
Lead	20.2	0.61
Nickel	23.5	2.9
Silver	ND	0.5
Zinc	111	7.9
Total susp. solids	626,000	?
Total phosphorus	368	153

Notes:

The treatment plants included are the Walter W. Bradley plant in Webster, the Frank E. Van Lare plant in Irondequoit, and the Northwest Quadrant plant in Greece.

Values for most metals in the river are "total recoverable" values. This includes most pollutants that are dissolved and that are attached to suspended sediments. Arsenic, chromium and silver are only measured in the dissolved form. No dissolved silver has been detected since 1987.

Values for metals in WWTP effluent are "total" values.

Sources:

USGS Water Resources Data Reports.
SPDES permit compliance data.

STPLOAD

TABLE 5-15
NONPOINT SOURCE LOADINGS TO EMBAYMENT FROM GENESEE BASIN
BETWEEN GENESEO AND CHARLOTTE DOCKS

	Estimate of Nonpoint Sources Using Calculated River Loadings Minus SPDES Discharges	Estimate of Runoff Using NURP Data
Total Suspended Solids (tons/yr)	>280,000	79,000
Total Phosphorus (tons/yr)	112.(est.)[1]	82
Lead (tons/yr)	6.6	7.2
Zinc (tons/yr)	39	385

1 Phosphorus loadings for the basin below Geneseo cannot be calculated because phosphorus is not measured at Geneseo. This value assumes that phosphorus loadings per acre are the same in the upper and lower basins.

NPGEN

TABLE 5-16
AREAL LOADINGS

Parameter	Loading by Basin (lbs/mi^2 per yr) Salmon Creek	Otis Creek	Thornell Subbasin	Irondequoit Creek	Genesee River
Cadmium	3	11	14	16	2
Lead	13	24	12	40	15
Zinc	61	135	698	962	105
Total Suspended Solids	118,000	198,000	161,000	231,000	560,000
Tot. Phosphorus	209	319	158	235	300

Notes:

Salmon Creek is a rural watershed in the West Basin and was sampled upstream of its confluence with Otis and Brockport Creeks.

Otis Creek is a small watershed in the West Basin which includes the Village of Brockport. The sampling station on Otis Creek is upstream of its confluence with Brockport Creek.

The Thornell watershed is part of the rural, upper Irondequoit Basin.

Irondequoit Creek watershed refers to the area upstream of Blossom Rd., a mixed-use suburban area.

The U.S. Geological Survey (USGS), in a report entitled Quantity and Quality of Urban Storm Runoff in the Irondequoit Creek Basin near Rochester, New York, (1986) recognized that the average mean storm concentrations of total zinc were high in the Irondequoit Creek basin compared with published values for storm runoff. The USGS suggests that a possible source of the zinc in the Irondequoit Basin may be the mineral spalerite (zinc sulfide), which occurs in the Silurian Lockport Dolomite that underlies the central part of the basin and is also within the drift and soils derived from it.

AREALOAD

TABLE 5-17.
ESTIMATED ATMOSPHERIC INPUT AND RIVER OUTFLOW OF SELECTED POLLUTANTS

Genesee River[1]

Parameter	Atmospheric Input to Genesee Basin (tons/yr)	Outflow from Genesee River (tons/yr)	Input/Outflow (1980-81) %
Arsenic	1.7	2.7	63%
Cadmium	1.2	2.6	46%
Lead	17.2	20.2	85%
Mercury	0.21	0.25	84%

Salmon, Otis and Irondequoit Creeks[2]

Parameter	Input/Outflow Salmon Creek (1989-90)	Input/Outflow Otis Creek (1989-90)	Input/Outflow Irondequoit Ck. (1980-81)
Lead	31%	95%	647%
Total Kjeldahl Nitrogen	260%	83%	135%
Total Phosphorus	110%	36%	65%

[1]Atmospheric deposition estimate calculated using Eisenreich/Strachan data.
[2]Atmospheric deposition and water quality data from Makarewicz data.

Sources:

Eisenreich, S. J. and Strachan, W. M. J. (1992). Estimating atmospheric deposition of toxic substances to the Great Lakes: an update. Burlington, ONT: Canada Centre for Inland Waters.

Kappel, W. M., Yager, R. M., and Zarriello, P. J. (1986). Quantity and quality of urban storm runoff in the Irondequoit Creek Basin near Rochester, New York. (USGS Water-Resources Investigations Report 85-4113). Ithaca, NY: U.S. Geological Survey.

Makarewicz, J. C., Lewis, T. W., Brooks, A., and Burton, R. (1990). Chemical analysis and nutrient loadings of: Salmon Creek, Otis Creek, Black Creek, Spencerport Sewage Treatment Plant; and precipitation falling in western Monroe County. Brockport, NY: SUNY Brockport Dept. of Biological Sciences.

ATMOS

Table 5-18

PCB Equipment Inventory Summary for the New York State Electric Utilities

(equip in svce as of 6/30/92 – 14th filing)

		NUMBER of CAPACITORS			NUMBER of TRANSFORMERS		
Company	Reporting Date	Distribution	Station	*Total*	Askarel	Oil>500	*Total*
RG&E	*Begin Phaseout*	5000	1483	6483	130	33	163
	12/31/85	634	1483	2117	76	33	109
	6/30/86	428	1456	1884	67	33	100
	12/31/86	176	1456	1632	62	27	89
	6/30/87	35	1420	1455	49	27	76
	12/31/87	0	1198	1198	44	17	61
	6/30/88	0	1198	1198	30	14	44
	12/31/88	0	1198	1198	23	13	36
	6/30/89	0	1198	1198	21	11	32
	12/31/89	0	1198	1198	18	7	25
	6/30/90	0	1132	1132	16	4	20
	12/31/90	0	1077	1077	12	5	17
	6/30/91	0	1077	1077	12	4	16
	12/31/91	0	1104	1104	8	5	13
	6/30/92	0	1034	1034	4	3	7
	removed this period	0	70	70	4	2	6
NMPC	*Begin Phaseout*	16734	10411	27145	515	433	948
	12/31/85	5393	10411	15804	389	433	822
	6/30/86	4665	10411	15076	389	266	655
	12/31/86	4165	10153	14318	360	252	612
	6/30/87	2424	9885	12309	297	225	522
	12/31/87	1185	9763	10948	261	192	453
	6/30/88	192	9568	9760	232	163	395
	12/31/88	0	9415	9415	218	156	374
	6/30/89	0	9261	9261	194	138	332
	12/31/89	0	8249	8249	146	122	268
	6/30/90	0	7956	7956	127	112	239
	12/31/90	0	6773	6773	118	96	214
	6/30/91	0	6449	6449	122	70	192
	12/31/91	0	5568	5568	72	62	134
	6/30/92	0	4915	4915	52	47	99
	removed this period	0	653	653	20	15	35

18–Mar–93

Table 5-18 (continued)

PCB Equipment Inventory Summary for the New York State Electric Utilities

(equip in svce as of 6/30/92 – 14th filing)

		NUMBER of CAPACITORS			NUMBER of TRANSFORMERS		
Company	Reporting Date	Distribution	Station	*Total*	Askarel	Oil>500	*Total*
NYSEG	*Begin Phaseout*	9000	4000	13000	8	114	122
	12/31/85	62	2392	2454	2	114	116
	6/30/86	0	2351	2351	1	114	115
	12/31/86	0	1506	1506	0	68	68
	6/30/87	0	837	837	0	51	51
	12/31/87	0	468	468	0	33	33
	6/30/88	0	274	274	0	22	22
	12/31/88	0	144	144	0	19	19
	6/30/89	0	69	69	0	19	19
	12/31/89	0	27	27	0	12	12
	6/30/90	0	27	27	0	11	11
	12/31/90	0	0	0	0	9	9
	6/30/91	0	0	0	0	7	7
	12/31/91	0	0	0	0	10	10
	6/30/92	0	0	0	0	1	1
	removed this period	0	0	0	0	9	9

TABLE 5-19. ESTIMATED 1974 SEDIMENT LOAD FROM GENESEE BASIN

Watershed	Tons/yr from Streambank Erosion	Tons/yr from Cropland	Tons/acre from Cropland	Total Tons/yr
Lower Genesee (north of Scottsville)	**25,270**	14,250	8.39	39,520
Red Creek	17,080	**17,120**	8.39	34,200
Black Creek (Genesee County)	81,361	**224,176**	7.88	305,537
Lower Honeoye	12,852	**89,504**	7.68	102,356
Middle Genesee (Mt. Morris to Scottsville)	58,808	**205,406**	6.97	264,214
Conesus Lake	31,934	**104,995**	6.73	136,929
Honeoye	26,387	**98,640**	9.56	125,027
Upper Honeoye	4,587	**21,083**	13.19	25,670
Oatka Creek	63,771	**219,261**	7.21	283,032
Little Beard Creek	14,450	**72,064**	6.63	86,514
Silver Lake-Genesee River	**35,119**	12,516	6.58	47,635
E. Koy and Wiscoy Creeks	30,450	**97,435**	6.56	127,885
Canaseraga Creek	143,882	**301,106**	7.00	444,988
Sixtown and Rush Creeks	**108,547**	17,752	5.62	126,299
Canadea Creek	**49,027**	4,958	6.00	53,985
Black Creek (Allegany County)	**78,728**	4,062	4.46	82,790
Angelica Creek	**75,275**	2,494	4.46	77,769
Baker Valley	1,262	-	-	1,262
Van Campen Creek	**52,486**	2,280	4.46	54,766
Vandermark and Knight Creeks	**129,142**	5,445	4.46	134,587
Dyke Creek	**57,644**	20,768	7.30	78,412
Chenunda Creek	**66,299**	3,171	4.46	69,470
Cryder River	22,851	**27,896**	7.75	50,747
TOTAL	1,187,212	1,566,382		

Note: The larger erosion source for each watershed is in **bold.**

Source: U. S. Department of Agriculture, Soil Conservation Service. (1974). Erosion and Sediment Inventory – New York. Washington, DC.

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TABLE 5-20

Comparison of phosphorus loading in subbasins of the Irondequoit Bay watershed to phosphorus loadings from Otis and Salmon Creeks. Irondequoit Basin data is from Bannister and Burton (1979) and Peet, Burton, Baker et al. (1985). Other data is from Makarewicz (1989) and this study.

Subbasin or Creek	Total Areal Phosphorus Loading (g P/ha/d)
Irondequoit Creek	
[a]1975-77 (pre-diversion)	5.6
[a]1978-79 (post-diversion)	2.0
[b]1979	2.3
[b]1980	2.2
[b]1989-85	0.88
Larkin Creek (1988-89)	0.70
Buttonwood Creek (1988-89)	1.58
Lower Northrup (1988-89)	4.24
Upper Northrup (1988-89)	3.23
Black Creek (1988-89)	0.60
Otis Creek (1989-90)	1.56
Salmon Creek (1989-90)	1.00

[a]At Browncroft Blvd.
[b]At Blossom Road

Note: Diversion refers to diversion of wastewater treatment plan effluent from streams in the Irondequoit Basin.

Source: Makarewicz, J. C., Lewis, T. W., Brooks, A and Burton, R. (1990). Chemical analysis and nutrient loading of Salmon Creek, Otis Creek, Black Creek, Spencerport Sewage Treatment Plant, and precipitation falling in Western Monroe County. Brockport, NY: SUNY Brockport. P.24.

TABLE 5-21. BENZENE, TOLUENE AND XYLENE SEEPS AT LOWER FALLS

Compound	Concentration at Four Sample Points (ppm)			
	B1	B2	B3	B4
Benzene	5.80	6.00	5.60	0.70
Toluene	4.80	5.00	5.50	0.68
meta-Xylene	1.70	0.87	1.60	0.30
ortho-Xylene	1.70	1.40	1.50	0.28
para-Xylene	0.73	0.75	0.79	0.14

TABLE 5-22. POOL AT BASE OF FALLS

Compound	Concentration (ppm)
Benzene	ND
Toluene	ND
Xylenes	ND
Chloroform	ND
Other volatiles	ND
Naphthalene	0.20
Acenaphthylene	1.30
Fluorene	0.77
Phenanthrene	2.30
Anthracene	0.68
Fluoranthene	0.98
Pyrene	1.70
Benzo(a)anthracene	1.60
Benzo(b)fluoranthene	0.73
Benzo(a)pyrene	1.00
Iodeno(1,2,3-cd)pyrene	ND
Benzo(g,h,i)perylene	ND
Di-n-butyl phthalate	0.78
Other Base/Neutrals	ND
Acid Extractables	ND

ND = not detected

Sources:

Monroe Co. Dept. of Health. (1986). Genesee River sediment toxics survey (205j). (Final report). Rochester, NY. Page 81.

RECRA Environmental, Inc. (1988). Expanded phase I investigation: Genesee River Gorge (Lower Falls), Site I.D. #828044. Albany, NY: NYSDEC. Table 4.3-12.

SEEPS

Table 5-23. NONPOINT SOURCE LOADINGS TO EMBAYMENT

WATERSHED	Watershed Total Area sq mi	Total C1 sq mi	Total H2 sq mi	Total M3 sq mi	Total L4 sq mi	Total Imperv. Area sq mi	Total % Imperv. Area	TSS load tons/yr	Total P load tons/yr	Lead load tons/yr	Zinc load tons/yr
WEST BASIN											
Round Pond/Slater	27.99	5.16	1.46	11.49	9.88	5.98	21.37	2775	6.23	1.79	22
Remainder West Basin (using Thornell)	280.54							22613	22.15	1.70	98
Total West Basin	308.53							25388	28.38	3.49	119
GENESEE BASIN											
Lower Genesee Urbanized area (Monroe Co.)	94.38	8.96	4.31	11.7	69.41	12.01	12.72	2886	7.51	1.44	54
Lower Genesee Geneseo to Charlotte minus urbanized area (using Thornell)	949							76496	74.92	5.76	331
Total Geneseo to Charlotte	1043							79382	82	7.19	385
Genesee Mouth below Charlotte docks	5.44	1.49	2.77	0.54	0.64	1.63	29.93	1727	3.35	1.44	5.65
Total Geneseo to mouth	1049							81109	85.79	8.63	390.59
CENTRAL BASIN											
Irondequoit Basin (NURP est.-see p.26)	175							19030	20.24	3.58	88
Mill/4-mile/ Shipbuilders Creeks	44.53	3.65	0	2.167	38.713	4.32	9.71	904	2.48	0.41	22.81
Durand area	7.64	0.33	0.95	3.26	3.1	1.43	18.68	525	1.24	0.31	5.36
Total Central Basin	227.17							20459	23.95	4.30	116

C1 = Commercial/industrial/multifamily land use, assumed to be 40% impervious
H2 = High density residential land use, assumed to be 31% impervious
M3 = Medium density residential land use, assumed to be 25% impervious
L4 = Low density/rural land use, assumed to be 6% impervious

Chapter 6
Summary of Linkages Between Impaired Uses, Pollutants Causing Impaired Uses, and Sources of Pollutants and Remaining Questions

This chapter was prepared primarily with information that is detailed in chapters 4 and 5 of the Stage I RAP. The purpose of this chapter is to summarize the linkages and remaining questions in a relatively easy to read format. For more detailed information on why the use impairments have been designated, see chapter 4. For information on the known or possible sources of pollutants, see chapter 5.

A. Summary of Linkages Between Impaired Uses, Pollutants Causing Impaired Uses, and Sources of Pollutants:

1. The following chart is a summary of the water quality problems, their sources, and the pollutants causing the problems.

ROCHESTER EMBAYMENT
USE IMPAIRMENTS, CAUSES AND SOURCES

INDICATOR (USE IMPAIRMENT)	LOCATION G. River	LOCATION L. O./Embmt.	CAUSES (Known)	CAUSES (Possible)	SOURCES[1] (Known)	SOURCES (Possible)[2]
Restrictions on fish and wildlife consumption	Yes	Yes	PCB		Atmospheric deposition Electrical equipment still in use Junkyards Landfills, dumps Recycling through sediments, water, air	Electrical equipment in storage
			Mirex		Niagara River area Oswego area	
			Dioxin		Atmospheric deposition/ Incineration Niagara River area	
			Chlordane (Irondequoit Bay)		Past agricultural and residential use	
Tainting of fish and wildlife flavor	Unknown	Unknown		Phenols		Atmospheric deposition. Industrial and Municipal wastewater
Degradation of fish and wildlife populations	Yes (for mink; unknown for other species)	Yes (for mink; unknown for other species)		PCB	Atmospheric deposition Electrical equipment still in use Junkyards Landfills, dumps Recycling through sediments, water, air	Electrical equipment in storage
				Mercury		Atmospheric deposition
Fish tumors or other deformities	Unknown	Unknown		PAHs in sediments		Ash fill Asphalt runoff Coal tar Atmospheric deposition Petroleum product spills
Bird or animal deformities or reproductive Problems	Yes (mink)	Yes (mink)		PCB (see Degradation of fish & wildlife populations)		
Degradation of benthos	Yes	Unknown	Oxygen depletion		CSOs and other past discharges (lasting effects in sed.)3 IndustrialWastewater Stormwater	
				Copper	Nonpt. sources Industrial and Municipal Wastewater	
				Iron	Nonpt. sources Landfill dumps	
				Nickel	Nonpt. sources Industrial and Municipal Wastewater	
				Silver	Kodak	

NOTES:

[1]SOURCES (known) lists known sources of the pollutants in question, but does not attempt to prioritize the importance of those sources. The relative magnitude of the sources can be determined for some pollutants but not for others. A more complete discussion of this is included in Chapter 5. When a particular point source is listed (e.g. Kodak), it appears from preliminary calculations to account for most of the loading other than that accounted for by nonpoint sources. Other point sources that appear to contribute a very small percentage of the total loading are not listed. Treatment plants discharging to the lake are not listed here, since their effluent is discharged where it is designed to have a minimal effect on the embayment.

[2]SOURCES (Possible) includes those sources that have already been identified as possible contributors to the impairments listed. Others may be identified as a result of further study.

[3]Combined Sewer Overflows (CSOs) are listed as sources of pollutants in several categories, even though the CSOAP program has now diverted most of the combined sewage to the Van Lare treatment plant and future overflows are expected to be rare. The reason CSOs are listed is that the impairments have been identified based on data collected during the past several years, when CSOs were a contributing factor. Some impairments may diminish in the future due to the CSOAP program. But of necessity, the table reflects information from the recent past. Data on operation of the CSOAP system will be collected in accordance with permit requirements and for review and analysis.

INDICATOR (USE IMPAIRMENT)	LOCATION G. River	LOCATION L. O./Embmt.	CAUSES (Known)	CAUSES (Possible)	SOURCES (Known)	SOURCES (Possible)
Degradation of benthos (cont'd)				PCB	Atmospheric deposition Electrical equipment still in use Junkyards Landfills, dumps Recycling through sediments, water, air	Electrical equipment in storage
Restrictions on dredging activities	Yes	No	Oxygen depletion		CSOs and other past discharges (lasting effects in sed.)[3] Industrial wastewater Stormwater	
			Fecal coliform		CSOs[3] Stormwater	
			Ammonia		Stormwater Wastewater	
			Turbidity (sediment)		Agricultural runoff Construction sites CSOs[3] Dredging Natural causes Streambank erosion Urban stormwater	
Eutrophication or undesirable algae	N/A[4]	Yes	Excess nutrients (phosphorus)		Agricultural runoff Atmospheric deposition CSOs[3] Dredge spoil On-site waste disposal systems Municipal and Industrial Wastewater effluent Urban stormwater	
Drinking water taste and odor problems	N/A[5]	Yes	Algae (phosphorus)		Agricultural runoff Atmospheric deposition CSOs[3] Dredge spoil On-site waste disposal systems Municipal and Industrial Wastewater effluent Urban stormwater	
			Turbidity and temperature changes		Weather conditions	

NOTES:

[3]Combined Sewer Overflows (CSOs) are listed as sources of pollutants in several categories, even though the CSOAP program has now diverted most of the combined sewage to the Van Lare treatment plant and future overflows are expected to be rare. The reason CSOs are listed is that the impairments have been identified based on data collected during the past several years, when CSOs were a contributing factor. Some impairments may diminish in the future due to the CSOAP program. But of necessity, the table reflects information from the recent past. Data on operation of the CSOAP system will be collected in accordance with permit requirements and for review and analysis.

[4]This impairment is not applicable in the Genesee River because flowing rivers are not subject to the process of eutrophication.

[5]The Lower Genesee River is not used as a source of drinking water.

INDICATOR (USE IMPAIRMENT)	LOCATION G. River	LOCATION L.O./Embmt.	CAUSES (Known)	CAUSES (Possible)	SOURCES (Known)	SOURCES (Possible)
Beach closings	N/A[4]	Yes	Algae (phosphorus)		Agricultural runoff Atmospheric deposition On-site waste disposal systems Municipal and Industrial Wastewater effluent CSOs[3] Dredge Spoil Urban stormwater	
			Fecal coliform		CSOs and stormwater (Genesee River)[3] Decomposing algae (see above) Dredging (distributes bacteria from sediments) Sewer cross-connections Stormwater runoff (West Sub-basin)	
			Turbidity (sediment)		Agricultural runoff Construction sites CSOs[3] Dredging Natural causes Streambank erosion Urban stormwater	
Degradation of aesthetics	Yes	Yes	Algae (phosphorus)		Agricultural runoff Atmospheric deposition CSOs[3] Municipal and Industrial Wastewater On-site waste disposal systems Dredge Spoil Urban stormwater	
			Turbidity (sediment)		Agricultural runoff Construction sites CSOs[3] Dredging Natural causes Streambank erosion Urban stormwater	

NOTES:

[3]Combined Sewer Overflows (CSOs) are listed as sources of pollutants in several categories, even though the CSOAP program has now diverted most of the combined sewage to the Van Lare treatment plant and future overflows are expected to be rare. The reason CSOs are listed is that the impairments have been identified based on data collected during the past several years, when CSOs were a contributing factor. Some impairments may diminish in the future due to the CSOAP program. But of necessity, the table reflects information from the recent past. Data on operation of the CSOAP system will be collected in accordance with permit requirements and for review and analysis.

[4]There are no beaches on the Lower Genesee River.

INDICATOR (USE IMPAIRMENT)	LOCATION G. River	LOCATION L.O./Embmt.	CAUSES (Known)	CAUSES (Possible)	SOURCES (Known)	SOURCES (Possible)
Degradation of Aesthetics (continued)			Litter		CSOs[3] Dredging Littering Storm sewers	
			Dead fish below Lower Falls		Natural die-off Fish cleaning	
			Chemical seeps at Lower Falls			Creosote from beams in RG&E tunnel Buried tank from old furniture factory or other industrial use Former dump in gully
Added costs to agriculture or industry	Yes	Yes	Zebra Mussels		Exotic species	
				Turbidity		Weather
Degradation of phytoplankton and zooplankton populations	Yes	Unknown		Eutrophication (excess nutrients)	Agricultural runoff Atmospheric deposition CSOs[3] On-site waste disposal systems Municipal and Industrial Wastewater Urban stormwater	
				Predation		Zebra mussels
				Phenols		
Loss of fish and wildlife habitat	Yes	Yes	Filling/draining of wetlands		Development near shorelines	
			Removal of riparian vegetation		Development near shorelines	
			Sedimentation		Natural causes Urban stormwater Agricultural runoff Streambank erosion	
				Rough water conditions		Boat traffic in Braddock Bay may disturb tern nests.

6/93

B. Summary of Remaining Questions

The following chart summarizes the data gaps and research needs required to make complete assessments of some impairments or pollutant sources. This chart concludes Stage I of the Rochester Embayment Remedial Action Plan. Stage II will outline the specific remedial actions that need to be taken to improve water quality conditions and restore beneficial uses determined to be impaired in the Stage I RAP.

	Use Impairment	Data Gaps/ Research Needs	Ongoing Studies	Chapter
1.	Added costs to agriculture or industry	Effect of zebra mussels on both water quality and the food chain.	None	3
2.	Degraded fish and wildlife populations	Baseline data assessing the abundance and condition of native species within the AOC.	None	3
3.	Degraded fish and wildlife populations.	"Fishless" segment of the lower Genesee River. What is the extent, location, and timing of this segment?	NYSDEC study in 1992-1993	4
4.	Degradation of Benthos	Whether the Lake Ontario portion of the embayment suffers from degradation of benthos.	None since 1976	4
5.	Degradation of Benthos	More specific tests in order to determine exact relationship between contaminants in Genesee River and Benthic community.	None	4
6.	Degraded fish and wildlife populations	Impact of zebra mussels on zooplankton and phyto-plankton populations.	None	4
7.	Loss of fish and wildlife habitat	Whether toxins or boat traffic are responsible for decline of black term populations in Braddock Bay.	None	4

	Use Impairment	Data Gaps/ Research Needs	Ongoing Studies	Chapter
8.	Tainting of fish and wildlife flavor	Whether fish in the AOC have a chemical odor.	1992 DEC survey of the Genesee River	4
9.	Fish tumors or other deformities	An investigation into liver tumors is needed.	None	4
10.	Degradation of aesthetics	Source of the foaming in Sandy Creek.	None	4
11.		An explanation for the discrepancy in atmospheric deposition among testing sites.	None	5
12.		Additional study should be conducted to validate the phosphorus loadings of the Genesee River and treatment plants.	None	5
13.		An estimation of cadmium loading from vehicle tires.	None	5
14.		Air loading data for cyanide.	None	5

NEXT STEPS:

These remaining data gaps will be considered in the development of the Stage II RAP, along with an analysis of remedial measures that will be considered for implementation to remediate the impaired uses identified in chapter 4.

The Stage II RAP preparation has already begun and is expected to be complete by the end of 1993.

APPENDIX A
Responsiveness Summary
In Response to Comments made on the Draft Stage I Rochester Embayment Remedial Action Plan

ROCHESTER EMBAYMENT REMEDIAL ACTION PLAN, STAGE I
RESPONSIVENESS SUMMARY
7-23-93

This responsiveness summary has been prepared to document and respond to questions and comments made regarding the Draft Stage I Rochester Embayment Remedial Action Plan that was distributed and commented on during January and February of 1993. Four meetings were held in January of 1993 on the Draft Stage I RAP. In addition, some individuals wrote letters with comments.

The responsiveness summary is organized into categories as follow:

1. Executive Summary, Introduction, Environmental Setting, and Project Administration Issues.
2. Goals
3. Use Impairments/Existing Conditions/Problems
4. Pollutants and Pollutant Sources
5. Waste Site Pollutant Sources
6. Public Involvement in RAP Development and Implementation
7. Drinking Water System Issues
8. Education
9. Comments Regarding Remedial Measures and the Stage II RAP

Comments or questions are labeled with a "C" and answers with an "A". In each case where the name of the commentor is known, their name is included after the written comment.

1. EXECUTIVE SUMMARY, INTRODUCTION, ENVIRONMENTAL SETTING, AND PROJECT ADMINISTRATION ISSUES

C.1: Can we get copies of the information presented in the slide show? (Judy Braiman)

A1: Information provided in the slide show at the public meetings is included in the Executive summary of the RAP. If you would like copies of the word slides used at the public meeting, they are available upon request.

C2: I am skeptical of this project because I don't know who funded the research.

A2: Funding for the development of the RAP came from two sources: federal grant funds made available under section 205(j) of the Clean Water Act, and from Monroe County.

C3: Is Canada included in this study? (Ed Murawski)

A3: Canada is also preparing Remedial Action Plans for Areas of Concern in that country. Canada is not directly involved in the development of the Rochester Embayment RAP, but Canada will review and comment on our final products (Stage I and Stage II RAP) through their participation on the International Joint Commission.

C.4: I was surprised that the executive summary has so little usable information. It is ludicrous to call this a summary of all the findings of the study, because there is not much which can be used in order to make concrete decisions. I would suggest that this be revised to include more information. (Bill Bayer) After reading the full Stage I report , I believe is not properly reflected in the Executive Summary, nor was it in the public presentation. (Diane Heminway)

A4. The Executive Summary is not a summary of all of the findings of the study. Instead, it provides highlights from the full Stage I RAP. In order to summarize all of the findings, the Executive Summary would be much larger. It is the belief of the technical staff and the advisory committee that it is more important for the document to be short so that the likelihood of people reading it will be greater. In response to the concern raised, we have included information in the final Stage I RAP Executive Summary about how the full Stage I RAP can be obtained.

C5. Are other areas in the country preparing Remedial Action Plans, or is this something that is only being done in the Great Lakes area? (Dennis Pellitier)

A5 There are other areas in the country who are doing basinwide water quality planning to clean up a water resource. One example is the Chesapeake Bay. Other efforts are not called Remedial Action Plans, however.

C6. The narrative definition of the Rochester Embayment on page 4 of the Executive Summary is inconsistent with the Figure 2 map that shows the western bound of the embayment as Bogus Point. This same comment holds true for the full Stage I. Figure 4 of the Executive Summary should have Bogus Point and Braddock Point added to it. (Paul Sawyko)

A6. We have changed the narrative of the Embayment definition so that Bogus Point is the western boundary of the Embayment in both the Executive Summary and the full Stage I document. Figure 4 of the Executive Summary, and Figure 2-3 has also been amended to include Bogus Point.

C7. The references to Basins and Sub-basins on the top of page 7 of the Executive summary seem to be used interchangeably and are confusing. The difference between these two terms needs to be clarified.

A7. The paragraph has been amended to make this more clear.

C8. Executive summary: At the bottom of page 11, under planning/regulating jurisdictions, we mention Monroe County and the City of Rochester. Should other counties and cities be mentioned here as well? This comment would hold true for the full Stage I as well. (Paul Sawyko)

A8: Yes. This paragraph has been changed to be less specific.

C9. Executive summary: Page 16 section IVB1(1): One option for change would be to eliminate the detailed information about the fish consumption advisory, and instead just note that there is a fish consumption advisory for Lake Ontario. (Paul Sawyko)

A9: Because many of the comments at the public meetings referred to the lack of information in the Executive Summary, we have chosen not to omit this. Without the specific fish consumption information included, the impairment loses meaning to people.

C10. The glossary describes Cladophora as a nuisance algae. We recommend that the definition be changed to read: *Cladophora--An algae, commonly known as "maiden's hair", which provides shelter and breeding habitat for many aquatic invertebrates..* (Industrial Mgt. Council)

A10. We have changed the definition to read: *Cladophora--A genus of green algae, commonly known as "maidens hair", which provides shelter and breeding habitat for many aquatic invertebrates and in excessive quantities cause unsanitary beach conditions.*

C11. A sentence on page 2-20 reads "However, the New York State Department of Health (DOH) has issued a health advisory on eating salmonids from Lake Ontario because their flesh contains potentially harmful levels of contaminants" may mislead the reader into believing that fish advisories are caused by many contaminants. We recommend the sentence be rewritten as: "However, the New York State Department of Health (DOH) has issued a health advisory on eating salmonids from Lake Ontario because their flesh may contain potentially harmful levels of dioxin, PCBs, pesticides, and mercury." (Industrial Mgt. Council)

A11. The sentence has been changed to read: "However, the New York State Department of Health (DOH) has issued a health advisory on eating salmonids from Lake Ontario because their flesh contains potentially harmful levels of <u>some</u> chemical contaminants." An additional sentence has been added at the end of that paragraph to refer the reader to the full information about the fish consumption advisory in chapter 6.

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2. GOALS

C12: One of the recommendations from the International Joint Commission was zero discharge of toxic chemicals, and I am curious if those people who work on the RAP also support that recommendation of zero discharge especially of persistent toxics. (Diane Heminway)

A12: Our stakeholders group, the Water Quality Management Advisory Committee, developed local goals and objectives for the RAP. During the development of the goals and objectives both before and after the publishing of the Draft Stage I RAP, the issue of zero discharge was debated at length. After much deliberation, one goal and several objectives developed by the Committee refer to "virtual elimination" or "elimination". One goal is "Virtual elimination of toxic substances which cause fish consumption advisories." An objective under that goal is "Scheduled elimination of the releases and runoff of persistent toxic substances that necessitate health advisories for the Rochester Embayment of Lake Ontario". Another objective is "Scheduled elimination of discharges of chemicals that contaminate sediments and harm aquatic life." The word "scheduled elimination" is used several other times throughout the goals and objectives which can be found in Chapter 3 of the final Stage I RAP.

C13. Three of the ten goals are related to problems that originate outside of the Rochester Embayment. The issues include fish, exotic species, and plants. How can we make sure that there is a coordinated effort so that we are not trying to accomplish something that is not accomplishable? (Larry Stid.) Since a major source of pollutants seems to be atmospheric, does our plan overlap with areas where there are some pollution concerns, i.e. the Ohio Valley? (Tom Low).

A13: There are several actions being taken in addition to our RAP to address the fish consumption advisory causes. For example, RAPs are being prepared in 42 other areas of concern in the Great Lakes. The actions to be implemented in these areas will contribute to remediating the problem. One objective we have stated in our RAP is to get a formal system in place to mandate the coordination of RAP jurisdictions. Also, the implementation actions of the already completed Lake Ontario Toxics Management Plan will help address the fish consumption problem. Those involved in that plan include the U.S. Environmental Protection Agency, Environment Canada, the New York State Department of Environmental Conservation, and the Ontario Ministry of the

Environment.

With regards to exotic species, the zebra mussel is the species of current concern in the Great Lakes. There is no realistic means of control of the proliferation of zebra mussels in the lakes. They will continue to spread and eventually reach a stable number. Local users of Lake Ontario are coping with the mussels by : 1) chlorination of service lines (by a restricted permit only), 2) use of hot water in pipes, 3) use of a molluskicide (by permit only), and 4) mechanical scraping of pipes.

Excess cladophora algae, is caused by excess nutrients, (especially phosphorus), to the shore zone of the lake. It will be important to determine, as part of the current development of the Lake Ontario Lakewide Management Plan (LaMP) by the U.S. and Canada, whether or not there is a need to reduce new inputs of phosphorus from all areas of the lake. Monroe County will need to get involved in reviewing the LAMP to insure that this is addressed. Meanwhile, Richard Draper, from New York State Department of Environmental Conservation has agreed to transmit this concern to those who are writing the LaMP.

Regarding atmospheric deposition, it is true that what happens in the airshed outside our jurisdiction is a problem. Our strategy is to deal with atmospheric deposition by treating stormwater runoff through mechanisms such as wetlands before the stormwater is discharged to Irondequoit Bay or Lake Ontario is a recognition of the magnitude of the airshed and limits on local control at the source. State and federal government agencies are now recognizing the need for "multi-media" pollutant regulation that recognizes the interconnection between pollutants on the land, in the water, and in the air. There are other USEPA initiatives stemming from the Clean Air Act Amendments of 1990 that will require an inventory of air sources that are contributing to toxics in the lake.

C14. Full Stage I: Page 3-16, 6th paragraph. The meaning of the sentence: "Now all permitted discharges in NYSDEC Region 8 have been brought into compliance with water quality standards." is unclear. Also in that paragraph, what is meant by "...waters that are above standard."? What standard? Also, are substance bans still a part of the Water Quality Enhancement and Protection Policy? (Chris Rau)

A14. The statement, *"All permitted discharges in NYSDEC Region 8 have been brought into compliance with water quality standards"*, is not clear and has been changed in the final Stage I document as follows: *" All permits for discharges in Region 8 have been written based upon conformity with minimum wastewater treatment requirements and current water quality* *standards (NYSDEC standards are referenced in 'Water Quality Regulations: Surface Water and Groundwater Classifications & Standards, NYCRR Title 6, Ch. X, Parts 700-705')".*

The phrase that in the draft Stage I which was worded, *"...waters that are above standard",* has been changed in the final Stage I to read, *"waters of a higher quality than existing standards".*

The toxic substance bans are a part of the NYSDEC's Water Quality Enhancement and Protection Policy. Some persistent toxic substances are threatening to the environment and the only way to eliminate the release of those substances is to ban the use, manufacture, and storage of them. The NYSDEC will investigate the issue for the purpose of controlling the release of specific toxic substances through substance bans. Also, the statement in that paragraph, " The NYSDEC Division of Water is advancing a Water Quality Enhancement and Protection Policy..." now is a new paragraph to minimize confusion with the previous discussion of discharge permits.

C15. The RAP may have gone beyond the requirements of the Great Lakes Water Quality Agreement as it relates to the RAP process. The draft Stage I RAP inappropriately has as one of its objectives the "virtual elimination of the releases and runoff of persistent toxic substances..." In many other objectives the terms "elimination" and "virtual elimination" appears. Nowhere does the Great Lakes Water Quality Agreement (GLWQA) identify "virtual elimination" or "elimination" as a RAP goal or objective. Rather, the GLWQA has as one of its objectives "...Pending virtual elimination of persistent toxic substances in the Great Lakes System, the Parties...shall identify and work toward the elimination of...critical pollutants pursuant to Annex 2 (the section of the GLWQA dealing with RAPs). The GLWQA also calls for RAPs to "...serve as an important first step toward virtual elimination of persistent toxic substances." There are levels at which pollutants may be present in the environment without causing adverse effects or impairments. This concept is the basis for the Clean Water Act's water quality standards system. Annex II, Subsection (6)(b) of the GLWQA appears to support this concept. "Virtual Elimination" and "elimination" are not appropriate goals for the RAP. Also, the footnote appearing on page 3-11 stages: "*it is recognized that the most effective way to achieve this objective is by dealing with the toxics at the source." This footnote should apply to all objectives relating to pollutant sources. (Industrial Mgt. Council)

A15. The goals and objectives were developed by the Water Quality Management Advisory Committee which had IMC representation on it throughout the RAP process. The WQMAC has considered the new IMC objection to the terms "virtual elimination" and "elimination" in the objectives. As a result, a definition of virtual elimination has been included. It now says: "In the following objectives, virtual elimination" or "elimination" refers to a process that must be negotiated among all affected parties in order to obtain reasonable and achievable results. It is recognized that the most effective way to achieve this objective of virtual elimination is by dealing with the toxics at the source." The first goal of the WQMAC is now "Virtual elimination of toxic substances which cause fish consumption advisories." The first objective under that goal now reads "Scheduled elimination of the releases and runoff of persistent toxic substances that necessitate health advisories for the Rochester Embayment of Lake Ontario."

C16. The first WQMAC objective under the goal of "Shorelines and waterways are free of objectionable materials which degrade water quality and appearance" is "Reduction of Cladophora, zebra mussels, and alewives within the Rochester Embayment to below nuisance levels." The alewife population has already declined and this forage food may have fallen below levels capable of supporting the desired salmon populations in Lake Ontario. To reduce the alewife population further may not be consistent with State policies. (Industrial Management Council)

A16. The objective has been changed to eliminate the words "and alewives".

C17. The second objective under the goal of "Contaminated sediments in the lower Genesee River have no negative impact upon the water quality and biota in the Rochester Embayment; sediment quality is suitable for open lake disposal" currently reads "Scheduled elimination of discharges of chemicals that contaminate sediments and harm aquatic life." It should be noted that there is little evidence to substantiate claims that the sediments in the Genesee River are contaminated <u>and</u> affect aquatic life. (Industrial Mgt. Council)

A17. Information on evidence of impaired uses is included in chapter 4. The evidence that we have on this issue is presented in the section entitled "Degradation of Benthos" in chapter 4. In that section, under the heading "Causes (possible)" there is an acknowledgement that "The presence of elevated levels of contaminants in tissues {of organisms} suggests that pollutants <u>might be</u> adversely affecting the benthic communities, but more specific tests would be needed to determine exact cause and effect relationships." The words "might be" replace the words "are".

C18. The last sentence of the first paragraph in section 2(a) in chapter 3 should be changed to read " The State has set water quality criteria for many toxics. The State has also prepared a nonpoint source strategy." (Industrial Mgt. Council)

A18. This change has been made.

C19. Chapter 3, Section B(2)(b) states, with respect to sediment guidelines that; "In addition, the IJC has identified background levels of 18 substances in several areas of the Great Lakes, including the Rochester basin (Eastern Lake Ontario). There is cause for concern if actual concentrations exceed the background levels." It is unclear whether this statement refers only to the 18 (undefined) substances which the IJC has identified background levels for or to all substances. From a scientific perspective, and to be consistent with the overall goals for the RAP Chapter 1A2 which are correcting existing impairments, prevention of future pollution of the waters and protection of human health, we ask that the Final Stage I RAP state that desired sediment concentrations be tied directly to these three goals and not to "background levels". (Industrial Mgt. Council)

A19. The reference in chapter 3 has been changed to be more clear as follows: "In addition, the IJC has identified background levels of 18 substances in sediments in the Great Lakes. That includes data on 10 substances (2 nutrients, 7 metals, and volatile solids) in the Rochester basin of Lake Ontario. The IJC Surveillance Work Group recognizes that additional work is necessary to quantify background levels of pollutants in the basins where no data currently exists. The Work Group suggests that sediment with concentrations less than or equal to background levels is acceptable." The goal that has been established by the WQMAC for sediments is that "Contaminated sediments in the lower Genesee River have no negative impact upon the water quality and biota in the Rochester Embayment; sediment quality is suitable for open lake disposal." This is contained in Chapter 3.

C20. In chapter 3, section 2(c) 1, under the section entitled Ecosystem Objectives, it states that one recommended ecosystem objective made by the Ecosystem Objectives Subcommittee is "Aquatic communities: The waters of Lake Ontario shall support diverse, healthy, reproducing and self-sustaining communities in dynamic equilibrium, with an emphasis on native species." This objective contrasts with the objective of some Rochester Embayment users as well as many state game management programs that the lakes sustain recreational and commercial fisheries. Coho and Chinook salmon are not native to Lake Ontario, and may not be self-sustaining at population densities desired by fishermen. The phrase "emphasis on native species" needs to be reconsidered. All ecological communities are dynamic. "Dynamic equilibrium" may not be a useful phrase for this objective. Certainly any community, impacted or not, will be at some kind of dynamic equilibrium. To the extent that the term "reproducing" is repetitive of "self-sustaining," it adds little to the objective. It does not occur in the wildlife objective. Many of the ecosystem objectives contain the verb "shall" implying that the objectives are mandatory. Neither Articles III or IV of the

GLWQA nor Annex II (specifically relating to RAPs) include a list of "mandatory objectives. Rather, Article III expressly indicates that "these waters should be free from substances..." Use of mandatory terms goes beyond the GLWQA and may prohibit the use of cost-effective approaches to remediating the Rochester Embayment. As noted in the USEPA's "Framework for Ecological Risk Assessment" (1992), the relationship of the indicators to the objective must be considered before adopting the indicators. Unless the indicator clearly reflects changes in the objective, it is not useful. Thus, changes in residue levels in fish might be useful as an indicator for evaluating human health objectives or wildlife objectives, but would not necessarily show that an aquatic community ecosystem objective was attained (unless better associations between body burdens and ecological function are developed). The RAP should identify usable indicators of achieving the ecosystem objectives and it should be an integral part of the objective development. Aquatic ecosystems have several basic functions. They convert sunlight to produce organic compounds, take up phosphorus, nitrogen, silicates, etc. and incorporate them into organic compounds (i.e. ecochemical cycles), and they provide food for aquatic and terrestrial communities. They also degrade compounds, both biotic and xenobiotic, demonstrating what is described as assimilative capacity. The challenge is to incorporate these functions into objectives. Thus, we recommend the following ecosystem objective for aquatic communities: *The waters of Lake Ontario should support diverse and self-sustaining communities capable of significant primary and secondary productivity. Populations of native species are to be encouraged. Management practices should optimize commercial and recreational uses of aquatic populations such as fish.* Controlling critical pollutants will not in and of itself solve the Embayment's use impairment problems. Habitat destruction, exotic species, and over fishing may be of equal or greater significance in the destabilization of the Embayment's ecosystem. (USEPA's Great Lakes Five Year Strategy). The RAP should state more clearly that the identified Genesee River and Lake Ontario Ecosystem objectives and goals cannot be met solely through implementation of the RAP. (Industrial Mgt. Council)

A20: The objectives in this section are ones recommended by a subcommittee of the IJC. Your concerns about the wording of these objectives will be relayed to the IJC and the NYSDEC for consideration through the submittal of this responsiveness summary to them as with the Stage I RAP. One of the goals of the WQMAC is "Diversity of plant and animal communities within the Rochester Embayment." An objective is "Self-sustaining populations of walleye, lake trout, Hexagenia (fly larvae) and fish eating birds and mammals (ospreys, mink, eagles)." Regarding your concern that the term "reproducing" is repetitive of "self-sustaining," we disagree. Reproduction can occur with a reproduction rate low enough that the population is not sustainable. The Stage I RAP recognizes that Lake Ontario Ecosystem objectives and goals cannot be met solely through the implementation of the RAP. This will be reiterated in the development of the Stage II RAP which will outline implementation measures to be conducted in the Rochester Embayment.

C21. The chronic value for silver listed in Table 3-3 as 0.12 µg/l is incorrect and should not be used. As of this date, USEPA has not issued a chronic water quality criterion for silver. Also, the acute value of 4.1 µg/L applies to water with a hardness of 100 mg/L (as CaCO3). We recommend the deletion of the chronic value of 0.12 µg/L for silver and the addition of ** after the acute value of 4.1 µg/L. We also recommend the footnote ** be changed to read: *"**Hardness-dependent; value assumes 100 mg/l hardness. The value of the criterion increases as the hardness of the water increases."* (Industrial Management Council)

A21. These changes have been made. The note also includes the value of Lake Ontario hardness-- 120 mg/L.

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3. USE IMPAIRMENTS/EXISTING CONDITIONS/PROBLEMS

C.22: You have defined four major chemical pollutants that necessitate fish consumption advisories. Is there a study being done on how to deal with eliminating these? (Dave Miller) C.32 An EPA study shows that even though industrial pollution has been monitored and reduced, stormwater runoff is a major concern because it carries pesticides that impact the fish. (Orlean Thompson)

A22. The four pollutants that necessitate the fish consumption advisories , the sources, and what is being done to deal with eliminating them are briefly outlined below: 1. Polychlorinated Biphenyls (PCBs) may come from some dumps, in-use electrical equipment, and cycling exchanges between sediments, water, and air. PCBs have been banned in any new uses, but are still in use in older electrical equipment much of which is the subject of an ongoing removal program. Some landfills known to have PCBs are being remediated. 2. Mirex was used as a pesticide in the south, especially against fire ants, but not in this area. It was manufactured in the Niagara Falls area and has also been found in the Oswego River area where it was used in a product manufactured in Fulton. The use of mirex has been banned in the United States. 3. The principal sources of dioxin are two dumps from the Niagara Falls area. (Dioxin was probably released as a by-product by a manufacturing process on the Niagara River that has now been discontinued.) There is an effort to remediate landfills in the Niagara Falls area that are leaking mirex and dioxin. No source of mirex has been found in the Rochester Embayment. Sources of dioxin may exist locally from the combustion process. 4. Chlordane, an insecticide now banned from use, was once in widespread use and may still contribute to stormwater contamination. A Lake Ontario Toxics Management Plan has been prepared that includes actions that need to be taken to help address these pollutants that are a lakewide problem. In addition, a Lake Ontario Management Plan (LaMP) is being prepared that will also address this issue by identifying a binational load reduction strategy to reduce inputs of critical pollutants contributing to lakewide problems such as fish consumption advisories.

C23: The DEC says you can eat the fish, and the Health Department says you cannot. Do you expect people to take such written information on fishing trips? Some people have been advised to eat more fish in their diet because of certain benefits to health and many poor people eat fish because it is affordable. Articles are published in the paper about how to fillet the fish so that you minimize contamination. We are getting mixed signals. For people who eat the fish for sustenance because of its affordability, there should be an opportunity to obtain uncontaminated fish.(Mr. Frank, John Schoth, Susan Sarini, Dick Streeter)

A23. The New York State Department of Health issues advice yearly about eating sportfish and wildlife taken waters of New York State (including Lake Ontario). The Health Department issues the advisory because some of these foods contain potentially harmful levels of chemical contaminants. The advisory is a recommendation rather than a mandate.

The New York State Department of Environmental Conservation prints the Health Department advisory in the annual edition of the Fishing Regulations Guide, received by those who buy fishing licenses.

For those individuals who decide to eat fish, information is available from both the New York State Departments of Health and Environmental Conservation on methods to prepare the fish in order to minimize contaminant intake. The State Health Department, in its written advisory, recognizes the health benefits of eating fish, but notes that fish with high contaminant levels should be avoided. The advisory suggests that when deciding whether or not to eat fish which may be contaminated, individuals should weigh the health benefits of eating fish against the health risks. The Health Department notes that, "For young women, eating contaminated fish is a health concern not only for herself but also to any unborn or nursing child, since the chemicals may reach the fetus and can be passed on in breastmilk. For an older person with heart disease, the risks, especially of long term health effects, may not be as great a concern when compared to the benefits of reducing the risks of heart disease." For your own copy of the 1993-

94 Health Advisories: Chemicals in Sportfish or Game, contact the NYSDOH at 1-800-458-1158.

The Monroe County Water Quality Management Advisory Committee has also prepared a smaller pamphlet on the fish consumption advisory that could be used by individuals. This pamphlet will be targeted specifically to cultural and socio-economic groups that depend on fish for sustenance. There are also many species and sizes of fish that can be caught in Lake Ontario that are less contaminated, and therefore have a less restrictive advisory to eat no more than one meal per week. However, it is recommended that women of childbearing age and children under the age of fifteen eat no fish from Lake Ontario.

C24: Some months ago I attended a presentation by the Monroe County Health Department regarding the health study done near Kodak, and one of the things they did not look at was brain tumors. We need to look for things which **are** causing problems and not things which **might** cause problems.

A24. The presentation by the Health Department was regarding the Disease and Symptom Prevalence Study done near Kodak Park. That particular study did not deal directly with cancer. However, a cancer incidence study was done by the New York State Department of Health in the Kodak Park area and it was found that the incidence of brain cancer was not elevated. This study was released to the public in 1991.

C25. When you looked at the list of 14 possible use impairments identified by the International Joint Commission, you found that there was not enough information available to determine whether or not two use impairments exist in the Rochester Embayment (the two impairments are tainting of fish and wildlife flavor, and fish tumors or other deformities). Will there be any local effort, or funding, to find out if these impairments exist? Garry Schmitt.

A25. In preparation of the RAP, we looked at the list of 14 use impairments identified by the International Joint Commission to see whether we know or suspect the impairments to be a problem in the Rochester Embayment. We answered these questions as best as possible with existing information. In many cases we did find known problems and known sources and in some cases we did not have enough data to determine whether or not we had a problem, or what the cause of the problem was. In the two cases where we could not determine whether or not we have use impairments, we are considering what actions need to be taken to determine whether we have the impairments. Any research actions deemed important will then be recommended for implementation in the Stage II RAP.

C26. In the Exec. Summary and the full Stage I RAP (Exec. Sum Page 24, item 3), it is stated that the cause for degradation of benthos is unknown; however, earlier in the text one known cause is listed as oxygen depletion. (Paul Sawyko)

A26. This has been amended to recognize that some but not all causes for the degradation of benthos is known

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C.27: Are there any hard facts on the levels of pollution and why are these facts not in the executive summary? (Barbara Clark)

A27. Chapter 4 of the Stage I RAP includes extensive information on the current levels of pollution. Portions of this information is included in the Executive Summary in the form of the status of the use impairments. Members of the RAP Technical Group and Advisory Groups felt that more detailed information on current conditions was not easily extractable for inclusion in the Executive Summary.

C.28: Is there a definition of the word Embayment? (Peter Smith)

A28. For purposes of the Rochester Embayment RAP, the definition of the Embayment is "...the area of Lake Ontario formed by the indentation of the Monroe County Shoreline between Bogus Point in the Town of Greece and Nine Mile Point in the Town of Webster, both in Monroe County. The northern boundary is the straight line between these two points. The southern boundary of the embayment also includes approximately six miles of the Genesee River that are influenced by lake levels from the river's mouth to the Lower Falls." Maps showing the embayment are included in chapter 2 of the Stage I RAP, and in the Executive summary.

C.29: Is the Embayment given a higher priority for monitoring than the watershed? (Peter Smith)

A29. The EPA, US Geological Survey, NYSDEC, and local Health Department all monitor at locations that they feel are appropriate. In many cases monitoring is of higher priority in the watersheds because that is the source of many pollutants.

C.30: You are probably familiar with the Leggett Report. Has a good comprehensive ground water quality study been done? Also, have you looked at mapping the watershed in terms of land use with GIS? (Peter

Smith)

A30. The Monroe County Health Department is familiar with the 1935 Leggett Report which inventories many of the groundwater wells in existance at that time and provides limited information on groundwater quality in Monroe County. The Monroe County Health Department also has a great deal of data on groundwater quality. While a recent comprehensive groundwater study has not been prepared for all of the watersheds tributary to the Rochester Embayment, Dr. Richard Young from S.U.N.Y. Geneseo is reviewing groundwater data needs. Monroe County is in the process of implementing a computerized Geographic Information System (GIS) to map county watersheds and land use. The maps prepared by Dr. Richard Young are being incorporated into this system. Monroe County has a working relationship with the U.S. Geological Survey (USGS) who has a GIS system capable of such work. The County currently has a joint agreement with the USGS to provide such information in the East Branch of Allens Creek watershed. It should also be noted that several other counties have GIS systems. As part of the Stage II RAP, where remedial measures will be considered, the application of a GIS system will be integrated, and used as a tool to create a relational geographic database.

C.31: Can anyone respond to a question on the solubility of heavy metals, lead, mercury and its potential impact in the environment on fish and wildlife? (Diane Heminway)

A31. Certain forms of lead and mercury are soluble. For example, methyl mercury and tetrethyl lead are soluble, while many other forms of these metals have limited solubility. These soluble forms of the metals can enter the tissue of fish and wildlife through the food chain and cause various kinds and degrees of health problems in fish and wildlife.

C32. We use a gas liquid chromatograph to test fish that we process into animal feed from the Lake Ontario system, and found no PCB's, DDT or Mirex this past year. (Bill Stappenbeck)

A32. The datareferred to, including information on the detection limit of the equipment used to analyze the fish, would be very helpful information to include in the RAP.

C33. Full Stage I: Page 3-27. This map shows the wrong location for the Water Authority intake pipe. (Paul Sawyko)

A33. This has been corrected.

C34. Full Stage I: Page 4-41: Table 4-12 is titled "Priority Toxic Pollutants in Water of Embayment." The use of the word "priority" needs to be considered carefully. It needs to be clear whose "priority" it is. Perhaps the word "priority" should be dropped from the title. (Chris Rau)

A34. The word "priority" has been removed from the title.

C35: Was the contribution of groundwater to surface waters considered as part of the study? (Steve Trojanczyk)

A35. A considerable amount of information about groundwater is available in the Irondequoit Basin. On a basinwide scale, the groundwater contribution can be reasonably estimated by using the base flow of rivers (base flow means low flow in rivers after a long period of no rain). This was not, however, done as part of the development of the Stage I RAP.

C36. Chapter 4 may present a major misimpression to most readers that the Embayment is impaired in 12 out of 14 possible categories without any attempt being made to highlight the common causes, such as the buildup of pesticides and PCBs in fish tissue (impairments 3, 4 and 5), the presence of BOD exerting substances (impairments 6 and 7) and the presence of elevated nutrients (ammonia and phosphorus) (impairments 7,8,9,10 and 11). The existence of these common causes strongly suggests that addressing these causes first would yield the greatest benefits, in terms of reducing the number of identified impairments. Most of the data in Chapter 4 (Water Quality Conditions/Problems) was collected more than ten years ago. Most of the analyses of sediments for PCBs were performed in 1981 (Table 4-2). Analyses of toxic substances in fish (Table 4-3) were performed between 1981 and 1984. If the RAP restricts itself to analyses performed within the last few years, the measured concentrations of chemicals in water and sediments would typically be lower than those previously reported. In table 4-5 (Bulk Sediment Analysis: Metals and Cyanide) the concentrations measured during 1985 and earlier are almost always higher than the corresponding 1990 values. This improvement is consistent with the information provided on dredging activities. Prior to 1992, restrictions were in place to prohibit overflow dredging. In 1990 sediment analysis showed most chemicals in the sediment were in the "nonpolluted" or "moderately polluted" range. A few fell in the "heavily polluted " range. Since 1992, sediments from the Genesee River are deemed suitable for open lake disposal. There is ample evidence that the presence of chemicals, particularly metals, in the Embayment sediments has decreased during the past few years. Much of the data is old and may not provide an accurate picture of the current situation in the Rochester

Embayment. Using historical data to determine impairment will lead to incorrect conclusions. As such, before conclusions are established in the final Stage I RAP, good information (data) and good science are necessary inputs to this process. (Industrial Mgt. Council).

A36. A sentence has been added to chapter 4, paragraph 1c to acknowledge some of the pollutants that cause more than one impairment. It states: *"Table 4-1 shows that 12 of the 14 use impairments exist in the Area of concern. Some common causes include build-up of PCBs in fish tissue, the presence of biological oxygen demanding substances, and an overabundance of sediments and the nutrient phosphorus."* In finalizing table 5-2 (High Priority Pollutants) during the development of the Stage II RAP, the linkage to multiple use impairments will be considered. It is true that much of the data in chapter 4 is not recent. We feel it is important to include this information to show that trends indicate a general improvement in sediment and water quality. The 1985 205(j) study of Genesee River Sediments, lead by the Monroe County Environmental Health Laboratory, made specific recommendations for follow-up analysis to extend trend data. The importance of this recommendation will be considered as part of the RAP Stage II Development as well.

It should be noted that restrictions to prohibit overflow dredging were in place both before and after 1992 and that the sediments were deemed suitable for open lake disposal both before and after 1992. The restrictions on overflow dredging were not due to designation of sediments as nonpolluted, moderately, or heavily polluted. The reason for restrictions on overflow dredging are to reduce the release of toxic chemicals to the river (e.g. ammonia, which is toxic to fish), to reduce incidents of increased oxygen consumption in the river, and to reduce the impact of resuspended sediments and fecal coliform on the swimming beach. Even if the sediments are cleaned up, it is expected that overflow dredging restrictions will continue to reduce the impact of resuspended sediments and fecal coliform on the swimming beach.

Further data is important and will be considered for implementation projects as part of the Stage II RAP.

C37: Under the possible causes section of the Degradation of Benthos impairment, the last sentence reads: "The presence of elevated levels of contaminants in tissues suggests that pollutants are adversely affecting the benthic communities, but more specific tests would be needed to determine exact cause and effect relationships." This may lead the reader to believe that conclusions have already been made with regard to contaminants adversely affecting benthic communities. The only information that is used to associate metals with the impairment of benthos is the presence of elevated concentrations of the metals copper, iron, nickel and silver in benthic organisms. The presence of these elements in the organisms does not necessarily indicate a problem. Copper and iron are essential nutrients. Some concentrations can be regulated and perhaps utilized beneficially by the organisms. Nickel and silver are not essential elements, but they are ubiquitous in the environment and are present in varying amounts in most organisms. Comparing the data in the Appendix Table 2, page B2, for copper and iron to the data in Table 3, page B-9, the present concentrations of copper and iron in Embayment sediments are less than pre-industrial concentrations in Great Lakes sediments. There is no evidence that the organisms in the Embayment benthos have accumulated detrimental amounts of these or any other elements. It is just as likely, if not more so, that COD, manganese, phosphorus and total Kjeldahl nitrogen would have an adverse effect. It also seems unreasonable to imply an impairment associated with high levels of titanium and aluminum based on the data from a single crayfish, particularly since there was no mention made as to the health of the single crayfish. We recommend that this sentence be deleted. (Industrial Mgt. Council)

A37. This sentence has been changed to read: "The presence of elevated levels of contaminants in tissues suggests that pollutants might be adversely affecting the benthic communities. More specific tests would be needed to determine whether these pollutants or other conditions (such as low dissolved oxygen or type of substrate) are affecting these benthic communities."

C38. Can the extent of undesirable algae and taste/odor problems in drinking water be quantified? (Tom Low)

A38. We have changed the text of impairment number 9 in chapter 4 to reflect the fact that taste and odor problems due to algae are occasional. This usually occurs in the late summer and/or early fall. The County Health Department keeps records about beach closures, including if the reason is due to algae. The County Parks Department is responsible for removing the algae from the beaches. Actual numbers on the amount of algae cleaned off the beach are not kept, but could be estimated from employee time records.

C39. The RAP should clearly explain to the reader why some beneficial use impairments are not applicable in the Genesee River and/or Lake Ontario. (Great Lakes National Program Office of the U.S. Environmental Protection Agency).

A39. This information is included in the narrative in chapter 4. The tables in chapters 4 and 6 which summarize the use impairments have been amended to refer the reader to the text or to include short explanations regarding the "not applicable" designations.

C40: Many of the discussions of beneficial use impairments point to data gaps and research needs required to make an accurate assessment of the impairment. The suggestions are interspersed throughout the RAP. It would be helpful if these suggestions could be summarized at the end of the use impairment chapter or in a separate chapter. A chart may be a useful tool to illustrate these needs with such column headings as: Use Impairment; Data Gaps/Research Needs; Ongoing Studies. (Great Lakes National Program Office, U.S. Environmental Protection Agency).

A40: Such a chart has been prepared and is included as part of chapter 6.

4. POLLUTANTS AND POLLUTANT SOURCES

C41: Kodak is the number one polluter in the state and while they are voluntarily reporting their emissions, they are still emitting nearly 14 million pounds of pollutants into the air and over 600,000 pounds into the water. (Diane Heminway)

A41. The reporting of emissions as stated above appears to be those reported by Kodak as required by the federal Superfund Amendments Reauthorization Act (SARA). The act requires that industries report, on a yearly basis, the discharges of certain substances to the environment via water, air, and fugitive discharges. The water discharges of 639,000 pounds is for the calendar year of 1991 at Kodak Park. The air emissions of 14.08 million pounds is the calendar year 1991 at Kodak Park. Because we were interested in data based on the "water year" which is not the same as the calendar year, we did not use SARA data in chapters 4 or 5 of the RAP. We use the water year because it is used by the U.S. Geological Survey who collects substantial amounts of data in our watershed. For further information on SARA data, interested individuals can call a toll-free number: 1-800-535-0202.

C.42: Is there a master list of SPDES permits within the area of concern? (Steve Lewandowski)

A42. Along with the RAP, we are also preparing basin water quality management plans for each of the three basins that flow to the Rochester Embayment. The Basin Plan format is similar to the RAP format. In each of the 3 basin plans, a list of major SPDES permits is included in Chapter 2. These lists do not include relatively small SPDES permits, and depending when you look at the basin plans, the information may be out of date. The New York State Department of Environmental Conservation has a master list of SPDES permits on a computer system. For specific information on the master list of SPDES permits within the NYSDEC Region 8, contact Tom Pearson at 226-

2466.

C.43: I can name 10 hazardous waste sites which are being started right now which DEC knows about. There are also collision shops, junk yards, and septic systems. These problems are known. When are these abuses going to be stopped and by who? (Mr. Frank)

A43. Specific inquiries into the status of enforcement actions at specific sites should be made to the New York State Department of Environmental Conservation in Avon, telephone 226-2466.

C44: Kodak has been dumping chemicals for over 100 years in the Genesee River and the atmosphere. Why this is not mentioned or alluded to? (Dick Streeter) C.3:The presentation did not include information on industrial pollution. There is a lot of talk about non-point source pollution, but Kodak is the number one polluter in the state. I have a problem with Kodak putting out 14 million pounds of toxicity into the air and 600,000 into the water, and this not being discussed at any great length. 4. Information should be included in the Stage I report about specific sources of pollutants. The names of polluters and their associated loading should be included. (Diane Heminway)

A44. Chapter 5 of the Stage I RAP discusses pollutant sources. This chapter provides information on pollutants in two different ways. First, the chapter contains information on loadings of pollutants to the water and to the air. In this section of the chapter, no specific sources are identified because the purpose is to identify the total loadings by pollutant, and by method the pollutant enters the ecosystem (non-point source runoff, point source discharge from regulated pipes, emissions to the air, and deposition from the air onto impervious surfaces). The second way the chapter provides information on pollutant sources is to provide detailed information on the pollutants that have been directly linked to use impairments identified in chapter 4. In this part of the narrative, Kodak is identified as a source of metals and phosphorus. It is also acknowledged that in the past Kodak used to be a part of the cause of oxygen depletion in the lower Genesee River. As part of the Stage II RAP development, pollutants will be prioritized. For the highest priority pollutants all known specific sources will be identified. This detailed information is needed to design appropriate remedial measures, not to state the problem.

C45: Lamprey eels should be noted in the report as part of the problem with fish. (Larry Moriarty)

A45. In the 1970's the sea lamprey was responsible for impairing the trout and salmon populations by predation. However, under the current control measures, the lamprey is NOT posing a major problem for the survival of trout and salmon. The Great Lakes Fish Commission is controlling the lamprey population by using a lampricide in those streams that the sea lamprey spawn in, such as Marsh Creek near Bogus Point.

C46: Algae on the beach does not come from the Rochester Embayment, but from Lake Ontario away from the Embayment. (Larry Moriarty)

A46. Algae does wash up on the beach from the Embayment and from other areas depending on the wind direction. The cause of excess algae is nutrients such as phosphorus in the near shore areas of the lake system. The density and growth is greatest on stable substrate (e.g. rocks) near human populations such as the Rochester Embayment. It is important that we do our part to limit the amount of phosphorus that enters the system and causes this problem whether our area causes local problems or drifts onto someone elses beach.

C47: Has any thought been given to road salt going into the Lake? (Robert White)

A47. Road salt does enter the Lake via stormwater runoff. The road salt has not resulted in any specific use impairments in the Rochester Embayment or Lower Genesee River. However, in the past it has interfered with the normal turnover of water in Irondequoit Bay. A campaign to reduce the use of road salt, together with relatively mild winters has reduced that problem in recent years. It is still important to prevent road salt use from causing an impairment in Irondequoit Bay again. The major long-term concern with road salt is the impact it can have on groundwater used for drinking. When road salt gets into the water supply, it can increase the rate of corrosion of the plumbing, and trace metals from the plumbing may enter the water. Road salt also damages vegetation along heavily salted roads and damages automobiles and bridges.

C48: Is there any quantitative information available on how much sediment in the Genesee River is due to human activity? (Doug Stinson)

A48. Chapter 5 of the Stage I RAP provides extensive information on sediment. The primary information available on sediment sources is from the Genesee River Watershed Study published by the U.S. Environmental Protection Agency, and prepared by the U.S. Geological Survey. The study provides good estimates based on standardized sediment measurements and three years of data. The study found the Canaseraga Creek watershed to be the most prominent source area for suspended solids. Intensive agricultural areas on calcareous soils were among the highest contributors to the loadings. Black Creek (Genesee County), Oatka Creek, the middle Genesee (Mt. Morris to

Henrietta) and Conesus Lake watersheds followed in order of total sediment load. All received the majority of their sediment from cropland erosion. The upper Honeoye Creek had the highest loading per acre, 80% of which was from cropland. Several of the creeks, primarily in the upper Genesee Basin, had a greater sediment load from bank erosion than from cropland. Using data provided in the March 1975 Soil Conservation Service report entitled Erosion and Sediment Inventory, it is estimated that 480,000 tons per year of sediment enter the Genesee River from stream and river bank erosion in the stretch from Mt. Morris to Rochester. We do not have any more data specific to how much comes from human activities. In urban and suburban areas, unprotected soil is more likely to be associated with construction sites than with agriculture. Streambank erosion also can be accelerated by real estate development due to the increase in impervious surfaces which cause increased storm flows in local streams. Numerous studies in individual watersheds have shown construction sites to be a significant source of sediment in urban areas.

C49: There was no mention of nuclear contamination in the report, or any mention of radioactive chemicals in fish. (Dick Streeter)

A49. To our knowledge, radioactive chemicals are not causing any use impairments in the Rochester Embayment. Radioactive thorium was discovered by Kodak near its Hawkeye Plant located near Driving Park Bridge in the City of Rochester in June of 1991. A workplan was prepared and implemented to identify the extent of the thorium. The workplan included sampling in the Genesee River gorge, the water, and sediment. The results found levels to be below regulatory limits.

C50: Do people still dump diapers and solid waste in the Lake? (Ed Murawski)

A50. Solid waste is not currently, and has not historically been known to be dumped in Lake Ontario. Solid waste products found in the Embayment area are likely carried to the Embayment with stormwater runoff or are from litter from boaters or shoreline users. In the case of Durand-Eastman Beach (which is specifically where the diapers were seen), there is littering by people who use the beach, despite the available garbage cans near the parking lot. Periodic clean-ups are done by the Monroe County Parks Department crew but are not sufficient to keep up with the heavy usage of the park area especially on summer weekends. The Monroe County Parks Department has started to encourage people to carry out what they carry in via signage and general advertising.

C51: Is DEC tracking the path of pollutants? (Barbara Clark)

A51. The NYSDEC keeps track of the amounts of pollutants discharged from permitted wastewater facilities as reported by the dischargers. There are also a few water quality monitoring stations operated by the NYSDEC, the U.S. Geological Survey, or the Monroe County Health Department that collect and analyze water samples at specific locations on a regular basis. Special studies are also conducted at locations where there are indications of water quality problems. Efforts that have been undertaken to trace the path of pollutants from a specific discharge point have been related to the study of closed landfills and they are generally very costly. Chapter 4 of the Stage I RAP includes extensive information on water quality monitoring data including the quality of water, sediments, and air.

C52: What are some examples of air pollutants which are discharged? Are air emissions the major source of PCB's?

A52. Examples of pollutants discharged to the air locally include lead, silver, zinc, acetone, benzene, methylene chloride, toluene, and methyl chloroform. There are no reported air discharges of PCBs in the 5-County area around the Embayment. However, PCBs are in the air. It is estimated that atmospheric deposition to the surface of Lake Ontario amounts to 42 kilograms per year. These PCBs may come from portions of the airshed outside the 5-County area or may leak from small sources or landfills, or evaporate from the lake surface.

C53: Are there any studies on industrial accidents?

A53. Chapter 5 of the Stage I RAP includes estimated amounts of pollutants spilled.

C54. Did the question of medical waste emerge? Peter Bush?

A54. We did not quantify medical waste as a part of this project. Occasionally hypodermic needles are found on beaches (Sommerville and Rock Beaches in Irondequoit). The Health Department requires beach safety plans for public beaches that include routine surveys of the beaches for needles and other unsafe materials and proper disposal. The source of needles is suspected to be from individuals who may be using the needles for insulin injection or illegal drug use. The needles found are from the careless discard of needles by individuals participating in recreational activities near the shore, or in or near the storm sewer system. There is no indication that medical waste from institutions is making its way to public places directly, however medical waste, like all waste has the potential to contribute pollutants into the system.

C55. Land use along Erie Canal will change over the next decade, and that could have a dramatic impact on the water quality. (Clark King).

A55. The Erie Canal Corridor Plan is considering the impact of changed land use on water quality. There are goals and actions in the Erie Canal Corridor Plan that complement the goals and objectives of the RAP. Local land use controls will be a key element of protecting water quality. Development review standards have been recomended in model ordinances contained as attachments in the Draft Canal Plan. It will be important to mitigate the impacts of land use on water quality. This will be further considered in the Stage II RAP.

Q56. Is the DEC or any other state agency doing anything to study herbicides? (George Turner)

A56. Information in this area is very limited. To our knowledge, herbicides have not been linked as a source of any of our identified use impairments in the Rochester Embayment of Lake Ontario, but no specific studies have been done on herbicides in this watershed. One study that has been done by the New York State Water Resources Institute at Cornell University conducted an "Assessment of Pesticides in Upstate New York Groundwater" from 1985 to 1987 at farms and found a few groundwater samples contained residues of two herbicides (atrazine and simazine). There are also reports that well-maintained, dense turfgrass lawns minimize runoff and associated pollutants. More work is needed in this area.

C57. On page 5-3 of the full Stage I Report, under the discussion about the SPDES discharges, it isn't clear that industrial wastewater is part of the discussion. It sounds as though this SPDES information is only for publicly owned treatment facilities. (Diane Heminway)

A57. This has been changed to make it clear.

C58. The information provided in the Stage I RAP about pollutant prioritization was confusing. It is not clear what the prioritization process was or that it is as yet incomplete. (Diane Heminway)

A58. This has been changed so that it is more clear.

C59. I am surprised about the Mercury figures in Table 5-11 in the full Stage I report and do not believe the lead figures. A lawyer once told me that Kodak discharges 50 pounds per day of lead which is far more than the lead loading shown in Table 5-11. (Diane Heminway)

A59. The pollutant loadings at Rochester in table 5-11, including those for Mercury and Lead were estimated based on 23 data points collected by the U.S. Geological Survey. For a full explanation of the method of calculating the data in table 5-11, see Appendix C in the Stage I RAP. The lead loading reported on table 5-11 is estimated at 8 tons per year between Geneseo and Rochester. That works out to be approximately 44 pounds per day total lead. Regarding Kodak discharges of lead, NYSDEC SPDES data shows an average Kodak lead discharge of 7.8 lbs./day with a range of 4.5 to 14 lbs. /day. Atlantic States Legal Foundation estimates Kodak lead discharge at 12 lbs./day and the 89/90 average at 10.7 lbs./day. The 50 lbs/day value may derive from the 1984 permit maximum value, but there is no evidence of a 50 lb./day average.

C60. Exec Summary, page 32, number 12. Regarding total suspended solids SPDES information. We do have TSS calculations that were done locally. We should use them. This comment holds true for the full Stage I RAP also. Also, in Full Stage I, table 5-15 (page 5-63) it appears as though some kind of SPDES TSS figures were used. (Paul Sawyko)

A60. We do have some estimates of Total Suspended Solids that have now been included in table 5-3. Estimated Total Suspended Solids discharged from wastewater facilities add up to approximately 26,500,000 pounds per year. This works out to be approximately 13,250 tons per year, compared to 626,000 tons per year to the Rochester Embayment estimated to come from non-point sources.

C61. Full Stage I: Page 2-12/13. The chart at the top of page 2-13 lists industrial flows. In the narrative that precedes the chart, it says that "The largest industrial discharges in the drainage basins are from facilities owned and operated by RG&E & Kodak. Together they account for 259.84 mgd or over half of the flow from the major permittees." Why is the small 1.13 mgd flow from Kodak Apparatus included? Also, the 27.6 mgd for Kings Landing is an average--not design flow. Design flow is 36 mgd. (Chris Rau) Average flows at Russell Station is 125.28, and Beebee is 53.4. (Paul Sawyko)

A61. This chart has been removed because the information it provides is not particularly useful. The narrative still includes the major points.

C62. Full Stage I: Page 5-16: First full paragraph notes that "Any dischargers to the public {sewer} system must conduct pretreatment." Not every industry needs to conduct pretreatment. (Chris Rau)

A62. This is true. Only industrial dischargers who have wastewater that exceeds specified pollution limits are required to conduct pretreatment. For some compounds listed in the Sewer Use Law, industrial users pay a surcharge in order to discharge to the public sewer. This sentence has been revised in the Final Stage I RAP.

C63. Table 5-18, page 5-66. This information on PCB Equipment Inventory should include comparable information for RG&E, and table 5-19 should be deleted. Information provided should be consistent among the utilities. (Paul Sawyko)

A63. We agree. Table 5-19 has been removed and PCB Equipment Inventory information for RG&E that is comparable to that from other utilities has been included in the Final Stage I Report. The information provided has been updated from the draft.

C64. Full Stage I: Table 5-3. Many of the numbers seem low because Kodak discharges more than the total SPDES loadings in this chart. Some specific pollutants that seem low include manganese, chloroform, phenolics, and xylene. The reason for the discrepancy in some cases may be that Kodak does not have permit conditions restricting discharge, so reporting is not required. (Ed Cooper, 2-18-93)

A64. The values shown in the table are correct for the 90/91 SPDES data base, and are the values reported by the dischargers to the NYSDEC. Manganese is not covered in the Kodak SPDES permit. Some of the discrepancy may be explained if Mr. Cooper is quoting 1989 data, while we have used the water year (October to September) of 1990/91. Xylene is not listed separately in our table 5-3, only as a part of BTX (Benzene, Toluene, Xylene).

C65: Page 5-22, Paragraph E of the full Stage I RAP states "The pollutants discussed in Section D were those that have been linked to impairments in the AOC. There is also a need to reduce the discharge of persistent toxics into Lake Ontario even if no impairment in the AOC is known to be associated with them. Work is being done as part of Stage II RAP to identify all pollutants of concern..." All pollutants discussed in Section D are not linked to impairments in the AOC. We suggest that this title be changed to read: "Sources of Pollutants in the AOC." Reducing the discharge of persistent toxics into Lake Ontario even if no impairment in the AOC is known goes beyond the intent of the GLWQA (Annex 2, (Para 2)(a) and Para 4). Para 2 states that "Remedial Action Plans and Lakewide Management Plans shall embody a systematic and comprehensive ecosystem approach to restoring and protecting beneficial uses in Areas of Concern or in open lake waters". Para 4 describes the requirements for RAPs for AOCs and makes no mention of persistent toxics in the open lake waters. Clearly the intent of the GLWQA is for RAPs to focus on AOCs and LaMPs to focus on the open lake waters. We recommend that Paragraph E be deleted. (Industrial Mgt. Council)

A65. The GLWQA (Annex 2, paragraph 2, (b) also says that RAPs should "...serve as an important step toward virtual elimination of persitent toxic substances and toward restoring and maintaining the chemical, physical and biological integrity of the Great Lakes Basin Ecosystem." The title of Section D has been retitled "Sources of Pollutants in the AOC." An additional sentence has been inserted in the cyanide paragraph noting that "Cyanide is not known to be causing any impairments in the AOC, However, high levels are found in both the Genesee River and Irondequoit Bay." Paragraph E has been modified as follows:

"Most of the pollutants discussed in Section D were those that have been linked to impairments in the AOC. There may also be a need to reduce the discharge of persistent toxics due to potential concerns for human health. Work is being done as part of the Stage II RAP to identify all pollutants of concern."

C66. The Draft RAP appears to place more emphasis on point source discharges than on pollutants from nonpoint sources. The Draft Plan identifies use impairments in the Embayment and clearly links nonpoint sources as major contributors to pollutant loadings. Page 5-3 (B)(1) Paragraph 2 states that "As part of the Stage II RAP, a table showing individual wastewater dischargers of the chemicals deemed to be of highest priority will be prepared. This will be an important tool in selecting remedial measures to be implemented." This section, relating to point source discharges is the only section that makes such a deliberate statement of how these priority chemicals will be handled. The reader may conclude that it is the intention of the RAP authors to treat point source water dischargers differently than all other pollutant sources. In the case of nonpoint sources, a table should also be prepared showing sources of the chemicals deemed to be of highest priority and that list should be used as a tool in the selection of remedial measures to be implemented on controlling nonpoint sources.

Page 5-7, Paragraph 5 describes how stormwater runoff loading estimates were calculated for presentation in this document. The closing statement suggests that the runoff estimates may be inaccurate and hence the warning that each reader "is encouraged to consult the appendix to make a judgement about the accuracy of the estimate." This disclaimer suggests the lack of credible data on nonpoint source runoff loadings. The absence of credible nonpoint source loading information will make it very difficult if not impossible to address impairments using a risk/prioritization process as recommended by USEPA. The Stage I and II RAP must insure that all sources issues are placed in their proper perspective with appropriate attention to the "real" loading and use impairment issues. Without good nonpoint source data the tendency may be to de-emphasize their contribution at the expense of already strictly regulated and controlled point source dischargers. Without accurate nonpoint source loading information, Stage I of the Rochester Embayment RAP is incomplete. A risk prioritized Stage II cannot be developed in the absence of this data. (Industrial Mgt. Council)

A66. Non-point source pollution (whose origin includes point and fugitive air pollution) is considered to be a major source of pollution as evidenced by the section C of Chapter 5 which goes into extensive detail about the Comparative Importance of Point and Nonpoint Sources of Pollution. Several tables and figures go with this section that evidence the contribution of nonpoint sources. We have added a sentence in the non-point source runoff section of chapter 5 (B)(5) that says: "Table 5-13 also gives an indication of pollutants with large non-point source contributions. Non-point source pollutants of greatest concern due to their link with a use impairment, and the quantity of pollution include Copper, Nickel, Total suspended solids, and total phosphorus. After pollutants are prioritized as part of the Stage II RAP, those known to have significant loadings from non-point sources will be identified and used in the selection of remedial measures.
On page 5-7, Paragraph 5, the closing statement suggesting that runoff estimates are inaccurate has been removed. We believe our methodology is sound.

C67. The loading estimates used to discuss air deposition to the embayment are uncertain and based on extremely limited and variable data. Consideration should be given to including a reference to the Clean Air Act Amendment of 1990 as the mechanism to collect meaningful air deposition information. It is generally acknowledged that wet and dry deposition of chemicals occurs in the Great Lakes Basin, but the characterizations of this deposition are subject to a great deal of variation due to an imperfect understanding of the physical science affecting such processes. Thus, assumptions and incomplete data must often be used to even approximate loadings from deposition (Air and Waste Management Association, 1991). While issues concerning deposition of particulate chemical contaminants are uncertain, this is even more true of vapor contaminants and, in particular, dry deposition of vapors, since such deposition is very difficult to measure. Many of the chemicals of concern that are deposited on the Embayment originate in other areas from nonpoint sources. While transport of contaminants from one region to another presents one set of concerns, loading due to deposition from local sources presents quite another. Volatile materials such as organic hydrocarbons released locally are expected to be dispersed largely outside of the Embayment. Many of these materials are not persistent in the environment because they degrade in the atmosphere. Many of those which reach water sources are further degraded. Significant percentages of other materials may be deposited on soil and persist there, such as metals, and would not be expected to reach the Embayment (EPA, 1990). Thus, any considerations having to do with point sources of air emissions within the Rochester Embayment should have a contaminant-specific basis, where factors such as particle size, chemical characteristics, and physical form are properly evaluated. Any attempts to use data on atmospheric releases of materials to estimate loading should recognize all of these uncertainties and should be structured accordingly. The Clean Air Act Amendments (CAA) of 1990 (Section 112(m) requires a monitoring network in the Great Lakes to assess deposition by 12/31/91, a report by USEPA to Congress pertaining to atmospheric deposition by 11/15/93, and promulgation of any emission standards deemed necessary to prevent adverse effects from bioaccumulation, etc. from indirect exposure by 11-15-95. Atmospheric deposition of chemical contaminants is a complex issue that is not well understood. Data generated in accordance with the CAAA should be utilized, and any data incorporated into the RAP should be done with a description of the uncertainties involved.(Industrial Mgt. Council)

A67. The loading estimates used to discuss air deposition to the embayment are from three different sources. The calculated loadings vary among the 3 data bases. In order to answer some of the points you raise, the narrative under air deposition (Chapter 5, (B)(2)) has been expanded to include the following paragraph taken from your comments: "There is an imperfect understanding of the physical science affecting atmospheric deposition. It is assumed that many of the chemicals of concern that are deposited on the Embayment and its watershed originate from a large geographic area from both point and nonpoint sources. Volatile materials released locally may be dispersed outside of the Embayment watershed, and those released hundreds of miles away may be deposited in the Embayment watershed. Some pollutants degrade in the atmosphere, and some may be deposited on soil and persist there. The Clean Air Act Amendments (CAAA) of 1990 (Section 112(m) requires a monitoring network in the Great Lakes to assess deposition by 12/31/91, a report by USEPA to Congress pertaining to atmospheric deposition by 11/15/93, and promulgation of any emission standards deemed necessary to prevent adverse effects from bioaccumulation, etc. from indirect exposure by 11-15-95. When this data is available, it will be considered to update the RAP."

C68: There is a reasonable concern that the criteria used to establish the lists in Chapter 5 "Priority Pollutants for the Rochester Embayment", Table 5-1 and "Highest Priority Pollutants",Table 5-2 may have been inappropriate; hence the criteria should be reevaluated. It must be clearly stated why a pollutant is listed and whether listing is consistent with the objectives of the RAP. This demonstration is not made for every substance listed. This information should be added to the draft and the public given a chance to comment before

the Stage I RAP is finalized.
The list of 80 pollutants (Table 5-1) was compiled from lists that have limited or no relevance to this Embayment. For example, "substances evaluated in the Niagara River Toxics Management Plan" were included on this list. We question why "the substances which exceeded Lake Ontario Management Plan standards" were included if these chemicals are not present in the Rochester Embayment. Table 5-1 should be reestablished to contain a list of pollutants of concern comprised of all other chemicals present in the Embayment. Since the chemicals on this list are not presently linked to any use impairment, their Prioritization in the Stage II RAP should consider the likelihood of causing an impairment. In this way we focus our attention on what we need to address, rather than being concerned about the things we cannot nor need to control.

The statement is made on page 5-1(A) that; "Of this initial list of chemicals, an additional technical group (The Priority Pollutant Task Group) determined which pollutants were of greatest concern to the Rochester Embayment based on toxicity, environmental effects, bioaccumulation, persistence, linkage with the use impairments identified in Chapter 4, and the known local pollutant loadings." A list of twenty chemicals was initially selected for Prioritization, based largely on the considerations listed here. This list has been referred to as "highest Priority Pollutants" (Table 5-2). While it was believed that many of the listed chemicals represented high concerns for the Embayment, this conclusion was based almost entirely on qualitative assessments, and no process had been established to evaluate them quantitatively. In addition to the criteria that are being used to rank pollutants, some chemicals appear to have been chosen simply because relatively large quantities of them are discharged to air or water. Thus, while some chemicals on the list of twenty might be considered high priority for evaluation using the above criteria, all of the chemicals on the list of twenty have not yet been characterized as being the highest concerns for the Rochester Embayment. It is improper to characterize these materials as being the highest concerns until a quantitative analysis is finalized. It should be clearly stated that some materials, listed in Stage I may not, upon further evaluation, be considered highest priority. After a review of the Draft Stage I RAP many pollutants identified are not linked to an impairment or its tendency to bioaccumulate. For example both methylene chloride and silver have very low bioaccumulation potential and there are no known impairments associated with either chemical in the Rochester Embayment. The term "Pollutants of Highest Concern" does not accurately describe the intent of or the conclusions reached to date by the Priority Pollutant Task Force. Once a more accurate identification of priority pollutants of concern is made then the plan can more correctly focus its efforts." Table 5-2 should be limited to those chemicals present in the Embayment that are known to be causing a use impairment. (Industrial Mgt.

Council).

A68: Table 5-1 has been amended to refer to a new appendix where information can be found on the origin of how chemicals got on the list. The table has also been amended to include a note that "It is recognized that the pollutant list should be dynamic and responsive to new information. This list should change as new information becomes available."The overall purpose of RAPs is to improve the quality of the Great Lakes. Therefore, the pollutants of concern to Lake Ontario are of concern to the Rochester Embayment RAP. In the effort to prioritize the importance of pollutants in the Rochester Embayment as part of the Stage II RAP, an important criteria will be whether or not a source of the pollutant exists in the Area of concern, and whether or not the pollutant is linked to a use impairment. It is true that Table 5-2 was based on qualitative rather than quantitative data and that the Priority Pollutant Task Group is currently developing a quantitative method of identifying the highest priority pollutants. The text in the Final Stage I RAP has been amended to recognize how table 5-2 was developed, and that it may change after a quantitative analysis is conducted. The title of table 5-2 has been changed to read "Preliminary List of High Priority Pollutants."

C69: We suggest that the first sentence in Chapter 5(A) be amended to say: "This chapter discusses the sources of pollutants and associated loading factors, measured and estimated, which may be contributing to use impairments in the Rochester Embayment AOC, and attempts to identify persistent toxic pollutants that may have sources in the AOC drainage basin." (Industrial Mgt. Council)

A69: This change has been made.

C70: In chapter 5, section A 1, a statement is made that "Pollutant sources were prioritized by evaluating a selected list of pollutants..." Prioritization of pollutants will appropriately take place in Stage II of the RAP. To more accurately reflect the RAP Stage I process, the word "prioritized" should be replaced by "identified". (Industrial Mgt. Council)

A70: This change has been made.

C71: In chapter 5, section 3a, is a narrative about nondetectables. The use of the 25% method for estimating nondetectable values may be an appropriate screening tool and probably sufficient for the purposes of the Stage I RAP. However, this method may significantly overestimate loadings from large volume point source dischargers. In a memo from USEPA Region 6 dated

November, 1992 Mr. Jack Ferguson recommends: "If any individual analytical test result for a permitted pollutant is less than the applicable quantification level you should treat the concentration of that pollutant as zero (0) when calculating daily maximum and weekly and monthly average loading and concentration values for the purposes of reporting on your DMR." Recognizing that most of the loadings to the AOC are coming from nonpoint sources and the inherent uncertainty in quantifying point source loadings based on nondetects, it may be more appropriate to utilize the Region 6 procedure, developing the list of pollutants of highest priority to the Embayment. (Industrial Mgt. Council)

A71: A discharge monitoring report (DMR) is the reporting mechanism used to demonstrate compliance with a SPDES permit. The SPDES permit is resultant of State and Federal Law, water quality limitations, and negotiation with the permittee. As part of the RAP process, an effort has been made to estimate pollutant sources and loadings discharged to the Rochester Embayment Area of Concern. A subcommittee of the Pollutant Loadings Task Group of the RAP Technical Group, including representatives of the major industrial and municipal dischargers to the Area of concern, were all aware of the difficulty in dealing with data at concentration values less than minimum detection limits (MDL). In the case of Monroe County, the pollutants were identifiable in the plant influents, but in many cases undetectable in the effluent. Since conventional treatment incidentally removes these pollutants at variable rates, the likelihood of some pollutants being discharged is real. To account for this, the Task Force felt that if a pollutant was detected in the effluent 25% of the time, it is reasonable to calculate the resultant pollutant loading at one half the MDL. The suggestion that the USEPA method be used when prioritizing the pollutants for inclusion in the Stage II RAP will be submitted to the task group for their consideration.

C72: In chapter 5, section A 3 b, the statement is made that "Air emissions from industries are often highly variable, with most emissions occurring during short periods." The basis for making this statement is unclear and appears to be an assumption not supported by data. The variability of air emissions is emitter specific. We recommend that this sentence be deleted. (Industrial Mgt. Council)

A72: The sentence has been amended to state: "Air emissions from industries may be highly variable over time."

C73: It is widely accepted that metals can exist in different chemical forms (species) and these species can differ in bioavailability and toxicity. Therefore, the relationships between chemical speciation and effects must be considered to prepare a proper environmental assessment. This is an essential consideration for silver which appears on both Table 5-1 and 5-2. Silver sulfide, the most prevalent form of silver in the environment, is essentially nontoxic. Laboratory studies confirm that no acute or chronic aquatic toxicity occurs upon exposure to silver sulfide, even at concentrations that are orders of magnitude greater than those likely to occur in the environment. Neither have any field studies shown evidence of a cause-effect relationship between silver sulfide and impairment of the aquatic habitat. Other species of complexed silver, such as silver thiosulfate and silver chloride, have also been tested for aquatic toxicity and found to be relatively nontoxic. The only species of silver that is known to cause adverse aquatic effects at concentrations less than 20 μg/L is silver ion, Ag+. This species of silver is very reactive and readily forms complexes with substances containing sulfur, nitrogen, and oxygen. Silver ion does not persist during biological waste treatment, but forms complexes/compounds with other chemicals, eventually ending up as silver sulfide. Even if silver ion were somehow discharged directly it would not persist. Recent studies at the University of Wisconsin have shown that silver ion is rapidly adsorbed onto particulates suspended in the water column and present in the benthos. Adsorption occurs quickly, within minutes, while desorption has not been observed because it occurs so slowly. The binding constant for silver ion to particulates is sufficiently large to ensure that in waters containing suspended solids, no significant amount of silver ion will be present. Trying to environmentally categorize "silver" is technically unsound because of speciation and the wide range in toxicity and concentration of silver species. The species of silver, e.g. silver ion, silver sulfide, etc., must be specified in order to select the correct environmental properties. If silver is listed on Table 5-1 and 5-2 it should be expressed as silver ion, Ag+. The presence of a metal in the waters or sediments of the Rochester Embayment does not indicate harmful or deleterious exposure. The relationship between chemical speciation and effect must be considered. (Industrial Mgt. Council)

A73: The speciation issue raised is important. However, current reporting of chemical discharges is not broken down in this manner, and if we put only some species of substances on the list, data would not be available. Table 5-1 remains as it did in the Stage I report. However, for the finalizing of table 5-2, which is being done by the Priority Pollutant Task Group as part of the Stage II RAP, this issue be considered.

C74: Methylene chloride is not discharged to the Genesee River in quantities to cause any use impairment or to result in human health concerns. Although methylene chloride is released into the atmosphere, its dispersion patterns and physical characteristics suggest that it is transported largely outside of the

Embayment. Moreover, those quantities that are discharged or deposited into water are unlikely to persist in the environment (Stover and Kincannon, 1983; Klecka, 1982; Tabak et al., 1981). In view of the lack of potential effect or persistence, it is inappropriate to list methylene chloride in a manner that associates it with actual environmental effects or concerns. It should be stated where appropriate why materials that do not appear to be high concerns are listed, or alternatively, these materials should be removed from the lists. Methylene chloride discharged to the embayment does not result in use impairments or in concentrations indicative of potential impairments, nor is methylene chloride persistent in the environment. If methylene chloride and other chemicals were selected primarily due to the quantity of discharge, it should be clearly stated that these chemicals are listed for purposes of evaluation, but are not necessarily chemicals of concern by RAP definition. (Industrial Mgt. Council)

A74: Methylene Chloride is on Table 5-1 because it was a chemical of concern in the Niagara River Toxics Management Plan. The way in which chemicals were chosen to include in Table 5-1 is now included in the Chapter 5 Appendix D. Inclusion of methylene chloride on Table 5-2 was because of the amount emitted in this area. However, the table and the narrative also recognizes the fact that this information is preliminary, and that a more quantitative methodology for preparing a final list will be conducted as part of the Stage II RAP. The information you have provided will be considered by the task group working on this in the Stage II RAP development. Copies of the references you note will be helpful to the Stage II RAP work.

C75: In chapter 5, section B9 has a first sentence that reads "The pollutant sources discussed above do not represent all sources, but only those for which there is a comprehensive information base..." This sentence suggests that there is a comprehensive information base for nonpoint source runoff. Extrapolating the NURP data for Irondequoit Bay to the Genesee River does not represent a comprehensive information base. Our previous comments referring to page 5-7 clearly demonstrates that this is not the case for nonpoint source runoff. We recommend the sentence be changed to read: "The Pollutant sources discussed above do not represent all sources." (Industrial Mgt. Council)

A75: This sentence has been changed to say "The pollutant sources discussed above do not represent all sources, but only those for which there is a good base of information."

C76: The fourth paragraph in chapter 5, section C (Comparative Importance of Point and Nonpoint Sources of Pollutants) states that *"Table 5-11 shows total loadings and loadings per square mile for the Genesee River above and below*

Geneseo. Even though the lower basin is more highly urban and industrial, the upper basin contributes half or more of all pollutants listed. The area of the upper basin is 58% of the area of the entire basin, so it would be expected to contribute 58% of the pollutants if area were the only factor." Using this logic, one could conclude that since the loadings to the Genesee River above Geneseo is primarily due to agricultural runoff and air deposition, those loadings should be similar below Geneseo. One could therefore conclude that after subtracting out agricultural runoff and air deposition below Geneseo, the contributions from urban and industrial areas are small and probably deminimus. (Industrial Mgt. Council)

A76: This is one conclusion that could be reached for the 3 pollutants that represent 58% or less of the total loading. The other 3 pollutants for which data is able to be estimated for the portion upstream and downstream of Geneseo shows higher percentages in the downstream portion. The result supports the theory that much of the loading is uniform as would be expected if non point source loads dominate. The analysis does suggest that point sources are not hugely dominant for some parameters.

C77: We concur with the statement in chapter 5, section D7 that states: "Atmospheric deposition appears to account for most of the mercury discharged by the Genesee River." The statement "However, NYSDEC data indicate only three air dischargers emitting less than 2 lbs/yr. of mercury to the air in Monroe Livingston, Allegheny, Genesee and Orleans County" should be expanded to include "...therefore, it appears that most mercury loadings to the Rochester Embayment are from sources beyond the Genesee River Basin and that additional studies may be necessary to determine mercury loading sources." (Industrial Mgt. Council)

A77: This section has been amended to read: "However, NYSDEC data indicate only three air dischargers emitting less than 2 lbs/yr. of mercury to the air in Monroe, Livingston, Allegany, Genesee and Orleans County. Therefore, it appears that significant mercury loadings to the Rochester Embayment are from sources beyond the Embayment watershed. Studies ongoing or planned by federal and/or international agencies should be sought to help address this issue."

C78: In chapter 5, section D5, it is stated that "Benzo(a)pyrene is one of the most toxic PAHs. It has been documented to cause liver tumors in freshwater fish." Many PAHs have very low toxicity's, and the implicit comparison of them to Benzo (a) pyrene may be misleading. This point should be emphasized. (Industrial Mgt. Council)

A78: The last sentence of the first paragraph of this section now reads: "As a group, they are widely distributed in the environment and have varying levels of toxicity."

C79: Figures 5-6, 5-7, 5-8, and 5-9 appear to add little value to the RAP document. They should be either expanded to provide clarification or deleted. (Industrial Management Council)

A79: The purpose of these figures are to show in a different format, the relative magnitude of pollutant sources for 4 pollutants. We have left these figures in for those who find this kind of representation helpful.

C80: The charts contained in chapter 6 which summarize the linkages between uses, pollutants and sources are very helpful. Even though the chart notes the difficulty in prioritizing and quantifying loadings from sources, it would be very helpful to have this information included. These charts could become a frontpiece for the RAP and/or a one page summary to be handed out at meetings, conferences, etc., for quick and easy reference. (Great Lakes National Program Office, U.S. Environmental Protection Agency)

A80: This will be considered during the work of the Stage II RAP.

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5. WASTE SITE POLLUTANT SOURCES

C81: What exactly is the seepage in the lower falls, who is responsible, and why is it still seeping? (Bill Bayer) What is the contribution of pollutants from chemical seeps at the lower falls of the Genesee River? (Steve Trojanczyk)

A81: In the early 1970s, a coal-tar like material which included the pollutants benzene, toluene, xylene and an oily substance were found seeping from the face of the Lower Falls of the Genesee River just north of downtown Rochester. Tunnel construction and maintenance activities upstream of the falls during the mid-1980's also encountered similar substances flowing from bedrock fractures into the tunnel. When the contamination was encountered in the tunnel, measures were taken to prevent the pollutants from entering the river. Excavated material was removed for safe disposal, and water pumped from the tunnel was treated in holding ponds. After the tunnel project was completed, the material in the ponds was excavated and properly disposed of and the ponds were backfilled. Sampling and analysis is proposed for the site of the work later in 1993.

Recent (1988) sampling and analysis of the seeps at the Falls was conducted by Malcolm Pirnie for the City of Rochester. Benzene, toluene, xylene, and a variety of Polynuclear aromatic hydrocarbons were detected. More recent non-scientific observations by City and RG&E staff may suggest that the amount of seep material present on the face of the Falls is diminishing. An odor is, however, occasionally noticeable. The source of the seeps is unknown. While there is no formal regulatory investigation, the site remains of concern to local authorities including the Monroe County Health Department who feels there is a need to define the source of the material. Potential sources include historic coking plants which were located on the banks of the river, upstream of the lower falls. The total amount of pollutants that have been entering the river from this source is not known but is estimated by the Monroe County Environmental Health Laboratory to be in the kilogram per day range. This estimate will be updated during the summer of 1993.

C82: I understand that the salmonids have not been able to spawn in the lower Genesee River. Is this related to the chemical seeps? (Steve Trojanczyk)

A82: The primary reason that salmonids are unable to spawn in the Lower Genesee River is the lack of proper habitat substrate (gravel beds) in which to lay their eggs. Another problem is that the water temperature in the river becomes too warm for salmonid spawning. According to the New York State Department of Environmental Conservation Region 8, these are the reasons for lack of spawning and they are not known to be related to the chemical seeps (also see the previous comment, C81).

C83: How many hazardous waste dumps are leaking into the River and the Rochester Embayment? I have concluded that dump sites are actually the main source of pollution going into the Niagara River. (Diane Heminway)

A83: The Stage I RAP has identified 78 waste sites in the watershed of the Embayment that have some potential for leaking pollutants of concern in the watershed.

C84: For many years, one hazardous waste site on the State Registry was the Lower Genesee Gorge Site. This was delisted from the Stage Registry and is no longer on the registry because coal tar is no longer considered toxic. This is a travesty! (Diane Heminway)

A84: A recent ruling has been made, as the result of a legal challenge, that coal tar is not automatically considered a hazardous waste unless it is tested and fails the federal Toxicity Characteristic Leaching Procedure test (TCLP). The NYSDEC has not adopted the federal TCLP test for characterizing hazardous wastes. Once the NYSDEC adopts the TCLP rule and conducts testing of coal tar substances, many of the coal tar sites may be relisted on the registry as inactive hazardous waste sites. The apparent rationale for the delisting of Coal Tar as a hazardous material is that the process that creates coal tar is no longer in use, and the main purpose of the regulations is to regulate wastes that are currently being produced. The Genesee River Gorge site also included many areas where coal gasification or coal tar disposal never occurred. Both the coal tar rule and the site boundaries contributed to the delisting of the Genesee River Gorge site from the inactive hazardous waste site registry.

C85: I have come to realize that hazardous waste sites are very difficult to clean up. Why do we keep manufacturing all of this waste which we don't know what to do with and why do we continue to put it out into the environment? (Diane Heminway)

A85: One answer is that products from which the hazardous waste results have been deemed by many to have benefits which exceed enviornmental costs.

C86. One source of pollutants not mentioned in the Draft Stage I RAP is the runoff of glycol used as deicing fluid at the Monroe County Airport. This source should be identified. (Chris Rau)

A86. Chapter 5 of the Stage I RAP has been amended to recognize this source of pollution which is an oxygen demanding chemical. It should be noted that the Monroe County Airport is in the process of studying alternative methods for eliminating the pollution caused by the use of deicing fluids at the airport.

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6. PUBLIC INVOLVEMENT IN RAP DEVELOPMENT AND IMPLEMENTATION

C87: You mentioned that there are 27 members of the Committee and that there is a Government Policy Group, a Public Outreach Committee and a Technical Group. Are any members employees of the Kodak company? I have a problem with Eastman Kodak's employees serving on committees where policy decisions are made for our welfare when they have been found criminally guilty. This is like having Arthur Shawcross advise people on what we should do against murdering women! (Dick Streeter) C.14: One of the frustrations with people who have gotten involved is that there is almost too much cooperation with the industries and that there may be a conflict of interest. (Diane Heminway) C14B: How was the Advisory Committee picked? (Bill Bayer) Is a Monroe County Fishery Advisory Board representative on one of your committees? (John Schoth)

A87. The 27-member Water Quality Management Advisory Committee has a member who represents the Industrial Management Council. That member is an employee of Eastman Kodak. The WQMAC also has a member representing the Fishery Advisory Board. The WQMAC has been in existence for over 13 years. The advisory group has members representing 4 categories of stakeholders: citizens, public interest groups, public officials, and economic interests. The membership categories include the kinds of groups that have a stake in the issues we are dealing with. A balanced number of members in each category is sought. At the beginning of the RAP, the County considered citizens already serving on the advisory committee, and in addition sought applications for citizen membership through an Open Appointments Board. Announcements were made in the newspaper that we were looking for members. Many of the members representing other categories (public officials, public interests, and economic interests) were sought through groups that represent stakeholders (such as the Town Supervisors Association, the Sierra Club, and the Industrial Management Council.) It is important to have the involvement of all stakeholders. Stakeholders that are part of the problem must be part of the solution.

C88: Citizens need to get involved in the permit process with industry. However, the amount of work needed to understand the issues is overwhelming. (Steve Trojanczyk, Diane Heminway)

A88. The issues involved in the permit process are extremely complex.

C89: Because of the difficulty for citizens to press lawsuits when the permits are in violation, the DEC should take more responsibility. (Judy Braiman)

A89. The DEC does accept the responsibility for following up on non-compliance with permits that have been violated. The Department has a policy of following up on all cases within the limits of resources that are available. The actions of the agency related to permit violations are subject to prioritization and protection of human and wildlife health are high priorities. The damage or threat to the environment created by the violation, and the benefit of taking action are some of the factors considered by the Department when allocating resources to non-compliance follow-up. It is a policy of the Department to encourage public citizens to support our actions by forming a partnership with DEC through the authority given in Section 505 of the Clean Water Act. The best partnership is one where citizen actions following up on cases of non-compliance are not duplicative but additive, covering areas beyond the resources of DEC. There are a number of examples of citizen groups working successfully with DEC to take actions related to permit violations. In some areas of the state, DEC extends its resources available for follow-up through formalized agreements with local governments such as counties. The Department encourages citizen participation in the monitoring of environmental problems, the resolution of differences and the development of solutions.

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7. DRINKING WATER SYSTEM ISSUES

C90: Is research being done on cleaning up pipes that carry drinking water? The pipes in Rochester are very old. (Susan Sarini) There are drinking water quality problems in Brighton that occur when there is a change in flow direction. (Marion Gilmour)

A90. As part of the development of the RAP, no research has been done on drinking water distribution systems. The RAP is focusing on the quality of the water in the Rochester Embayment. However, both the City of Rochester and the Monroe County Water Authority have aggressive water main cleaning/lining and replacement programs to upgrade the water distribution systems. The City of Rochester Water Bureau is in the process of evaluating water pipe corrosion control technologies that, once implemented, should lower lead levels in water, reduce "red" water problems, and help reduce biofilm bacteria within the distribution system whose water comes from the Hemlock Lake water supply.

Distribution system turbidity problems such as those that occur in Brighton, most often result from hydraulic disturbances (e.g., flow reversals and hydrant flushing). These episodes are usually very localized and of short duration and represent an aesthetic rather than a sanitary problem. Parts of Brighton are particularly susceptible because the distribution system contains some older unlined cast iron pipe, the area is supplied primarily by the unfiltered Hemlock supply that the Monroe County Water Authority purchases from the City of Rochester, and major flow reversals can occur when the area is switched over to the Lake Ontario supply. Since taking over operation of the water distribution system from the Town of Brighton, the Water Authority has aggressively targeted these problem areas with its pipe replacement and cement relining programs. A study is also currently under way to minimize flow reversal disruptions in the area. Further relief should occur with the completion of the City of Rochester's filtration plant at Hemlock Lake in 1993.

C91. Lead can leach from faucets, and pipes. (Judy Braiman)

A91. It is true that lead can leach from solder used to connect water pipes in homes. In some cases there may be old lead pipe in homes as well. Efforts are being made by the New York State and Monroe County Health Departments to educate people on how to minimize the impact of the leaching of lead. For further information on how to minimize exposure to lead in your drinking water, contact the Environmental Protection Agency Lead Hotline at 1-800-LEAD FYI or the Monroe County Health Department at 274-6057.

C92. All kinds of things have accumulated on the inside of the water mains to taint the water just as much as they do the fish. (Marion Gilmour) I represent Citizens of East Rochester for Reverse Osmosis. I have an EPA study that notes that of 400 compounds, only 40 have been reduced in the Great Lakes. It is because of the concern of chemicals in Lake Ontario that our group feels it is important to have our own groundwater supply in East Rochester. (John Ryan) Where is the data which tells us what the concentrations of various types of chemicals are in the drinking water?

A92. Drinking water taken from Lake Ontario and treated by the Monroe County Water Authority meets all state and federal standards including those for toxic compounds. The Monroe County Water Authority conducts an extensive quarterly monitoring program for 140 different inorganic and organic compounds. A report summarizing the quarterly data is available to customers upon request. The source of the fish consumption problem stems from contaminated sediments, and the processes known as bioaccumulation and bioconcentration, rather than a problem in the water. Most of the persistent organic pollutants such as mirex and PCBs are not very soluble in water and end up settling with sediments. Through bioaccumulation and bio-concentration, toxic compounds that settle in the sediments move up the food chain into the fish, eventually returning to the sediments when the fish die. The State Health Department and others continue to survey drinking water quality with the latest methods.

C93: What kind of water filtration is used by the Monroe County Water Authority? (John Ryan)

A93. The Monroe County Water Authority water drawn from Lake Ontario is treated at the Shoremont Water Treatment Plant, a 140 million gallon a day direct filtration facility using constant rate dual media filters. The filter media consists of approximately 10 inches of anthracite coal on top of approximately 20 inches of sand. After filtering, the water is then treated with chlorine for disinfection.

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8. EDUCATION

C94: People need more education. As a nurse I have been asked by people if they can throw antibiotics down the toilet, and I cannot answer that question. (Susan Sarini)

A94. Education on water quality issues and the water system is needed. Small quantities of antibiotics can be flushed down the toilet for disposal.

C95: We all have a personal responsibility for keeping the environment safe and clean. We all have to share the responsibility rather than assuming the government will clean it all up. How can we develop a way to change the way people look at our environment? (Tom Baird)

A95. We recognize that an education program will be crucial to improving and protecting Rochester Embayment water quality. We will be further developing ideas of how to achieve this education as part of the Stage II RAP. We welcome the involvement of as many people as possible in developing such remedial measures. If you would like to assist, contact Margit Brazda at the Monroe County Department of Planning and Development, (716) 428-5466. Meanwhile, throughout the writing of the RAP, educational projects are being done. For example a major effort is being taken to educate people on the proper disposal of household hazardous waste. Storm drains in street gutters will be painted with a message, "Don't dump, drains to a stream" and brochures indicating where to recycle these materials will be circulated.

C96: I would welcome anyone coming out to talk to the college students at Finger Lakes Community College as part of the Environmental Conservation/Law program. (Steve Trojanczyk)

A96. This will be kept in mind when developing the educational program needs.

C97: The best project I ever ran with the schools was with storm drain painting and it was done with 5th and 6th graders. This can be done in conjunction with education on how a storm sewer system works and on proper disposal methods of household hazardous waste. It is worth doing. (Steve Lewandowski)

A97. This is a project that is hoped to be implemented soon within Monroe County.

C98: Regarding educational programs, where would the money come? If it came from industry the perspective might be biased. (Judy Braiman)

A98. The Stage II RAP scheduled for completion in the summer of 1993 will evaluate the various possible funding sources for remedial measures including education. The concern about industry funding will be considered.

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9. COMMENTS REGARDING REMEDIAL MEASURES AND THE STAGE II RAP

C99: Are we going to study this to death? There are so many reports sitting on shelves and nothing is done, so I get frustrated when I see another study. Is anything being done now to solve some of these problems? (Tom Baird, Dick Streeter, Jerry Brixner.)

A99: This document (the Stage I RAP) identifies the water quality problems and causes and documents many known improvements that have been made. The second part of this document (the Stage II RAP) is an action plan that will identify what more needs to be done, who should do it, where the funding should come from, and what should be done when. The Stage I document provides much of the justification for required resources to implement actions that will be identified in the Stage II RAP. Continuing public involvement and support will be crucial to insure that actions are taken.

C100: Will conditions improve if the other Counties along the river do not participate in water quality management? (Steve Trojanczyk)

A100: In order to meet many of our goals and objectives, other Counties in the Genesee Basin must be involved and are involved. Each County in the Genesee Basin has already prepared a water quality strategy. We have initiated a Genesee Basin Coordinating Committee to work together to coordinate water quality protection/improvement activities. The Stage II RAP will consider actions that need to be taken throughout the watershed--not just at the Embayment itself.

C101: How are industries such as RG&E and Kodak going to be held accountable? (Dave Miller)

A101: The Stage II RAP, expected to be drafted by summer of 1993, will specify what local pollutant sources are to the extent known. For known sources of pollutants of concern, specific actions will be proposed in the Stage II RAP.

C102: I have been attending meetings on the Lake Ontario Toxics Management Plan for eight years. What I heard at this year's meeting is no different from what I heard five years ago. When asked how many industrial discharge permits had been renewed over the last five years there was no answer. We do not know how to measure progress. The LOTMP calls for reducing PCB discharges yet DEC gives permits to discharge PCBs. When we asked how many permit renewals mandated reductions, they couldn't name one. A report was issued several years ago saying that in five years it will be possible to achieve 50% reduction in the toxics being produced and put out. We are nowhere near that target. Industries fought against approaching even a 20% reduction, and we have a government which is not strict enough when issuing discharge permits. DEC has admitted that they have not mandated any industries to reduce toxics and in fact Kodak is asking for increases, not decreases. When is DEC going to stop giving permits to pollute? How can we get industries to stop polluting, and do you expect industries to work with communities? (Diane Heminway & Judy Braiman)

A102. Permits are given to dischargers of PCBs in order to have a regulatory means of limiting the amounts of the substance released to the waters. PCB loadings from known sources could not be controlled without SPDES permits that include limits on the substance. In most cases, the PCB limits in SPDES permits are at the level of detection of available analytical methodology. The SPDES program has required mandatory reductions in the amounts of pollutants released, along with a schedule to do so, when reductions are necessary to achieve compliance with minimum treatment requirements or receiving water quality standards. This was more common in the past when waste treatment facilities were being required to upgrade. Generators of hazardous waste are currently required to have reduction plans and New York State is developing new regulations requiring generators of other pollutants to have waste reduction plans. SPDES permits are not "permits to pollute" they are a means of limiting the quantities of pollutants discharged to amounts that do not cause water quality standards to be exceeded under worst case conditions in the environment. Industries will work with the local community if it is clear that there is a mandate for a healthy environment and a willingness to accept the costs associated with achieving one.

C103: I would like there to be a real push--including a recommendation in this RAP for toxic use reduction with strict time tables stating written percentage decreases. Before permits (air or water) are given, there should be mandatory reductions of persistent toxics. An example of an end goal that might be set to guide the reductions might be a 50% reduction in 5 years. (Diane Heminway

A103: This idea is being considered in development of the Stage II RAP.

C104: I am very cognizant of the frustrations of the State Agencies because there are a lot of good people working for them. DEC and EPA are both underfunded and understaffed and they do not have the resources to do adequate checking. (Diane Heminway)

A104: No Response

C105: Will the funding for implementation actions be shared by the federal government, industry, and the public? (Steve Trojanczyk)

A105: Specific funding sources will be identified in the Stage II RAP. It is likely that funding will come from all levels of government, business, industry, agriculture and the public.

C106: What are the standards and what progress is being made toward achieving the standards--of really breaking the backs of these pollutants? (John Schoth)

A106: Chapter 4 of the Stage I RAP focuses on current water quality conditions and specific standards. For information on the quality of drinking water obtained from Lake Ontario, see Comment 92 on pages 39 and 40. There is a great deal of information in chapter 4 that includes data on the quality of water, sediment, and biota along with the standards that have been set. For example, chapter 4 notes that some sediment samples taken in the Genesee River have levels of one or more of the following pollutants that are high enough to have the sediments considered as being "heavily polluted." The pollutants of concern are total PCB's, cyanide, arsenic, barium, Chemical Oxygen Demand, Manganese, phosphorus, and total Kjeldahl nitrogen.

C107: If you summarized the levels of pollutants in the mid sixties and early seventies and equated them to what the loadings were, relative to the loadings that are listed now you will be able to tell what progress has been made. (Larry Moriarty)

A107: Persistent toxics were not routinely monitored in the 1960s and early 1970s, so there is little available information to compare. Overall, pollutant loadings from the mid 1960s and early 1970s as compared to the current situation show that BOD and phosphorus are lower than in the past. Better waste treatment is the reason why.

C108: It is very possible that in the not too distant future the Eastman Kodak Company may not be around. Before Kodak goes out of business, the County should make Kodak provide a fund to ensure studies can be done independently. (Dick Streeter)

A108: This comment will be considered in the Stage II RAP when we are investigating and recommending funding sources for remedial actions to address impaired uses where sources have been identified.

C109: Companies who have been discharging into the river may not have reached zero discharge, but you cannot go to zero discharge on everything. (Larry Moriarty)

A109: "Zero discharge" of all pollutants or all toxic pollutants is not currently a goal of this RAP nor would such a goal likely be attainable. However, one goal of the RAP is "Virtual elimination of the toxic substances which cause fish consumption advisories." An objective under that goal is "Scheduled elimination of the releases and runoff of persistent toxic substances that necessitate health advisories for the Rochester Embayment of Lake Ontario." It should be noted that the classification of "persistent toxic substances" is a relatively narrow classification. See further information on the 4 pollutants causing the advisory, in the first question and answer under the heading of "Use Impairments."

C.110: DEC has never brought any action against Kodak and some of their discharges are 100 times the New York State limit. DEC is next to a worthless organization. It does nothing to protect your interests. In fact the DEC is helping to write the new Permit with the Eastman Kodak Company on what they can or cannot discharge. (Dick Streeter)

A110. Since DEC is the agency that is responsible for the SPDES program in New York State, it is required to write the permit. The permittee is required to provide information to DEC regarding factors such as the level of contaminants in untreated wastewater and operational and waste treatment processes at the facility. It is not unreasonable that the operators of the regulated facility have input into the permit that they will be required to comply with.

C111: Have you been talking to any private industry about setting up a filtration system at any locations? (Peter Shortell)

A111: Monroe County has considered installing a "Swirl Concentrator" to concentrate pollutants from storm sewers that carry large amounts of stormwater. The concentrate would be diverted to a sanitary sewer where it would then be directed to treatment, and the remaining stormwater would be discharged to the waterway. We have sought grant funding to conduct such a project, but have not been successful in obtaining funds to date.

C112: What is needed are volunteer environmental police. (Diane Heminway)

A112. We will be investigating this idea as a possible remedial action in Stage II of the RAP Development.

C113. At the conclusion of Stage II RAP, how will recommendations be enforced? Will responsibilities be assigned to certain groups? How do we continue to drive it? Garry Schmitt.

A113. Part of our responsibility in preparing the Stage II RAP is to identify who will have responsibility for each recommended remedial measure. Another responsibility we have in preparing the Stage II RAP is to monitor the success of our implementation. In the Stage II RAP we will outline how the monitoring will occur and how the results will be publicized.

C114. Once we start getting into the analysis of remedial measures, we need to involve the Government Policy Group more. Many remaining problems are from non-point sources that need to be addressed by local governments. The Government Policy Group needs to insure that changes (for example a model local law on storm runoff) are made in a way that causes the least amount of pain. It would be advisable to create a subcommittee of the Government Policy Group who could then report back to the larger group. Such a subcommittee should have representatives of the County, towns, and Villages. (Martin Minchella)

A114. We agree and will work to insure this happens. Sandy Frankel and Jerry Brixner indicated an interest in getting involved in such an effort.

C115. For purposes of water quality and specific remedial measures implementation, the golf course industry should be considered separately from the agricultural industry because of the intensity of turf maintenance at a golf course. Finely maintained turf does not have the leaching effect of agriculture. The golf course industry would like to have a representative participate in the development of the Stage II RAP.

A115. In considering remedial measures, we will consider how remedial measures need to be implemented by different kinds of entities and we will insure that the involvement of golf course interests occurs.

C116. Please describe the method by which you intend to collect data through Phase II of this effort that might have an impact on remedial actions? For example, investigation of the current status of the seeps at the lower falls. What is the timing of the Stage II RAP? (Kevin Hylton).

A116. The Stage II RAP is scheduled to be complete in the summer of 1993. We will not be collecting new data on existing water quality conditions. However, if we are made aware of new information that will impact recommended remedial measures, we will consider the new information.

One recommendation of the Stage II RAP could be further investigation of the seeps at the lower falls. This will be considered by the Water Quality Coordinating Committee who will be coordinating the development of the Stage II RAP.

One thing we will be doing as part of the Stage II RAP development is the prioritization of pollutants of concern. This is being done by a Task Group, and will be reviewed by the Water Quality Management Advisory Committee.

C117. Is this RAP going to be more stringent than existing regulations of the USEPA, ? (Bill Stappenbeck).

A117. The Stage II RAP will make recommendations on what actions need to be taken to meet our goals and objectives. It is likely that the recommended actions made in the Stage II RAP will be consistent with existing regulations, but it is also possible that it might recommend additional regulations.

C118. In response to a request for more industry, business, agriculture involvement in the development of the Stage II RAP, Bob Ottley offered to represent the lawn care industry in developing remedial measures. Bob noted that phosphorus is not widely used by the professional lawn care industry because not much is needed.

A118. Representatives from the Lawn Care Industry and the Golf Courses have been added to the mailing list for the Water Quality Management Advisory Committee so that when these remedial measures are discussed, they can be involved.

C119. What will be the implementation roles of the major players (Ken Gordon).

A119. Those specific roles will be identified in the RAP Stage II.

C120. Will there be public meetings at the time of the Draft Stage II document? (Chris Rau)

A120. yes.

C121: One of the Stage II RAP's major objectives should be to prioritize environmental risk. USEPA believes that the success of the Lakewide Management Plans (LaMP) and RAP programs rests on their ability to prioritize documented ecosystem impairments and address the most pressing problems first. The Stage II RAP must select remedial measures to control the loading of Priority Pollutants from all sources and not select the easy route of addressing known sources that are well documented and regulated. Following this strategy is particularly important since many of the chemicals which are linked to impairments appearing on Table 5-1 Priority Pollutants for the Rochester Embayment and Table 5-2 Highest Priority Pollutants, are no longer produced or used, but they continue to be introduced to the ecosystem through diffuse sources. (Industrial Mgt. Council)

A121: This comment will be considered in development of the Stage II RAP.

C122: An exhaustive, cost/benefit analysis should be prepared for each proposed remedial measure. In the present hard times for both the public and private sectors, resources should be devoted to only the most efficient and effective measures. (Tom Low, Town of Brighton)

A122: Initial cost/benefit analyses will be conducted as part of the Stage II RAP. Exhaustive cost/benefit analyses may not be feasible within the time frame and budget of the Stage II RAP. Policies to insure that public and private sector funds will be appropriately spent will be carefully considered in the development of the Stage II RAP.

APPENDIX B

WATER RESOURCE GOALS

WATER RESOURCE GOALS

GLWQA	U.S. CLEAN WATER	U.S. COASTAL ZONE	NEW YORK STATE WATER RESOURCES	NEW YORK STATE COASTAL RESOURCES	MONROE COUNTY WQMAC
Protection of Human Uses					
	Provide for recreation in and on the water.		Provide for public health and enjoyment of the waters of the state, and for the industrial development of the state.		Public beaches in the Rochester Embayment are open for swimming, based upon best available health and safety standards.
					Fish caught in the Rochester Embayment are safe to eat according to dietary standards which are generally accepted by the scientific community.
Make waters free from human-caused floating or immiscible materials that are unsightly or deleterious.			[Addressed in standards]		Shorelines and waterways are free of objectionable materials which degrade water quality and appearance.
Make waters free from human-caused conditions that interfere with beneficial uses (such as color, odor or taste).			[Addressed in standards]		Drinking water produced from Lake Ontario water has no unpleasant tastes or odors.
Make waters free from human-caused nutrients in amounts that create growths of aquatic life that interfere with beneficial uses.			[Addressed in standards]		The littoral zone of the Rochester Embayment is mesotrophic rather than eutrophic.

GLWQA	U.S. CLEAN WATER	U.S. COASTAL ZONE	NEW YORK STATE WATER RESOURCES	NEW YORK STATE COASTAL RESOURCES	MONROE COUNTY WQMAC
Protection of Human Uses (cont.)					
		Achieve wise use of the land and water resources of the coastal zone, giving full consideration to ecological, cultural, historic and esthetic values as well as to needs for economic development.		Achieve a balance between economic development and preservation that will permit the beneficial uses of coastal resources while preventing their loss or damage.	
		Provide for public access to the coasts for recreation purposes.		Encourage and facilitate public access for recreational purposes.	
		Manage coastal resources to minimize loss of life and property caused by improper development.		Minimize damage to natural resources and property from flooding and erosion, including protection of critical coastal features.	
Protection of Biological Uses					
Make waters free from human-caused conditions that are toxic or harmful to human, animal or aquatic life.	Provide for protection and propagation of fish, shellfish and wildlife.		Provide for the protection and propagation of fish and wildlife, including birds, mammals and other terrestrial and aquatic life.		Water and shoreline habitats within the Rochester Embayment support thriving fish and wildlife populations.
					Diversity of plant and animal communities within the Rochester Embayment are comparable in impacted and unimpacted habitats.

GLWQA	U.S. CLEAN WATER	U.S. COASTAL ZONE	NEW YORK STATE WATER RESOURCES	NEW YORK STATE COASTAL RESOURCES	MONROE COUNTY WQMAC
Protection of Biological Uses (cont.)					
Significant wetland areas within the Great Lakes System that are threatened by urban and agricultural development and waste disposal activities should be identified, preserved and, where necessary, rehabilitated.		Protect natural resources, including wetlands, flood plains, estuaries, beaches, ...and fish and wildlife and their habitat within the coastal zone.		Conserve, protect and where appropriate promote commercial and recreational use of fish and wildlife resources, and conserve and protect fish and wildlife habitats.	The benthic macroinvertebrate community in the Lower Genesee River is not degraded by pollution.
Water Pollution Control					
	Eliminate discharge of pollutants into navigable waters.		Prevent new pollution and abate existing pollution.		
Prohibit discharge of toxic substances in toxic amounts.	Prohibit discharge of toxic pollutants in toxic amounts.		[Addressed in standards]		Virtual elimination of discharges and runoff of persistent toxic substances that necessitate health advisories for the Rochester Embayment.
Virtually eliminate discharge of persistent toxic substances.					
Abate, control and prevent municipal discharges and urban drainage.	[Municipal discharges included in discharge elimination goal]		[Addressed in standards]		Virtual elimination of raw or untreated sewage discharges into the Embayment.
Provide assistance to construct publicly-owned waste treatment works.	Provide assistance to construct publicly-owned waste treatment works.				

GLWQA	U.S. CLEAN WATER	U.S. COASTAL ZONE	NEW YORK STATE WATER RESOURCES	NEW YORK STATE COASTAL RESOURCES	MONROE COUNTY WQMAC
Water Pollution Control (cont.)					
Abate, control and prevent pollution from industrial sources.	[Included in discharge elimination goal]		[Addressed in standards]		
Reduce and control inputs of phosphorus and other nutrients.	[Included in discharge elimination goal]				Scheduled elimnation of point and non-point discharges that impede survival of a healthy and diverse planktonic community.
Abate and control pollution from shipping sources.					
Abate and control pollution from agriculture, forestry and other land use activities.	Develop and implement programs for control of non-point sources of pollution.		Safeguard the waters of the state from non-point source pollution.		Virtual elimination of beach closures due to stormwater runoff.
Assess and control contaminated groundwater and subsurface sources entering the Great Lakes.					
Air Pollution Control					
Implement pollution control measures for the purpose of reducing atmospheric deposition of toxic substances to the Great Lakes Basin Ecosystem.	[U.S. 1990 CLEAN AIR ACT sets up a research program and authorizes the EPA to set emission standards for toxic air pollutants based on their effects on the Great Lakes.]				

GLWQA	U.S. CLEAN WATER	U.S. COASTAL ZONE	NEW YORK STATE WATER RESOURCES	NEW YORK STATE COASTAL RESOURCES	MONROE COUNTY WQMAC
Sediment Pollution Control					
Make waters free from human-caused materials that will settle to form putrescent or otherwise objectionable sludge deposits or that will adversely affect aquatic life or waterfowl.			[Addressed in standards]		Contaminated sediments in the lower Genesee River have no negative impact upon water quality and biota in the Rochester Embayment; sediment quality is suitable for open lake disposal.
Abate and control pollution from all contaminated sediments.					

NOTES:

Goals are quoted or paraphrased from the Great Lakes Water Quality Agreement (GLWQA), the applicable legislation, and the goal statements of the Monroe County Water Quality Management Advisory Committee (WQMAC).

This table does not include the many dozens of goals embodied in the plans of administrative agencies.

WQMAC objectives (means of achieving goals or more detailed expression of goals) were only included when they particularly corresponded to other goals in the area of water pollution control.

The GLWQA and its annexes and the referenced legislation contain many more objectives and programs than could be shown here.

APPENDIX C

SEDIMENT QUALITY CRITERIA

TABLE 1

EPA SEDIMENT CLASSIFICATION CRITERIA OF 1977

PARAMETER	NONPOLLUTED	MODERATELY POLLUTED	HEAVILY POLLUTED
Volatile Solids	<5%	5% - 8%	>8%
COD	<40,000	40,000 - 80,000	>80,000
TKN	<1,000	1,000 - 2,000	>2,000
Oil & Grease (Hexane Solubles)	<1,000	1,000 - 2,000	>2,000
Lead	<40	40 - 60	>60
Zinc	<90	90 - 200	>200
Ammonia	<75	75 - 200	>200
Cyanide	<0.10	0.10 - 0.25	>0.25
Phosphorus	<420	420 - 650	>650
Iron	<17,000	17,000 - 25,000	>25,000
Nickel	<20	20 - 50	>50
Manganese	<300	300 - 500	>500
Arsenic	<3	3 - 8	>8
Cadmium	*	*	>6
Chromium	<25	25 - 75	>75
Barium	<20	20 - 60	>60
Copper	25	25 - 50	>50
Mercury			≥1
Total PCB			≥10

Note: All values in mg/kg dry weight unless otherwise noted.

*Pollutional classification of sediments with total [PCB] between 1.0 and 10.0 mg/kg dry weight determined on case-by-case basis.

Source: International Joint Commission, Dredging Subcommittee. 1982. Guidelines and Register for Evaluation of Great Lakes Dredging Projects.

TABLE 2

BACKGROUND SEDIMENT CONCENTRATIONS

Basin specific background levels of pollutants in sediments of the Great Lakes (mg/kg). Additional work is necessary to quantify background levels of pollutants in the basins where no data currently exists.

	LAKE SUPERIOR					LAKE HURON		LAKE MICHIGAN					LAKE ERIE		LAKE ONTARIO			Recommended Dredging Guideline[4]
	DSB	TBB	IRSB	MaB	KB	NoB	SaB	FB	MwB	WaB	SoB	GHB	WeB	CeB	NiB	MiB	RoB	
Total P	800	700	N/A	1200	1000	1000	700	N/A	N/A	N/A	N/A	N/A	700	1100	1000	700	1600	1000
Total N	3070	3000	N/A	3070	2670	3600	4270	N/A	N/A	N/A	N/A	N/A	1500	1500	2700	2300	2300	2000
Ammonia	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	100
Hg	0.08	0.08	N/A	0.08	0.07	0.04	0.08	N/A	N/A	N/A	0.03	N/A	0.1	0.1	0.08	0.03	0.09	0.3
Pb	18	23.2	N/A	24.6	20.4	16.2	14.4	N/A	N/A	N/A	27.5	N/A	28	28	32	32	30	50
Zn	117	108	N/A	105	118	88	60	N/A	N/A	N/A	120	N/A	70	110	121	101	108	105
Fe	59400	53700	N/A	56000	58800	51600	32200	N/A	N/A	N/A	22278	N/A	N/A	N/A	52500	46200	46200	45500
Cr	50.7	51.8	N/A	49.8	57.1	28.5	30.0	N/A	N/A	N/A	37.1	N/A	N/A	N/A	N/A	N/A	N/A	120
Cu	69	57	N/A	61	69	51	31	N/A	N/A	N/A	21	N/A	30	40	56	46	46	45
Cd	0.9	0.5	N/A	0.8	0.5	1.0	0.4	N/A	N/A	N/A	0.6	N/A	2.0	2.0	1.5	0.9	1.0	1.5
Ni	63.5	59.7	N/A	57.7	64.4	61.1	29.9	N/A	N/A	N/A	32.8	N/A	N/A	N/A	N/A	N/A		90
Mn	0	1000	N/A	1200	900	1100	400	N/A	N/A	N/A	446	N/A	600	600	2300	2300	1700	1625
As	N/A	N/A	N/A	N/A	5	6	3	N/A	N/A	N/A	1.1	N/A	N/A	N/A	N/A	N/A	N/A	8
Cyanide	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.1
Volatile Solids { LOI 600°C	26300	22900	N/A	27300	24000	27800	35200	N/A	N/A	N/A	N/A	N/A	10000	20000	18400	19100	18400	60000
COD	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	50000
PCB	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	0.05
Oil & Grease	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	1500
Other Organic Contaminants	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	Below detection using best available technology. (GLWQA, 1978)

CEB - Central basin
DSB - Duluth sub basin
FB - Fox basin
GHB - Grand Haven basin
IRSB - Isle Royale sub basin
KeB - Keweenaw basin
MaB - Marathon basin
MwB - Milwaukee basin
MiB - Mississauga basin
NiB - Niagara basin
NoB - Nottawasaga basin
RoB - Rochester basin
SaB - Saginaw basin
SoB - Southern basin
TBB - Thunder Bay basin
WaB - Waukegan basin
WeB - Western basin
1 - Kemp and Thomas, 1976
2 - Kemp et al. 1978
3 - Robbins, J (pers. comm.)
4 - Thomas and Mudroch, 1979
N/A = not available

Source: Surveillance Work Group (1987). Guidance on Characterization of Toxic Substances Problems in the Great Lakes Basin. Report to the Great Lakes Water Quality Board. Windsor, Ontario: IJC

TABLE 3

SEDIMENT CRITERIA

Sediment Criteria, Derived for a Variety of Environmental Protection Objectives. (Sediment criteria are normalized to organic carbon (OC) content as ug/gOC; to obtain criteria for bulk sediments in ug/Kg multiply criteria by fraction OC;i.e. for 1% multiply by 10, for 2% OC by 20, etc.)

Substance	Log K_{ow}	Freshwater or Marine F or M	Aquatic Toxicity Basis AWQS/GV/C* ug/l	Aquatic Toxicity Basis Sediment Criterion ug/gOC	Human Health Residue Basis AWQS/GV/C ug/l	Human Health Residue Basis Sediment Criterion ug/gOC	Wildlife Residue Basis AWQS/GV/C ug/l	Wildlife Residue Basis Sediment Criterion ug/gOC
Acenapthene	4.33	F		730**				
Anilene		F		0.0662**				
		M		0.248**				
Aldrin and Dieldrin	5.0	F&M			0.001++	0.1		
		F&M	0.084+	8.4	0.00001+	0.001	0.0077+	0.77
Azinphosmethyl	2.4	F	0.005++	0.001				
		M	0.01++	0.003				
Azobenzene	3.82	F&M			0.07+	0.5		
Benzene	2.0	F&M			6++	0.6		
Benzo(a)pyrene and some other PAHs♦	6.04	F			0.0012++	1.3		
		M			0.0006++	0.7		
Benzidene	1.4	F	0.1++	0.003				
Bis(2-chloro-ethyl) ether	1.73	F&M			0.2+	0.01		
Bis(2-ethylhexyl) phthalate	5.3	F	0.6++	119.7				
Carbofuran	2.26	F	1++	0.2				

Source: NYSDEC (1989). Clean-Up Criteria for Aquatic Sediments.

TABLE 3 (continued)

Substance	Log K_{ow}	Freshwater or Marine F or M	Aquatic Toxicity Basis AWQS/GV/C* ug/l	Aquatic Toxicity Basis Sediment Criterion ug/gOC	Human Health Residue Basis AWQS/GV/C ug/l	Human Health Residue Basis Sediment Criterion ug/gOC	Wildlife Residue Basis AWQS/GV/C ug/l	Wildlife Residue Basis Sediment Criterion ug/gOC
Carbon tetrachloride	2.64	F&M			1.3+	0.6		
Chlordane	2.78	F&M			0.002++	0.001		
		F&M	0.01+	0.006	0.00008+	$8X10^{-8}$	0.01+	0.006
Chlorobenzene	2.84	F&M	5++	3.5				
Chloro-o-toluidine	about 2.0	F&M			6.5+	0.65		
Chlorpyrifos	5.11	F		3.22**				
		M		0.44**				
DDT, DDD & DDE	6.0	F&M					0.001++	1
		F&M						0.828**
		F&M	≤0.05+	≤50	0.00001+	0.01		
Dieldrin	5.0	F		19.5**		0.13**		
		M		5.77**		0.13**		
Diazinon	1.92	F	0.08++	0.007				
Dichlorobenzenes	3.38	F&M	5++	12				
1,2-Dichloroethane	1.48	F&M			24+	0.7		
1,1-Dichloroethylene	1.48	F&M			0.8+	0.02		
2,6-Dinitrotoluene	2.05	F&M			1+	0.1		
Diphenylhydrazine	3.03	F&M			0.1+	0.1		

TABLE 3 (continued)

			Aquatic Toxicity Basis		Human Health Residue Basis		Wildlife Residue Basis	
Substance	Log K_{ow}	Freshwater or Marine F or M	AWQS/GV/C* ug/l	Sediment Criterion ug/gOC	AWQS/GV/C ug/l	Sediment Criterion ug/gOC	AWQS/GV/C ug/l	Sediment Criterion ug/gOC
Endosulfan	3.55	F	0.009++	0.03				
		M	0.001++	0.004				
Endrin	5.6	F&M	0.002++	0.8			0.0019+	0.8
		F		1.04**		0.0532**		
		M		0.215**		0.0532**		
Ethyl Parathion	2.1	F		0.081**				
Heptachlor & Heptachlor epoxide	4.4	F&M	0.001++	0.03	0.00003+	0.0008	0.0038+	0.1
		F				0.11**		
		M				0.104**		
Hexachlorobenzene	6.18	F&M	<5+	<7568	0.0001+	0.15	0.008+	12
Hexachloro-butadiene	3.74	F&M			0.06+	0.3	0.07+	0.4
		F	1++	5.4				
		M	0.3++	1.6				
Hexachloro-cyclohexanes	3.8	F		0.157**				
		F	0.01++	0.06				
		M	0.004++	0.03				
		F&M			0.009+	0.05	0.23+	1.5
Hexachlorocyclo-pentadiene	3.99	F	0.45++	4.4				
		M	0.07++	0.7				
Isodecyldiphenyl phosphate	5.4	F	1.73++	434				

TABLE 3 (continued)

Substance	Log K_{ow}	Freshwater or Marine F or M	Aquatic Toxicity Basis: AWQS/GV/C* ug/l	Aquatic Toxicity Basis: Sediment Criterion ug/gOC	Human Health Residue Basis: AWQS/GV/C ug/l	Human Health Residue Basis: Sediment Criterion ug/gOC	Wildlife Residue Basis: AWQS/GV/C ug/l	Wildlife Residue Basis: Sediment Criterion ug/gOC
Linear alkyl-benzene sulfonates	3.97 (Sodium dodecyl-benzene sulfonate)	F	40++	373				
Malathion	2.2	F&M	0.1++	0.02				
Methoxychlor	4.3	F&M	0.03++	0.6				
Mirex	5.83	F&M F&M			0.001++ 0.0001+	0.7 0.07	0.0055+	3.7
Octachloro-styrene	About 6.0						0.0005+	0.5
Parathion & methyl parathion	2.5	F	0.008++	0.003				
Pentachlorophenol	5.0	F	0.4++	40				
Phenanthrene	4.45	F M		139** 102**				
Phenols, total	2.75	F	1++	0.6				
Phenols, total unchlorinated	2.0	F	5++	0.5				
PCB	6.14	F&M F&M F M	<0.2+	<276	0.000006+	0.008	0.001++ 0.0004+	1.4 0.6 19.5** 41.8**

TABLE 3 (continued)

Substance	Log K_{ow}	Freshwater or Marine F or M	Aquatic Toxicity Basis AWQS/GV/C* ug/l	Aquatic Toxicity Basis Sediment Criterion ug/gOC	Human Health Residue Basis AWQS/GV/C ug/l	Human Health Residue Basis Sediment Criterion ug/gOC	Wildlife Residue Basis AWQS/GV/C ug/l	Wildlife Residue Basis Sediment Criterion ug/gOC
2,3,7,8-Tetra-chlorodibenzo-dioxin	7.0	F&M F&M	<0.001+	<10	$1X10^{-6}$++ $2X10^{-10}$+	0.01 $2X10^{-6}$	 $2X10^{-8}$+	 0.0002
1,1,22-Tetrachloro-ethane	2.56	F&M			0.7+	0.3		
Tetrachloro-ethylene	2.88	F&M			1++	0.8		
O-Toluidine	1.4	F&M			18+	0.45		
Toxaphene	3.3	F&M	0.005	0.01	0.009+	0.02		
Trichlorobenzenes	4.26	F&M	5++	91				
1,1,2-Trichloro-ethane	2.17	F&M			4+	0.59		
Trichloroethylene	2.29	F&M			11++	2		
Triphenyl phosphate	4.59	F	4++	156				
Vinyl chloride	0.6	F&M			18+	0.07		

* AWQS/GV/C = Ambient water quality standard or guidance value in TOGS 1.1.1 or other water quality criterion.
\+ AWQGV proposed by Division of Fish and Wildlife.
++ Current NYS AWQS or GV in TOGS 1.1.1.
** EPA proposed interim sediment criteria; taken from an EPA briefing document for the EPA Science Advisory Board.
♦ The sediment criterion for benzo(a)pyrene also applies to benz(a)anthracene, benzo(b)fluoranthene, benzo-(k)fluoranthene, chrysene, indeno(1,2,3-cd)pyrene, and, methylbenz(a)anthracenes. These PAH have the same TOGS 1.1.1. guidance value as benzo(a)pyrene.

TABLE 3 (continued)

Sediment Criteria for Five Non-polar Substances in 1% and 3% Organic Carbon Content Sediment

Substance	F or M	Sediment Criteria, ug/kg: Aquatic Toxicity Basis	Sediment Criteria, ug/kg: Human Health Residue Basis	Sediment Criteria, ug/kg: Wildlife Residue Basis
Benzo(a)pyrene				
1% OC	F		13*	
	M		7*	
3% OC	F		39*	
	M		21*	
Dichlorobenzenes				
1% OC	F&M	120*		
3% OC	F&M	360*		
Mirex				
1% OC	F&M		7*	37
	F&M		0.7+	
3% OC	F&M		21*	111
	F&M		2.1+	
PCB				
1% OC	F&M		0.08+	14*
	F&M			6+
	F,M			195,418#
3% OC	F&M		0.24+	42*
	F&M			18+
	F,M			585,1254#
2,3,7,8-TCDD				
1% OC	F&M	100+	0.1*	0.002+
	F&M		2×10^{-5}+	
3% OC	F&M	300+	0.3*	0.006+
	F&M		6×10^{-5}+	

* Based on current NYS AWQS or GV in TOGS 1.1.1.

\+ Based on AWQGV proposed by Division of Fish and Wildlife; human health based criteria relate to 1×10^{-6} cancer risk from fish consumption and wildlife based criteria are derived from wildlife fish flesh criteria.

\# EPA proposed interim sediment criteria.

TABLE 3 (continued)

Sediment criteria for metals, ug/g (ppm) except iron which is in percent.

	Background*	Criteria**	Limit of Tolerance***
Arsenic	12	5 (4.0- 5.5)	33
Cadmium	2.5	0.8(0.6- 1.0)	10
Chromium	75	26 (22 - 31)	111
Copper	65	19 (15 - 25)	114
Iron (%)	5.9	2.4 (2 - 3)	4
Lead	55	27 (23 - 31)	250
Manganese	1200	428 (400 -457)	1100
Mercury	0.6	0.11(0.1- 0.12)	2
Nickel	75	22 (15 - 31)	90
Zinc	145	85 (65 -110)	800

* From MOE (1988); upper 95% confidence limit of pre-industrial concentrations in Great Lakes sediments.

** Values in parentheses are "no-effect" and "lowest-effect" levels, respectively, from Persaud (1989).

*** Concentration which would be detrimental to the majority of species, potentially eliminating most. (Persaud 1989)

TABLE 3 (continued)

Sediment Criteria Derived by the Sediment-to-fish Bioaccumulation Method

	PCB		2,3,7,8-TCDD	
	Fish Residue ug/kg	Sediment Criterion*, ug/kg	Fish Residue ug/kg	Sediment Criterion,* ug/kg
Tolerance or Advisory	2000	2000-200	0.01	0.1-0.01
10^{-6} Cancer Risk @ ½ lb/week fish consumption	0.6	0.6-0.06	$1.4X10^{-5}$	$1.4X10^{-4}$-$1.4X10^{-5}$
Wildlife Fish Flesh Criterion	100	100-10	0.003	0.03-0.003

* For PCB and 2,3,7,8-TCDD, the ranges result from dividing the Fish Residue by a fish to sediment accumulation factor of 1-10 and 0.1-1, respectively.

TABLE 3 (continued)

References

EPA. 1989. Briefing report to the EPA Science Advisory Board on the equilibrium partitioning approach to generating sediment quantity criteria. U.S. EPA. Office of Water Regulations and Standards. EPA 440/5-89-002.

Newell, A.J., D.W. Johnson and L.K. Allen. 1987. Niagara River Biota Contamination Project: Fish flesh criteria for piscivorous wildlife. NYSDEC, Bur. Env. Prot., Technical Report 87-3. 182 pp.

Ontario Ministry of the Environment (MOE). 1988. Development of Sediment quality Guidelines. Phase II - Guideline Development. Prepared by Beak Consultants.

Morse, J.W., F.J. Millero, J.C. Cornwell and D. Rickard. 1987. The chemistry of the hydrogen sulfide and iron sulfide systems in natural waters. Earth Science Reviews 24:1-42.

Persaud, D. 1989. Personal communication - Development of Provincial Sediment Quality Guidelines. Ontario Ministry of the Environment.

APPENDIX D
Background on Rationale for Selecting Priority Pollutants for the Rochester Embayment
(Table 5-1)

MONROE COUNTY HEALTH DEPARTMENT
ENVIRONMENTAL HEALTH LABORATORY

435 EAST HENRIETTA ROAD
ROCHESTER, NEW YORK 14620

MEMORANDUM

DATE: 13 April 1993

TO: Margy Peet - Department of Planning & Development

FROM: Richard S. Burton - Department of Health

SUBJECT: **15 April 1992 Memo From R.S. Burton To The RAP Loadings Committee**

At the last meeting of the Water Quality Coordinating Committee you gave me an annotated listing of the chemicals that made up the eighty pollutants we had previously identified as being of concern in the Rochester Embayment. You asked that I fill in the source of some of those listed chemicals. I have attached previous communications on this subject that I believe were distributed to the members of the Technical Group that discussed this issue last fall. As you can see some of the chemicals are on several lists and a few are on only one. Many of the ones that have no source on your list were derived from the Niagara River list of evaluated chemicals; others were added by the Loadings Group at the 6 November 1991 meeting; Cyanide and Total Suspended Solids by Dave Persson and Trichloroethylene by Rick Elliott. This information also includes earlier lists and shows the sequence of a list being built to the 15 April 1992 communication.

The questions that had been raised about the list reflect the variety perspectives that had been brought to this discussion both in the Pollutant Loadings Committee and the Technical Task Group. As we have previously discussed it is not so important what is on the list or not on the list now, but that there is an initial list and a procedure for delisting and adding chemicals so that the list can be dynamic and responsive to new information.

I hope this answers the questions you had regarding the source of listed pollutants, if you need more information give me a call at 274-6820.

RSB/sh

cc: R. Elliott
M. Ballerstein

NROE COUNTY HEALTH DEPARTMENT — 435 EAST HENRIETTA ROAD
VIRONMENTAL HEALTH LABORATORY — ROCHESTER, NEW YORK 14620

we need to indicate the source of these parameters w/o a letter following.

MEMORANDUM

DATE: 15 April 1992

TO: RAP Loadings Committee

FROM: Richard S Burton, Monroe County Environmental Health Laboratory

SUBJECT: Updated Pollutant Load Assessment List (80 pollutants)

Aluminum (D,
Arsenic (A,
Barium (E)
Cadmium (A,D
Chromium (A,D
Cobalt
Copper (A,D
Iron (A,
Lead (A,D
Manganese (D
Mercury (A,
Molybdenum (E
Nickel (A,D
Selenium (A,
Silver (E,
Strontium (E
Vanadium
Zinc (A,D

Alkylated lead (E,

Phosphorus (A,

Cyanide (E

Total Suspended Solids (C

Aldrin (A,
Chlordane (A,
Dieldrin (A,D,
DDT and metabolites (A,
Endosulfan, Total (F
Endrin (A,D,
Heptachlor and Heptachlor epoxide (A,D
Hexachlorocyclohexane (BHC), Total (D,
Methoxychlor (A,
Mirex (Mirex and Photomirex) (A,
Toxaphene (A,D,

large quantity - Acetone
Benzene (E,
Benz(a)anthracene (E,
Benzo(a)pyrene (E,
Benzo(b)fluoranthene (E,
Benzo(k)fluoranthene (E,
Bis(2-ethylhexyl) phthalate (E,
Carbon tetrachloride
Chloroform (F,
Chlorinated dibenzofurans (D
2-Chlorotrifluorotoluene
4-Chlorotrifluorotoluene
Chrysene (E,
1,2-Dichlorobenzene (D
1,3-Dichlorobenzene (D
1,4-Dichlorobenzene (D
Dichlorobromomethane (E
2,4-Dichlorotrifluorotoluene
3,4-Dichlorotrifluorotoluene
Di-n-octyl phthalate (E)
Dioxin (2,3,7,8-TCDD) (D
Fluoranthene (E,
Furan (2,3,7,8-TCDF)
Heptanone
Hexachlorobenzene (D,
Hexachlorobutadiene (E,
Hexane
Methylene chloride (E,
Methyl ethyl ketone
Octochlorostyrene (D,
Pentachlorobenzene (D.
Pentachlorophenol (E,
Phenol (E,
Polychlorinated biphenyls (PCBs), Total (A
Pyrene (E,
1,2,3,4-Tetrachlorobenzene (D,
1,2,4,5-Tetrachlorobenzene
Tetrachloroethylene (E)
2,3,4,5-Tetrachlorophenol
2,3,5,6-Tetrachlorophenol
Tetrahydrofuran
Toluene (E,
1,2,3-Trichlorobenzene (D,
1,2,4-Trichlorobenzene (D
1,3,5-Trichlorobenzene (D
1,1,1-Trichloroethane — typo. should have been 1,1,1-Trichloroethylene
2,4,5-Trichlorophenol (E
2,4,6-Trichlorophenol (E)
2,3,6-Trichlorotoluene
2,4,5-Trichlorotoluene

(A) = GLWQA objective set
(B) = Exceeds std. or criteria
(C) = Possible or known link to impairment
(D) = Toxic as listed in LOTMP
(E) = LOTMP evidence of presence at levels ... with (Category II A ...)

F = GLWQA ...

ROE COUNTY HEALTH DEPARTMENT
VIRONMENTAL HEALTH LABORATORY

435 EAST HENRIETTA ROAD
ROCHESTER. NEW YORK 14620

MEMORANDUM

DATE: 2 October 1992

TO: Priority Pollutants Task Group

FROM: Richard S Burton, Health Department

SUBJECT: **RAP Pollutant Loadings Committee Load Assessment List: Prioritization**

Derivation of the list.

As detailed in the attached 1 October 1992 memorandum, the Pollutant Load Assessment List used by the RAP Technical Group Pollutant Loadings Committee was derived from several lists of pollutants of concern. The majority of substances on the final list are in the Niagara River Toxics Management Plan, to which were added other pollutants of local concern. Attached is a re-sorted list which shows which substances were from which references.

It should be noted that 2,3,7,8-Tetrachlorodibenzofuran (2,3,7,8-TCDF) and Chlorinated dibenzofurans, which include 2,3,7,8-TCDF, are separately listed (2,3,7,8-TCDF is considered the most toxic of the chlorinated furans). However, only 2,3,7,8-Tetrachlorodibenzodioxin (2,3,7,8-TCDD), the most toxic of the chlorinated dioxins, is listed, although other dioxins are considered toxic; the assumption is made that all dioxins are reported as their 2,3,7,8-TCDD equivalent.

Prioritization and planning.

The entire list should be considered the long-term list around which strategic planning should focus. To set short term tactical plans, the list should be prioritized into groups of ten substances of greatest concern.

The top ten items needing local remediation should be identified, and a three-year plan should be developed to address those pollutants, establishing goals and remedial action plans for each.

A second group of ten should be identified to look ahead to the next three years and begin obtaining the data which will be needed to determine whether local remediation is needed.

This task group might meet every three years to review status of the previous three year plan, and to set new action items for the next three-year plan.

Our recommendation would be to select the IJC's "Eleven Pollutants of Greatest Concern", with the exception of Dieldrin, as our top ten. Dieldrin could be deferred to the second group. Thus, the top ten list would be as follows:

Polychlorinated biphenyls (PCBs)
DDT and metabolites
Toxaphene
Dioxin (2,3,7,8-TCDD)
Furan (2,3,7,8-TCDF)
Mirex
Mercury
Benzo(a)pyrene
Hexachlorobenzene
Alkylated Lead

Our recommendation for the second group of ten pollutants to be addressed includes the following:

Dieldrin
Chlordane
Octochlorostyrene
BTX (Benzene,Toluene,Xylene)
Phenols
Cadmium
Silver
Zinc
Phosphorus
Cyanide

RAP Technical Group Pollutant Loadings Committee Pollutant Load Assessment List

leven Critical Pollutants identified by the IJC Water Quality Board

- ++* Polychlorinated biphenyls (PCBs),Tot
- ■ ++* DDT and metabolites
- ■ ++* Dieldrin
- ■ * Toxaphene
- ■ ++* Dioxin (2,3,7,8-TCDD)
- * Furan (2,3,7,8-TCDF)
- ■ ++* Mirex (Mirex and Photomirex)
- ■¤++* Mercury
- ■ * Benzo(a)pyrene
- ■ ++* Hexachlorobenzene
- * Alkylated lead

\+ Substances which exceed LOTMP standards: 2 October 1990 memo from G.Mikol to B.Butler

- \+ Aluminum
- ■ + Chlordane
- ■ ++* Dioxin (2,3,7,8-TCDD)
- \+ Iron
- ■ ++* Mirex (Mirex and Photomirex)
- ■¤++* Mercury
- ■ ++* Polychlorinated biphenyls (PCBs), Total
- ■ ++* DDT and metabolites
- ■ ++* Dieldrin
- ■ ++* Hexachlorobenzene
- ■ + Octochlorostyrene
- ¤+ Phosphorus

¤ Summary of needs for SPDES permit data: 5 March 1990 letter from S.Sherwood to B.Butler

- ¤+ Phosphorus
- ¤ Silver
- ■¤ Zinc
- ■¤ Cadmium
- ■¤ Lead
- ■¤ Chromium
- ■¤++* Mercury
- ■¤ Benzene
- ■¤ Toluene

¥ Added at 6 November 1991 meeting of RAP Technical Group Pollutant Loadings Committee

- ¥ Cyanide
- ¥ Total Suspended Solids
- ¥ 1,1,1-Trichloroethylene

■ Toxic substances evaluated in the Niagara River Toxics Management Plan

- ■ Arsenic
- ■ Benz(a)anthracene
- ■ * Benzo(a)pyrene
- ■ Benzo(b)fluoranthene
- ■ Benzo(k)fluoranthene
- ■ + Chlordane
- ■ Chrysene
- ■ ++* DDT and metabolites
- ■ ++* Dieldrin
- ■ ++* Dioxin (2,3,7,8-TCDD)
- ■ ++* Hexachlorobenzene
- ■¤ Lead
- ■¤++* Mercury
- ■ ++* Mirex (Mirex and Photomirex)
- ■ + Octochlorostyrene
- ■ ++* Polychlorinated biphenyls (PCBs),Tot
- ■ Tetrachloroethylene
- ■ * Toxaphene
- ■ Aldrin
- ■ Barium
- ■ Hexachlorocyclohexane (BHC), Total
- ■¤ Benzene
- ■ Bis(2-ethylhexyl) phthalate
- ■¤ Cadmium
- ■ Carbon tetrachloride
- ■¤ Chromium
- ■ Cobalt
- ■¤ Copper
- ■ 1,2-Dichlorobenzene
- ■ 1,3-Dichlorobenzene
- ■ 1,4-Dichlorobenzene
- ■ Di-n-octyl phthalate
- ■ Endosulfan, Total
- ■ Endrin
- ■ Fluoranthene
- ■ Heptachlor and Heptachlor epoxide
- ■ Hexachlorobutadiene
- ■ Manganese
- ■ Methoxychlor
- ■ Methylene chloride
- ■ Nickel
- ■ Pentachlorobenzene
- ■ Pentachlorophenol
- ■ Phenol
- ■ Pyrene
- ■ Selenium
- ■ 1,2,3,4-Tetrachlorobenzene
- ■ 1,2,4,5-Tetrachlorobenzene
- ■ 2,3,4,5-Tetrachlorophenol
- ■ 2,3,5,6-Tetrachlorophenol
- ■ Tetrahydrofuran
- ■¤ Toluene
- ■ 1,2,3-Trichlorobenzene
- ■ 1,2,4-Trichlorobenzene
- ■ 1,3,5-Trichlorobenzene
- ■ 2,4,5-Trichlorophenol
- ■ 2,4,6-Trichlorophenol
- ■ Vanadium
- ■¤ Zinc
- ■ Chloroform
- ■ Acetone
- ■ Chlorinated dibenzofurans
- ■ 2-Chlorotrifluorotoluene
- ■ 4-Chlorotrifluorotoluene
- ■ Dichlorobromomethane
- ■ 2,4-Dichlorotrifluorotoluene
- ■ 3,4-Dichlorotrifluorotoluene
- ■ Heptanone
- ■ Hexane
- ■ Methyl ethyl ketone
- ■ Molybdenum
- ■ Strontium
- ■ 2,3,6-Trichlorotoluene
- ■ 2,4,5-Trichlorotoluene

COUNTY HEALTH DEPARTMENT
NMENTAL HEALTH LABORATORY

435 EAST HENRIETTA ROAD
ROCHESTER, NEW YORK 14620

MEMORANDUM

DATE: 1 October 1992

TO: Richard S Burton, Laboratory Administrator

FROM: Lisa P Spittal, Senior Chemist

SUBJECT: **Pollutants on the Loadings Committee List of 80**

Per your request, the Pollutant Load Assessment List used by the RAP Technical Group Pollutant Loadings Committee has been reviewed to determine information sources which resulted in each analyte's inclusion on the list.

The initial list, distributed on 18 October 1991, was generated from the following:

Eleven Critical Pollutants Identified by the Water Quality Board, as listed in the IJC Virtual Elimination Task Force publication: Persistent Toxic Substances: Virtually Eliminating Inputs to the Great Lakes. Interim report, July 1991. ISBN 1-895085-27-0.

Seven substances that exceed enforceable standards in the Lake Ontario Toxics Management Plan, and four substances the exceed unenforceable criteria, as listed in the 2 October 1990 memorandum from G.Mikol to B.Butler.

Summary of needs for SPDES permit data, as listed in the 5 March 1990 letter from S.Sherwood to B.Butler.

Toxic substances evaluated in the Niagara River Toxics Management Plan.

Three additional substances were added at the 6 November 1991 meeting of the Pollutant Loadings Committee, as documented in minutes dated 26 November 1991, revised 31 December 1991. (NB. Those minutes also indicate addition of Phosphorus, which was already on the original list.)

Attached is a copy of the final list, annotated to illustrate which analytes were indicated by which references; copies of the references are also attached.

RAP Technical Group Pollutant Loadings Committee
Pollutant Load Assessment List

+	Aluminum
■	Arsenic
■	Barium
■¤	Cadmium
■¤	Chromium
■	Cobalt
■¤	Copper
+	Iron
■¤	Lead
■	Manganese
■¤+*	Mercury
■	Molybdenum
■	Nickel
■	Selenium
¤	Silver
■	Strontium
■	Vanadium
■¤	Zinc
*	Alkylated lead
¤+	Phosphorus
¥	Cyanide
¥	Total Suspended Solids
■	Aldrin
■ +	Chlordane
■ +*	Dieldrin
■ +*	DDT and metabolites
■	Endosulfan, Total
■	Endrin
■	Heptachlor and Heptachlor epoxide
■	Hexachlorocyclohexane (BHC), Total
■	Methoxychlor
■ +*	Mirex (Mirex and Photomirex)
■ *	Toxaphene

■	Acetone
■¤	Benzene
■	Benz(a)anthracene
■ *	Benzo(a)pyrene
■	Benzo(b)fluoranthene
■	Benzo(k)fluoranthene
■	Bis(2-ethylhexyl) phthalate
■	Carbon tetrachloride
■	Chloroform
■	Chlorinated dibenzofurans
■	2-Chlorotrifluorotoluene
■	4-Chlorotrifluorotoluene
■	Chrysene
■	1,2-Dichlorobenzene
■	1,3-Dichlorobenzene
■	1,4-Dichlorobenzene
■	Dichlorobromomethane
■	2,4-Dichlorotrifluorotoluene
■	3,4-Dichlorotrifluorotoluene
■	Di-n-octyl phthalate
■ +*	Dioxin (2,3,7,8-TCDD)
■	Fluoranthene
*	Furan (2,3,7,8-TCDF)
■	Heptanone
■ +*	Hexachlorobenzene
■	Hexachlorobutadiene
■	Hexane
■	Methylene chloride
■	Methyl ethyl ketone
■ +	Octochlorostyrene
■	Pentachlorobenzene
■	Pentachlorophenol
■	Phenol
■ +*	Polychlorinated biphenyls (PCBs), Total
■	Pyrene
■	1,2,3,4-Tetrachlorobenzene
■	1,2,4,5-Tetrachlorobenzene
■	Tetrachloroethylene
■	2,3,4,5-Tetrachlorophenol
■	2,3,5,6-Tetrachlorophenol
■	Tetrahydrofuran
■¤	Toluene
■	1,2,3-Trichlorobenzene
■	1,2,4-Trichlorobenzene
■	1,3,5-Trichlorobenzene
¥	1,1,1-Trichloroethylene
■	2,4,5-Trichlorophenol
■	2,4,6-Trichlorophenol
■	2,3,6-Trichlorotoluene
■	2,4,5-Trichlorotoluene

* Eleven Critical Pollutants identified by the IJC Water Quality Board
+ Substances which exceed LOTMP standards: 2 October 1990 memo from G.Mikol to B.Butler
¤ Summary of needs for SPDES permit data: 5 March 1990 letter from S.Sherwood to B.Butler
■ Toxic substances evaluated in the Niagara River Toxics Management Plan
¥ Added at 6 November 1991 meeting of RAP Technical Group Pollutant Loadings Committee

ıROE COUNTY HEALTH DEPARTMENT · 435 EAST HENRIETTA ROAD
ɴVIRONMENTAL HEALTH LABORATORY ROCHESTER, NEW YORK 14620

MEMORANDUM

DATE: 15 April 1992

TO: RAP Loadings Committee

FROM: Richard S Burton, Monroe County Environmental Health Laboratory

SUBJECT: Updated Pollutant Load Assessment List (80 pollutants)

Aluminum
Arsenic
Barium
Cadmium
Chromium
Cobalt
Copper
Iron
Lead
Manganese
Mercury
Molybdenum
Nickel
Selenium
Silver
Strontium
Vanadium
Zinc

Alkylated lead

Phosphorus

Cyanide

Total Suspended Solids

Aldrin
Chlordane
Dieldrin
DDT and metabolites
Endosulfan, Total
Endrin
Heptachlor and Heptachlor epoxide
Hexachlorocyclohexane (BHC), Total
Methoxychlor
Mirex (Mirex and Photomirex)
Toxaphene

Acetone
Benzene
Benz(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Bis(2-ethylhexyl) phthalate
Carbon tetrachloride
Chloroform
Chlorinated dibenzofurans
2-Chlorotrifluorotoluene
4-Chlorotrifluorotoluene
Chrysene
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Dichlorobromomethane
2,4-Dichlorotrifluorotoluene
3,4-Dichlorotrifluorotoluene
Di-n-octyl phthalate
Dioxin (2,3,7,8-TCDD)
Fluoranthene
Furan (2,3,7,8-TCDF)
Heptanone
Hexachlorobenzene
Hexachlorobutadiene
Hexane
Methylene chloride
Methyl ethyl ketone
Octochlorostyrene
Pentachlorobenzene
Pentachlorophenol
Phenol
Polychlorinated biphenyls (PCBs), Total
Pyrene
1,2,3,4-Tetrachlorobenzene
1,2,4,5-Tetrachlorobenzene
Tetrachloroethylene
2,3,4,5-Tetrachlorophenol
2,3,5,6-Tetrachlorophenol
Tetrahydrofuran
Toluene
1,2,3-Trichlorobenzene
1,2,4-Trichlorobenzene
1,3,5-Trichlorobenzene
1,1,1-Trichloroethylene
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
2,3,6-Trichlorotoluene
2,4,5-Trichlorotoluene

.ROE COUNTY HEALTH DEPARTMENT
.NVIRONMENTAL HEALTH LABORATORY

435 EAST HENRIETTA ROAD
ROCHESTER, NEW YORK 14620

MEMORANDUM

DATE: 18 October 1991

TO: Paul Schmied, New York State Department of Environmental Conservation

FROM: Richard S Burton, Monroe County Environmental Health Laboratory

SUBJECT: **Pollutant Load Assessment List to be Searched (80 pollutants)**

Aluminum
Arsenic
Barium
Cadmium
Chromium
Cobalt
Copper
Iron
Lead
Manganese
Mercury
Molybdenum
Nickel
Selenium
Silver
Strontium
Vanadium
Zinc

Alkylated lead

Phosphorus

Aldrin
Chlordane
Dieldrin
DDT and metabolites
Endosulfan, Total
Endrin
Heptachlor and Heptachlor epoxide
Hexachlorocyclohexane (BHC), Total
Methoxychlor
Mirex (Mirex and Photomirex)
Toxaphene

Acetone
Benzene
Benz(a)anthracene
Benzo(a)pyrene
Benzo(b)fluoranthene
Benzo(k)fluoranthene
Bis(2-ethylhexyl) phthalate
Carbon tetrachloride
Chloroform
Chlorinated dibenzofurans
2-Chlorotrifluorotoluene
4-Chlorotrifluorotoluene
Chrysene
1,2-Dichlorobenzene
1,3-Dichlorobenzene
1,4-Dichlorobenzene
Dichlorobromomethane
2,4-Dichlorotrifluorotoluene
3,4-Dichlorotrifluorotoluene
Di-n-octyl phthalate
Dioxin (2,3,7,8-TCDD)
Fluoranthene
Furan (2,3,7,8-TCDF)
Heptanone
Hexachlorobenzene
Hexachlorobutadiene
Hexane
Methylene chloride
Methyl ethyl ketone
Octochlorostyrene
Pentachlorobenzene
Pentachlorophenol
Phenol
Polychlorinated biphenyls (PCBs), Total
Pyrene
1,2,3,4-Tetrachlorobenzene
1,2,4,5-Tetrachlorobenzene
Tetrachloroethylene
2,3,4,5-Tetrachlorophenol
2,3,5,6-Tetrachlorophenol
Tetrahydrofuran
Toluene
1,2,3-Trichlorobenzene
1,2,4-Trichlorobenzene
1,3,5-Trichlorobenzene
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
2,3,6-Trichlorotoluene

APPENDIX E

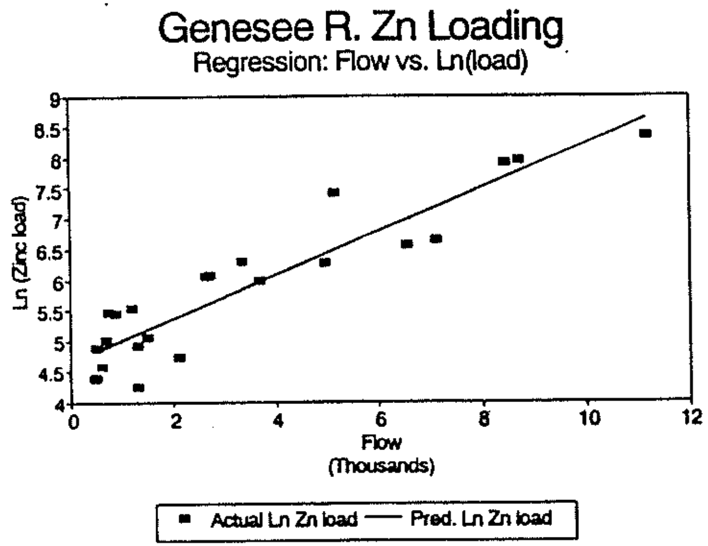
Background and Loading Estimate Calculations used in Chapter 5

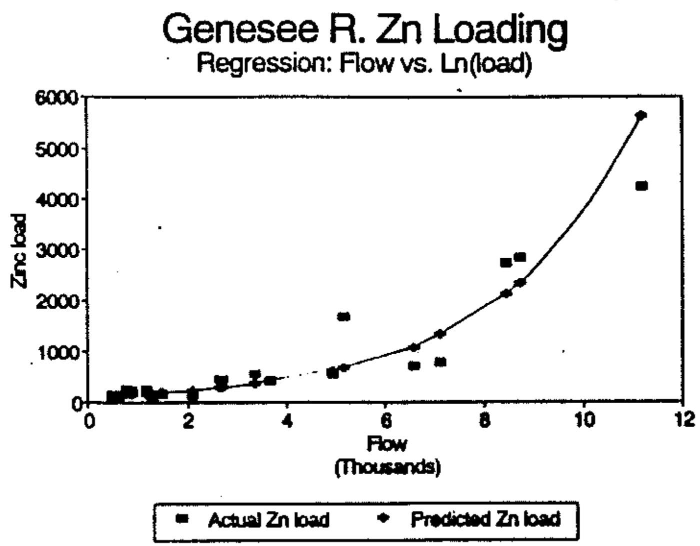
Methodology for Estimating Comparative Loadings 10/31/92

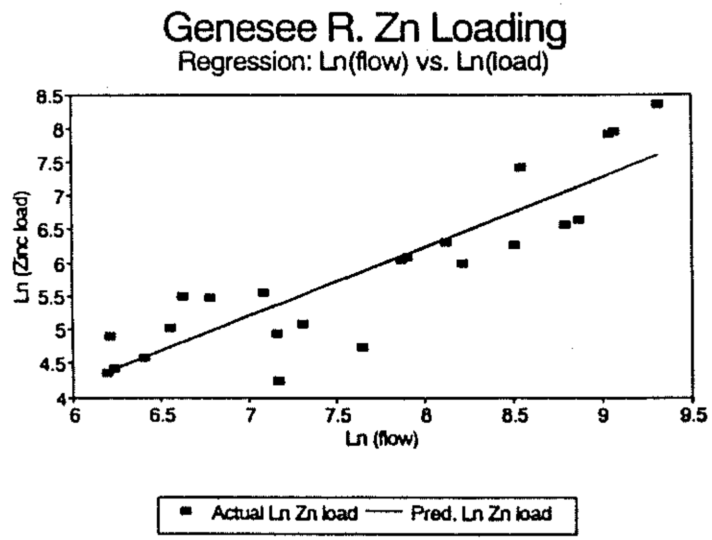
a. Total Loadings from the Genesee River (Table 5-11)

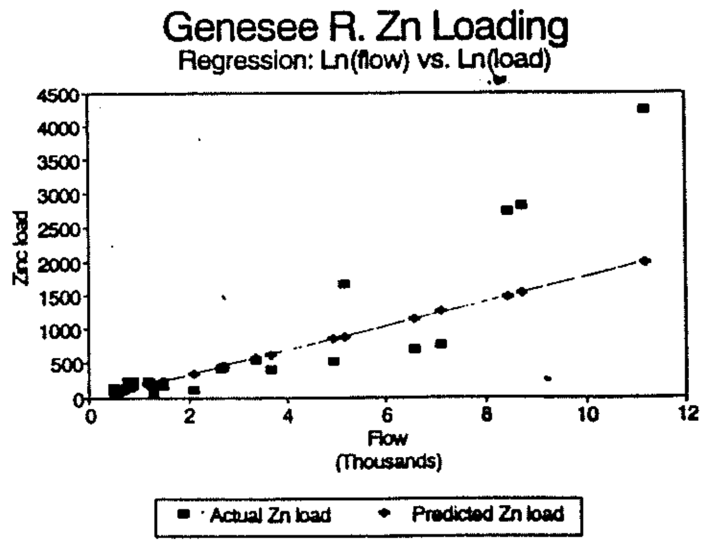
In order to determine annual loadings of the water quality parameters in question, daily loadings on the sampling dates were correlated with the river flow on those dates. (Method suggested by Don Sherwood, USGS Ithaca). Whenever possible, "total recoverable" values were used for metals. The tests for this began in 1988, so the data used for the correlation was from 1988-1990. Some metals continue to be measured as "dissolved." Data used for these metals was from 1986-1990. For Total Suspended Solids and Total Phosphorus calculations, the data used went back to 1980. The regression equations thus generated were then applied to the flow on each day of the water year 1990. The daily loadings were added to arrive at an annual loading figure.

Correlations of pollutant loadings with flow were generally good, particularly at Geneseo. Each was plotted in three different ways to see which yielded the closest fit: Flow vs. Load, Natural Log (Ln) (flow) vs. Load, and Ln (flow) vs. Ln(load). Different pollutants may behave differently due to their sources and the way in which they are carried by the river (dissolved or suspended, etc.) In deciding which regression equation to use, it was necessary to look at which was the best straight-line fit (had the highest correlation coefficient) and which gave the best estimate of the high values, since those high values will make the greatest contribution to the annual loading. When two equations had similar correlation coefficients, the one that estimated the high values better was used. As an example, look at the plots of zinc loading for the Genesee River at Charlotte Docks. The regression plots for Flow vs. Ln(load) and Ln(flow) vs. Ln(load) both approximate straight lines, or at least do not show an obvious curvature. Correlation coefficients are .85 and .79, respectively. But by plotting these graphs without the log transformations, it is possible to see the difference in the way that the regression equations predict the higher loadings. The Flow vs. Ln(load) equation appears to be a better predictor of high values than the Ln(flow) vs. Ln(load) equation. The total annual loading computed using the Flow vs. Ln(load) equation is 111 tons. Using the other equation, the annual load computed is 89 tons.


Genesee R. Zn Loading
Regression: Flow vs. Ln(load)
Ln (Zinc load)
Flow
(Thousands)
Actual Ln Zn load
Pred. Ln Zn load


Genesee R. Zn Loading
Regression: Flow vs. Ln(load)
Zinc load
Flow
(Thousands)
Actual Zn load
Predicted Zn load

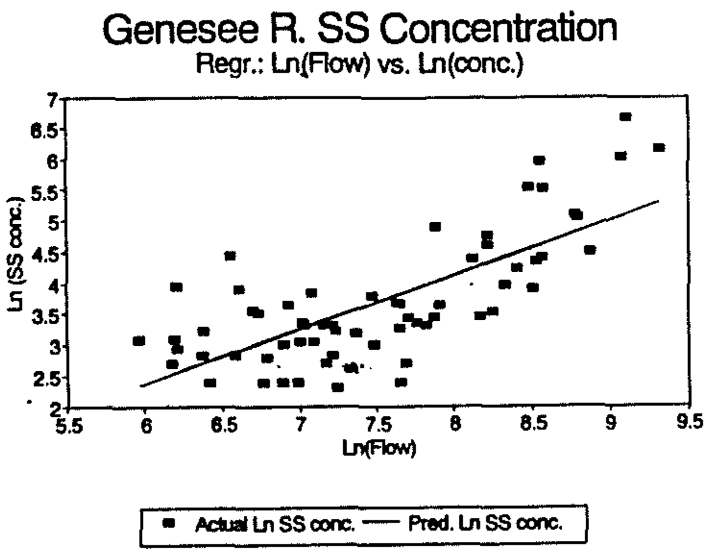

Genesee R. Zn Loading
Regression: Ln(flow) vs. Ln(load)
Ln (Zinc load)
Ln (flow)
Actual Ln Zn load
Pred. Ln Zn load

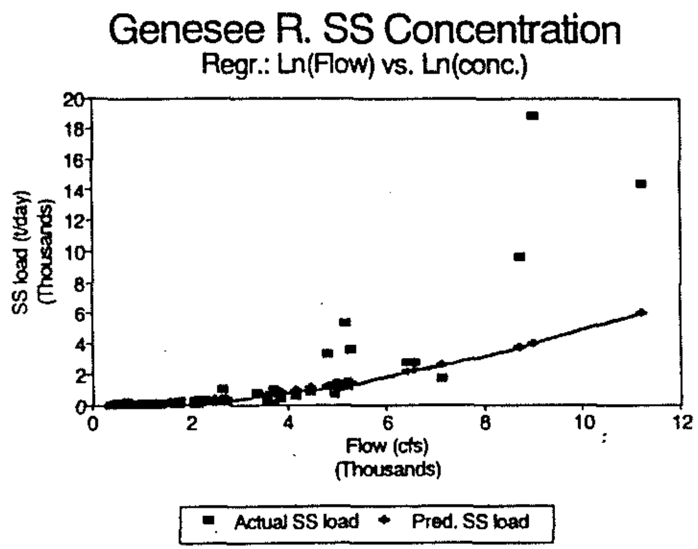

Genesee R. Zn Loading
Regression: Ln(flow) vs. Ln(load)
Zinc load
Flow
(Thousands)
Actual Zn load
Predicted Zn load

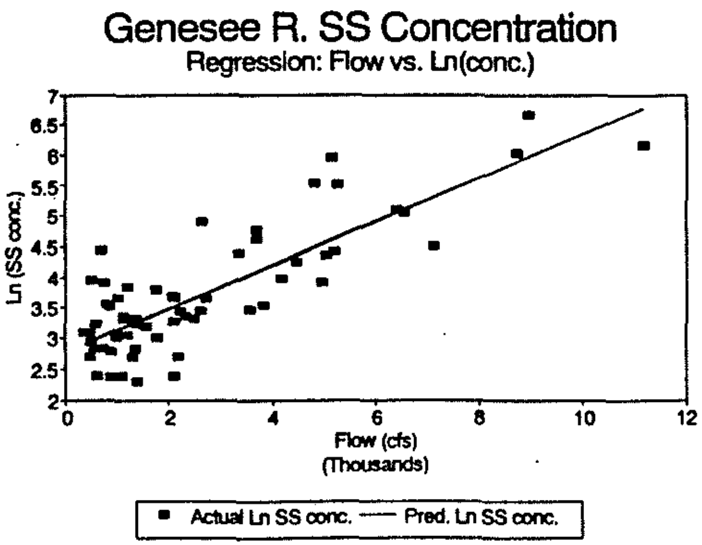
Total suspended solids presented a problem because the regression lines calculated to predict suspended solids from actual data either underestimated or overestimated the two highest values by a large amount. The problem was addressed by using concentration instead of loading to correlate with flow. The high values were less exaggerated this way, and the predicted loadings better approximated them. After the regression was run, the concentrations were converted into loadings. The second highest loading occurred in April, 1990 during spring runoff when the river flow was at its greatest. But the highest loading occurred in June, 1982 at a considerably lower river flow. (In early June many farm fields are bare and particularly susceptible to erosion.) More sampling during spring runoff and storm events will be needed to improve on loading estimates for all parameters.

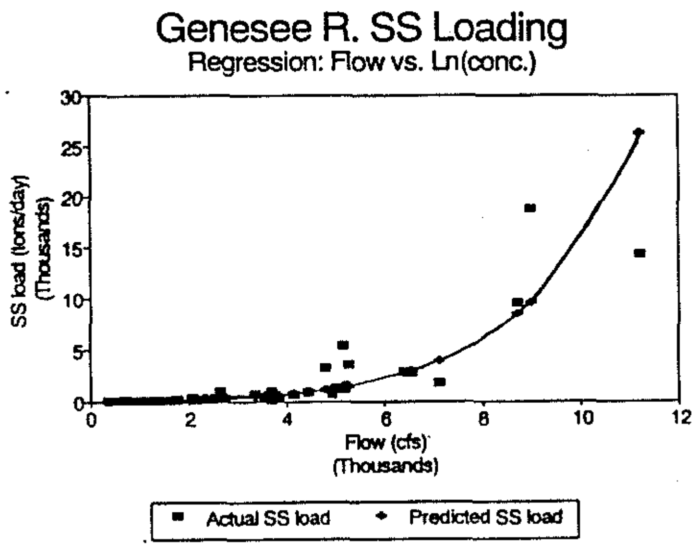
Note: multiple regression may be able to generate better estimates using the data available.

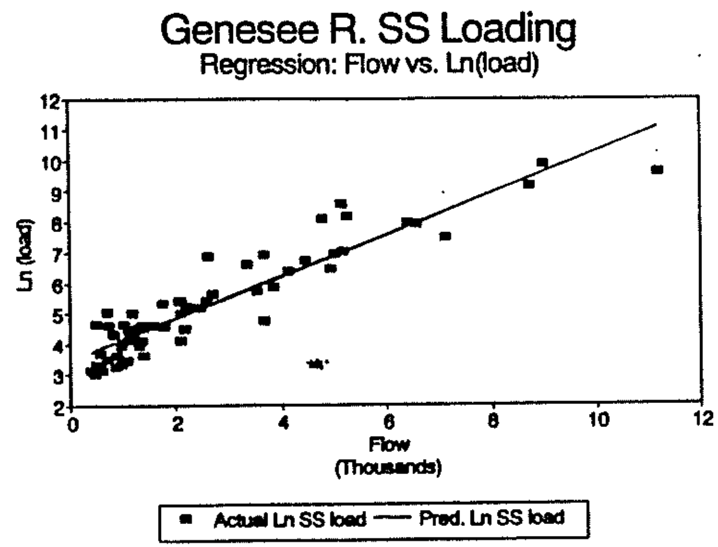
The following graphs show the different ways in which suspended solids regressions were run. The graphs on the left show the log-transformed data and the regression line (predicted values). The graphs on the right show how the predicted values compare with actual values without the log transformation. The last graph is the one that was considered the best.

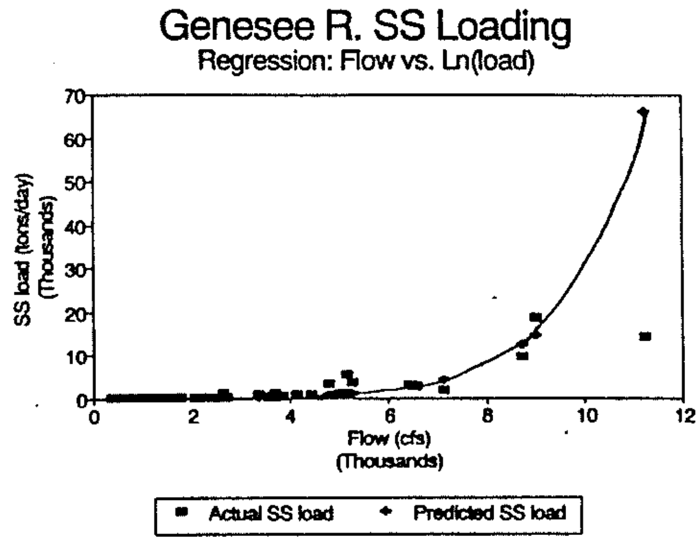

Genesee R. SS Concentration
Regr.: Ln(Flow) vs. Ln(conc.)
Ln (SS conc.)
Ln(Flow)
Actual Ln SS conc.
Pred. Ln SS conc.

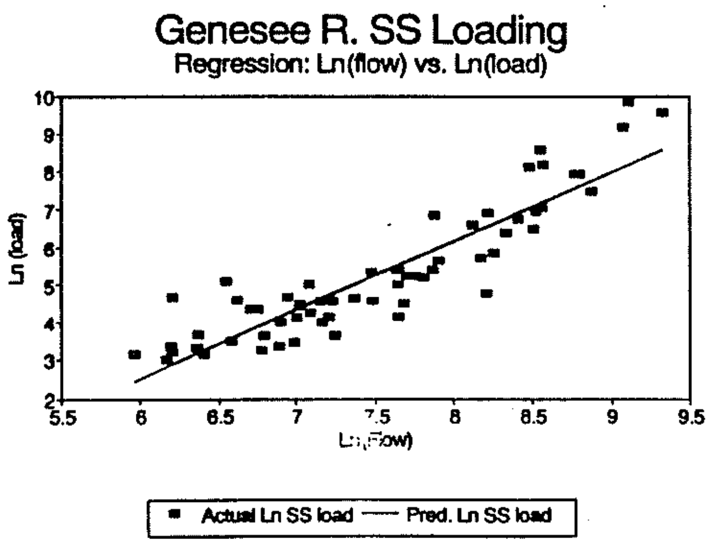

Genesee R. SS Concentration
Regr.: Ln(Flow) vs. Ln(conc.)
SS load (t/day)
(Thousands)
Flow (cfs)
(Thousands)
Actual SS load
Pred. SS load

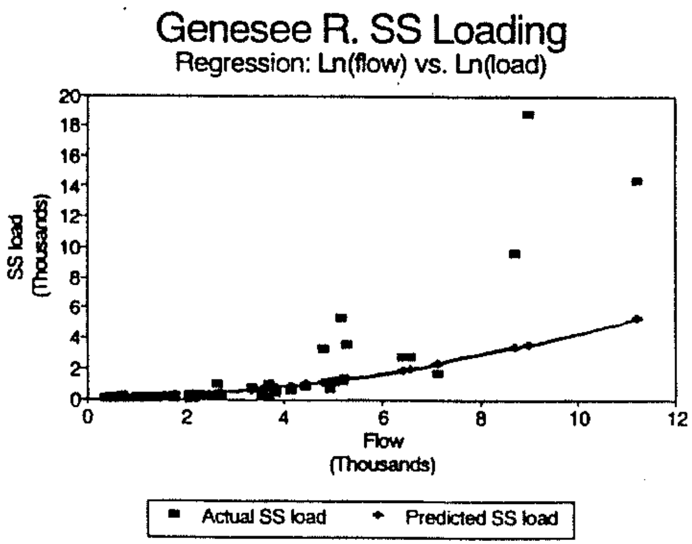

Genesee R. SS Concentration
Regression: Flow vs. Ln(conc.)
Ln (SS conc.)
Flow (cfs)
(Thousands)
Actual Ln SS conc.
Pred. Ln SS conc.


Genesee R. SS Loading
Regression: Flow vs. Ln(conc.)
SS load (tons/day)
(Thousands)
Flow (cfs)
(Thousands)
Actual SS load
Predicted SS load


Genesee R. SS Loading
Regression: Flow vs. Ln(load)
Ln (load)
Flow
(Thousands)
Actual Ln SS load
Pred. Ln SS load


Genesee R. SS Loading
Regression: Flow vs. Ln(load)
SS load (tons/day)
(Thousands)
Flow (cfs)
(Thousands)
Actual SS load
Predicted SS load


Genesee R. SS Loading
Regression: Ln(flow) vs. Ln(load)
Ln (load)
Actual Ln SS load
Pred. Ln SS load


Genesee R. SS Loading
Regression: Ln(flow) vs. Ln(load)
SS load
(Thousands)
Flow
(Thousands)
Actual SS load
Predicted SS load

Regression equations used for all parameters at Charlotte Docks are shown below. Graphs of these equations follow. (Whether calculations are done in tons or pounds is arbitrary.)

Total Suspended Solids:

No. of observations: 34

$Y = .000357X + 2.766$ $R^2 = .69$
Std. error of Y = 0.57

Where:
Y = Ln(conc. in mg/L)
X = flow in cfs
R^2 = correlation coefficient

TSS load (tons/day) = $e^{(.000357X + 2.766)}X \times .00277$

Where:
X = flow in cfs
.00277 = conversion factor

Total Phosphorus:

No. of observations: 44 (10/80 - 8/90)

$Y = .000405X - 2.077$ $R^2 = .52$
Std. error of Y = 0.74

Where:
Y = Ln(load in tons/day)
X = flow in cfs
R^2 = correlation coefficient

P load (tons/day) = $e^{(.000405X - 2.077)}$

Where X = flow in cfs

Arsenic (dissolved):

No. of observations: 16

$Y = 0.00455X + 0.665$ $R^2 = .86$
Std. error of Y = 3.175

Where:
Y = As load in lbs/day
X = flow in cfs
R^2 = correlation coefficient

Barium (dissolved):

No. of observations: 16

$Y = 0.861X - 0.406$ $R^2 = .96$
Std. error of Y = 0.150

Where:
Y = Ln(load in lbs/day)
X = Ln(flow in cfs)
R^2 = correlation coefficient

Ba load (lbs/day) = $e^{(0.861X - 0.406)}$

Where X = Ln(flow in cfs)

Cadmium (total recoverable):

No. of observations: 24

$Y = .903X - 4.52$ $R^2 = .69$
Std. error of Y = 0.631

Where:
Y = Ln(load in lbs/day)
X = Ln(flow in cfs)
R^2 = correlation coefficient

Cd load (lbs/day) = $e^{(.903X - 4.52)}$

Where X = Ln(flow in cfs)

Copper (total recoverable):

No. of observations: 24

$Y = 1.077X - 3.556$ $R^2 = .87$
Std. error of Y = 0.432

Where:
Y = Ln(load in lbs/day)
X = Ln(flow in cfs)
R^2 = correlation coefficient

Cu load (lbs/day) = $e^{(1.077X - 3.556)}$

Where X = Ln(flow in cfs)

Iron (total recoverable):

No. of observations: 24

$Y = 1.984X - 12.56$ $R^2 = .91$
Std. error of Y = 0.669

Where:
Y = Ln(load in tons/day)
X = Ln(flow in cfs)
R^2 = correlation coefficient

Fe load (tons/day) = $e^{(1.984X - 12.56)}$

Where X = Ln(flow in cfs)

Lead (total recoverable):

No. of observations: 24

$Y = 0.000422X + 2.450$ $R^2 = .74$
Std. error of Y = 0.789

Where:
Y = Ln(load in lbs/day)
X = Flow in cfs
R^2 = correlation coefficient

Pb load (lbs/day) = $e^{(0.000422X + 2.450)}$

Where X = Flow in cfs

Manganese (total recoverable):

No. of observations: 24

$Y = 1.188X - 9.475$ $R^2 = .82$
Std. error of Y = 0.532

Where:
Y = Ln(load in tons/day)
X = Ln(flow in cfs)
R^2 = correlation coefficient

Mn load (tons/day) = $e^{(1.188X - 9.475)}$

Where X = Ln(flow in cfs)

Mercury (total recoverable):

No. of observations: 23

$Y = 1.094X - 8.474$ $R^2 = .72$
Std. error of Y = 0.721

Where:
Y = Ln(load in tons/day)
X = Ln(flow in cfs)
R^2 = correlation coefficient

Hg load (tons/day) = $e^{(1.094X - 8.474)}$

Where X = Ln(flow in cfs)

Nickel (total recoverable):

No. of observations: 24

$Y = 1.392X - 6.452$ $R^2 = .90$
Std. error of Y = 0.471

Where:
Y = Ln(load in lbs/day)
X = Ln(flow in cfs)
R^2 = correlation coefficient

Ni load (lbs/day) = $e^{(1.392X - 6.452)}$

Where X = Ln(flow in cfs)

Zinc (total recoverable):

No. of observations: 24

$Y = 0.000354X + 4.666$ $R^2 = .85$
Std. error of Y = 0.462

Where:
Y = Ln(load in lbs/day)
X = flow in cfs
R^2 = correlation coefficient

Zn load (lbs/day) = $e^{(0.000354X + 4.666)}$

Where X = flow in cfs

Regression equations at Geneseo are:

Total Suspended Solids:

No. of observations: 19

$Y = .811X - 1.37$ $R^2 = .84$
Std. error of Y = 0.473

Where:
Y = Ln(conc. in mg/L)
X = Ln(flow in cfs)
R^2 = correlation coefficient

TSS load (tons/day) = $e^{(0.811X - 1.37)}X \times .00277$

Where:
X = Ln(flow in cfs)
.00277 = conversion factor

Total Phosphorus: Not measured at Geneseo

Arsenic: Not measured at Geneseo

Cadmium (total recoverable): Most values below detection limit.

Copper (total recoverable):

No. of observations: 23

$Y = 1.273X - 5.035$ $R^2 = .96$
Std. error of Y = 0.352

Where:
Y = Ln(load in lbs/day)
X = Ln(flow in cfs)
R^2 = correlation coefficient

Cu load (lbs/day) = $e^{(1.273X - 5.035)}$

Where X = Ln(flow in cfs)

Iron (total recoverable):

No. of observations: 23

$Y = 1.795X - 10.43$ $R^2 = .96$
Std. error of Y = 0.459

Where:
Y = Ln(load in tons/day)
X = Ln(flow in cfs)
R^2 = correlation coefficient

Fe load (tons/day) = $e^{(1.795X - 10.43)}$

Where X = Ln(flow in cfs)

Lead (total recoverable):

No. of observations: 23

$Y = 1.491X - 7.313$ $R^2 = .92$
Std. error of Y = 0.588

Where:
Y = Ln(load in lbs/day)
X = Ln(flow in cfs)
R^2 = correlation coefficient

Pb load (lbs/day) = $e^{(1.491X - 7.313)}$

Where X = Ln(flow in cfs)

Manganese (total recoverable):

No. of observations: 23

$Y = 1.386X - 10.82$ $R^2 = .98$
Std. error of Y = 0.288

Where:
Y = Ln(load in tons/day)
X = Ln(flow in cfs)
R^2 = correlation coefficient

Mn load (tons/day) = $e^{(1.386X - 10.82)}$

Where X = Ln(flow in cfs)

Mercury (total recoverable): Most values below detection limit.

Nickel (total recoverable):

No. of observations: 23

$Y = 1.631X - 8.262$ $R^2 = .94$
Std. error of Y = 0.530

Where:
Y = Ln(load in lbs/day)
X = Ln(flow in cfs)
R^2 = correlation coefficient

Ni load (lbs/day) = $e^{(1.631X - 8.262)}$

Where X = Ln(flow in cfs)

Zinc (total recoverable):

No. of observations: 23

$Y = 1.543X - 6.220$ $R^2 = .91$

Std. error of Y = 0.648

Where:

Y = Ln(load in lbs/day)

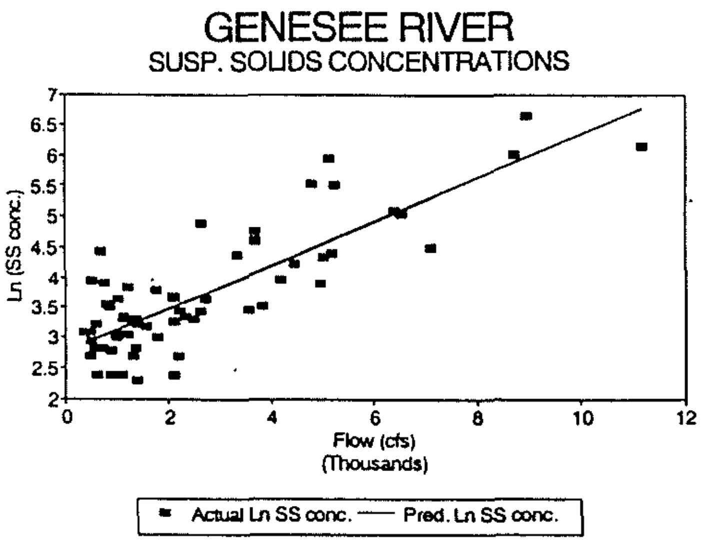
X = Ln(flow in cfs)

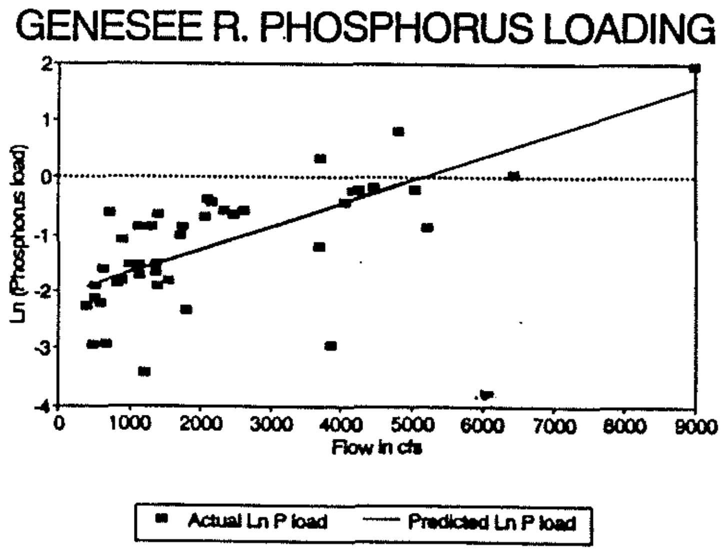
R^2 = correlation coefficient

Zn load (lbs/day) = $e^{(1.543X - 6.220)}$

Where X = Ln(flow in cfs)

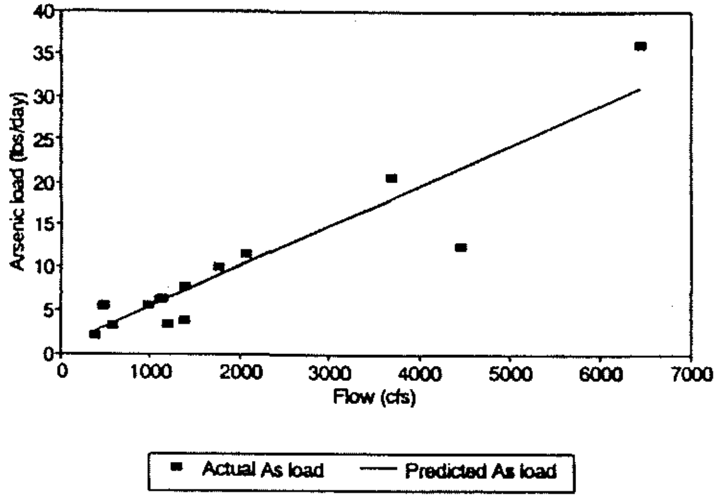
REGRESSION GRAPHS



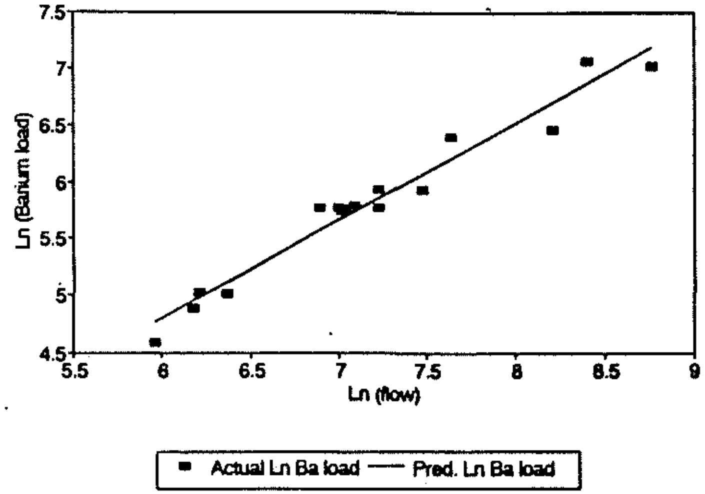


REGRESSION GRAPHS

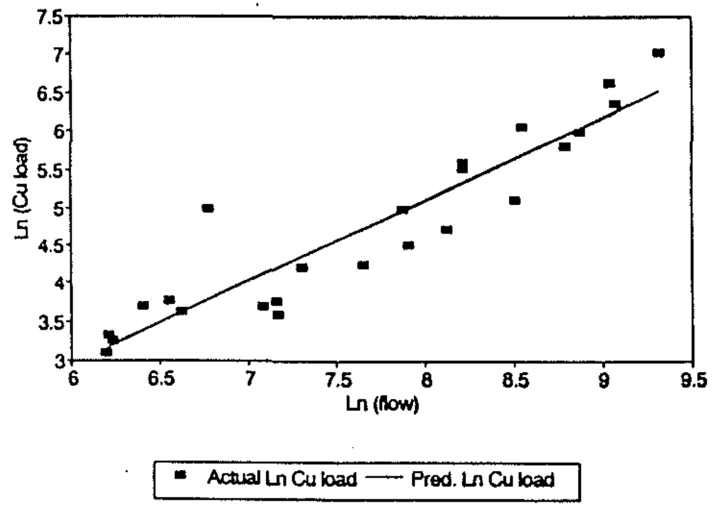
GENESEE R. ARSENIC LOADING



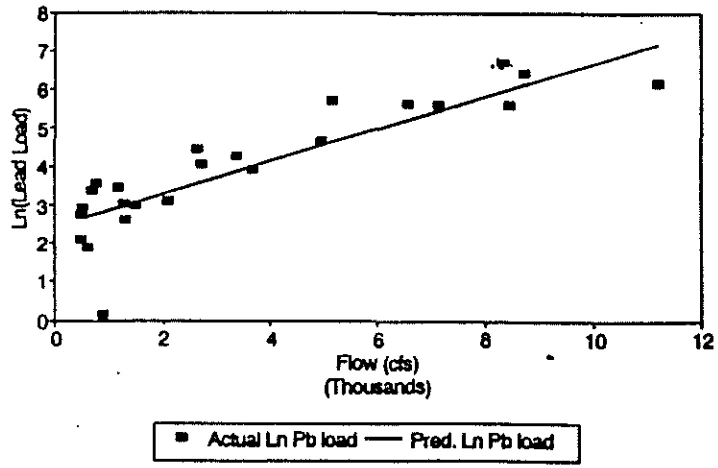
GENESEE R. BARIUM LOADING



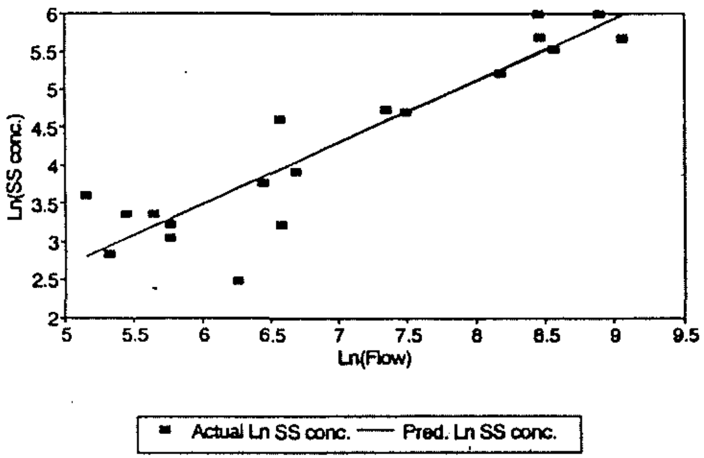
GENESEE R. COPPER LOADING



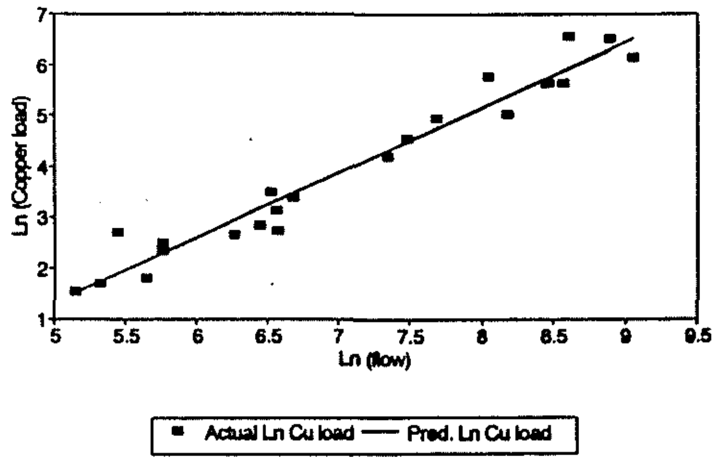
GENESEE RIVER
LEAD LOADING



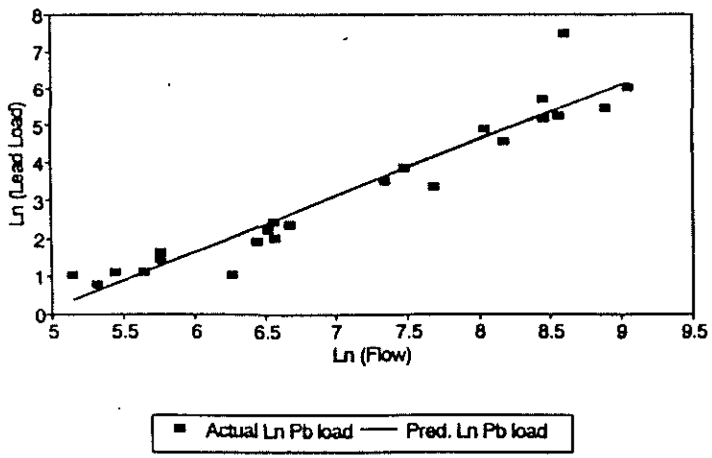
Upper Genesee R. SS Conc.



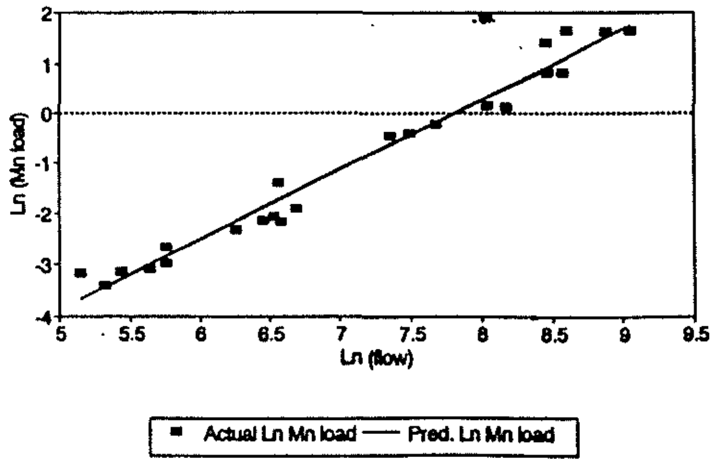
UPPER GENESEE RIVER
COPPER LOADINGS



UPPER GENESEE RIVER
LEAD LOADING

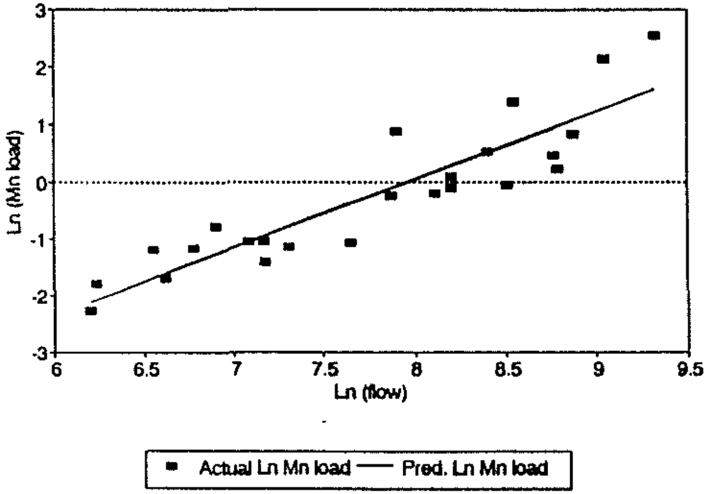


UPPER GENESEE RIVER
MANGANESE LOADING

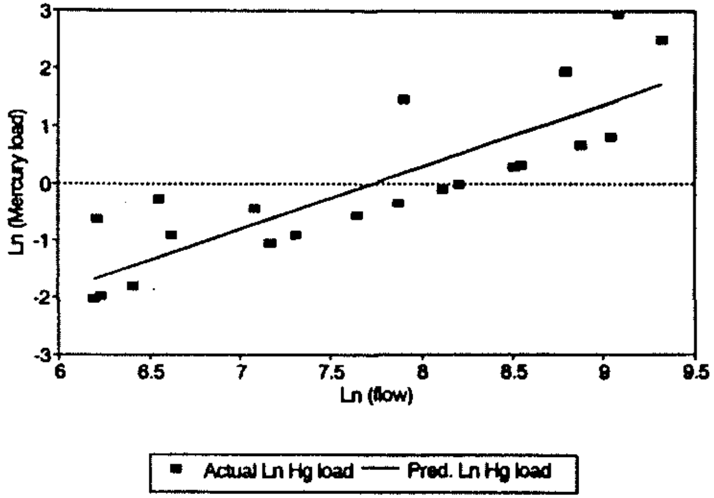


REGRESSION GRAPHS

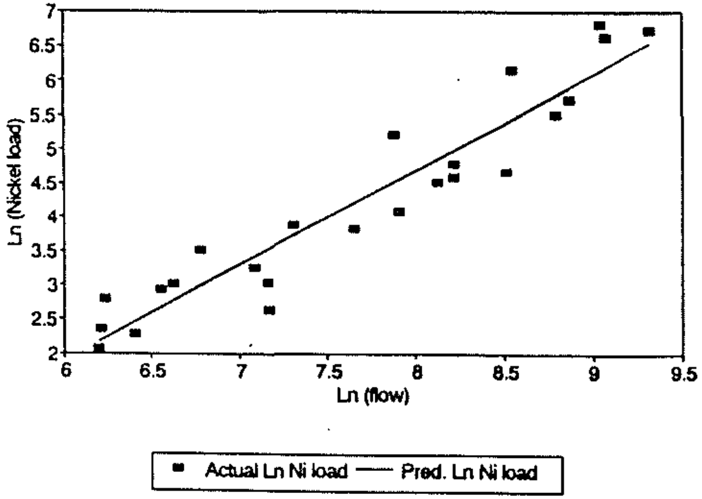
GENESEE R. MANGANESE LOADING



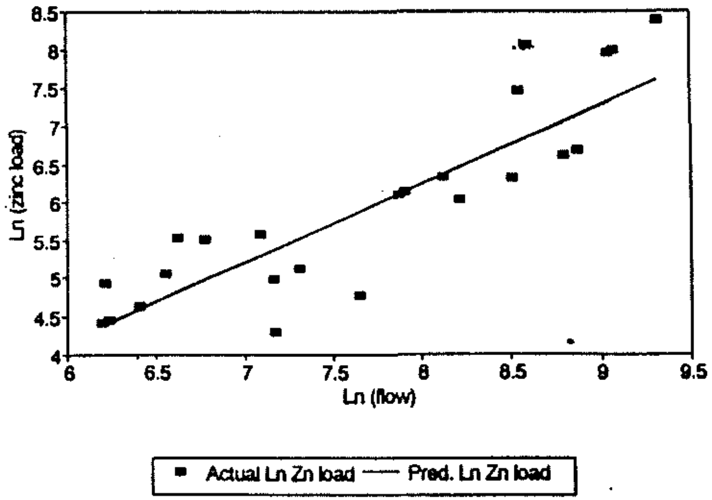
GENESEE R. MERCURY LOADING

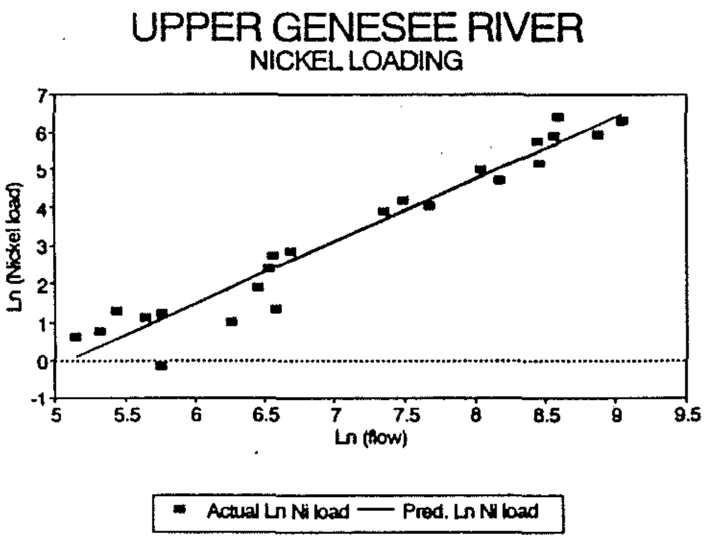


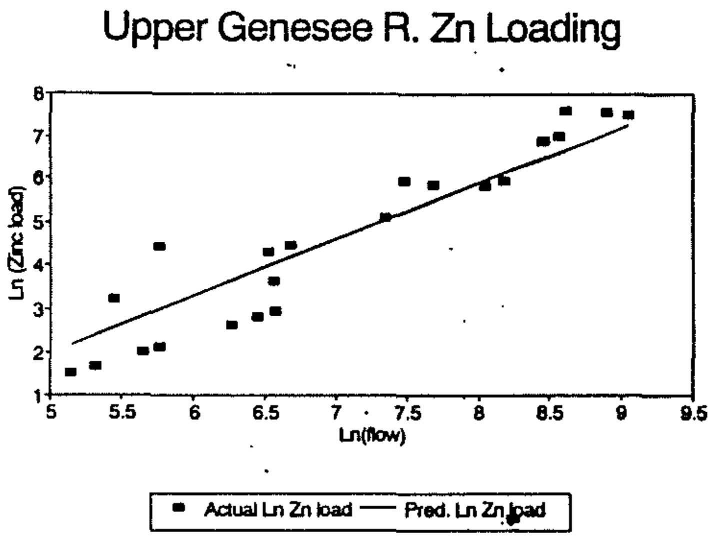
GENESEE RIVER NICKEL LOADING



GENESEE RIVER ZINC LOADING




UPPER GENESEE RIVER
NICKEL LOADING
Ln (Nickel load)
Ln (flow)
Actual Ln Ni load
Pred. Ln Ni load


Upper Genesee R. Zn Loading
Ln (Zinc load)
Ln(flow)
Actual Ln Zn load
Pred. Ln Zn load

b. Dredge Loadings (Table 5-12)

The annual or biennial dredging of Rochester Harbor deposits sediments and their associated pollutants from the Genesee River into Lake Ontario. Loadings of these sediment-associated pollutants were calculated using Corps of Engineers data on total volume dredged in 1990 and the chemical analyses of the sediment samples (Aqua Tech, 1990). The Aqua Tech data is shown in chapter 4, Table 4-5. Pollutant concentrations from 11 sample sites were averaged and then multiplied by the total amount of sediment dredged. The Corps expresses sediment volumes in cubic yards; pollutant concentrations are measured in mg/kg. Thus it is necessary to know the density and the % solids of each sample in order to calculate the loadings. This information is provided in the Aqua Tech data.

When comparing loadings from the river to loadings from dredging, it is important to note that river samples are taken at Charlotte Docks, which is near the upper limit of dredging. Most of the dredged material is taken from areas downstream of that sample point.

c. Nonpoint Source Estimates (Table 5-23)

Data derived from Nationwide Urban Runoff (NURP) studies of the Irondequoit Basin (Kappel *et al*, 1986) were used to determine runoff loadings to the embayment from its watershed. Only the Western, Central, and lower Genesee Basins were deemed similar enough to the Irondequoit Basin to utilize extrapolated NURP results; Allegany County has a very different type of landscape, with wooded hills and narrow valleys, as opposed to the more gently rolling agricultural landscape of the rest of the study area. Therefore runoff calculations were not performed for the Genesee Basin upstream of Geneseo.

NURP studies were carried out between July, 1980 and August, 1981. Average monthly rainfall at Rochester during that time was 2.78 inches. During the water year October, 1989-September, 1990 the average monthly rainfall was 3.00 inches, 7.9% greater.

The methods used to estimate nonpoint source runoff were as follows:

(1). Urban and Suburban Watersheds

In the Irondequoit Basin, the export of several pollutants of interest to this study was shown to bear an exponential relationship to the percent of impervious area in the watershed. Plotting the percent imperviousness vs. the log of the annual load per unit area appears as a straight line. Figures 5-2 through 5-5 show this relationship for suspended sediments, total phosphorus, lead, and zinc.

The regression lines for these curves were determined to be the following:

Total Suspended Solids (TSS):

$Y = .137X + .671 \quad R^2 = .79$

Where:
X = % impervious
Y = Ln(TSS yield) in mg/km^2-yr
R^2 = correlation coefficient

TSS load (tons/yr) = $e^{(.137X + .671)}a \times 2.77$

Where:
X = % impervious
a = land area
2.77 = conversion factor (to convert metric to english units)

Total Phosphorus

$Y = .119X + 1.844 \quad R^2 = .89$

Where:
X = % impervious
Y = Ln(P yield) in kg/km^2-yr
R^2 = correlation coefficient

P load (tons/yr) = $e^{(.119X + 1.844)}a \times .00277$

Where:
X = % impervious
a = land area
.00277 = conversion factor

Total Lead:

$Y = .166X - .409 \quad R^2 = .94$

Where:
X = % impervious
Y = Ln(Pb yield) in kg/km^2-yr
R^2 = correlation coefficient

Pb load (tons/yr) = $e^{(.166X - .409)}a \times .00277$

Where:
X = % impervious
a = land area
.00277 = conversion factor

Total Zinc:

$Y = .035X + 4.88$ $R^2 = .87$

Where:
X = % impervious
Y = Ln(Zn yield) in kg/km^2-yr
R^2 = correlation coefficient

Zn load (tons/yr) = $e^{(.035X + 4.88)}a \times .00277$

Where:
X = % impervious
a = land area
.00277 = conversion factor

The watersheds in the Irondequoit Basin for which these relationships held true had impervious areas ranging from 8 to 32%. The regression equations were used to predict pollutant runoff from other watersheds with percentages of impervious surface within that range. Since these watersheds were mostly located in Monroe County, a 1988 Monroe County land-use map was used to estimate imperviousness. Land areas were placed in four categories with the following imperviousness ratings:

Land Use	Percent Impervious
Low density/rural	6%
Medium density residential	25%
High density residential	31%
Commercial/industrial/ multifamily	40%

These percentages, when applied to test watersheds in the Irondequoit Basin that were surveyed in person as part of the NURP study, yielded the same total percentages of impervious surface as the surveys showed.

(2) Rural Watersheds

The NURP study surveyed a rural watershed (Thornell Road) in Monroe and Ontario Counties. The pollutant yields per unit area for this watershed were used to predict pollutant yields from rural watersheds in the study area. Loadings per unit area were assumed to be the same as in the Thornell study:

Total suspended solids: 29.1 mg/km^2 = 81 $tons/mi^2$

Total phosphorus: 28.5 kg/km^2 = 0.079 $tons/mi^2$

Total lead: 2.19 kg/km^2 = 0.006 $tons/mi^2$

Total zinc: 129 kg/km^2 = 0.36 $tons/mi^2$

(3) Results

Table 5-23 shows results of the calculations described above. Loadings from urbanized areas are calculated using measured areas of the four different land use types, which allows the percentage of imperviousness for the entire watershed to be estimated. Loadings for rural areas are calculated using the Thornell figures described above. Areas of watersheds were estimated by a GIS program based on tracings from a county land use map. They may not be exactly equal to areas listed for these watersheds or basins in other parts of this report.