Chapter 3: Use Impairments, Causes and Sources

Chapter 3: Use Impairments, Causes and Sources
Introduction

The Stage I Remedial Action Plan (RAP), Chapter 4, lists the possible International Joint Commission use impairments (indicators of poor water quality) and identifies those use impairments that exist in the Rochester Embayment Area of Concern (AOC). Stage I also provides documentation of the use impairments and describes their known and possible causes and sources. A summary of the linkages between use impairments identified for the Embayment and their causes and sources is shown in table form in the Stage I RAP, Chapter 6, beginning on page 6-2.

This Stage II chapter:

- Briefly reviews the International Joint Commission use impairments that have been identified for the Rochester Embayment AOC and the more recent evidence that the use impairments exist.
- Includes summaries of studies that have been completed since the 1993 publishing date for the Stage I RAP.
- Updates some of the data that appeared in the Stage I RAP.
- Completes "unfinished business" from the Stage I RAP, such as the outcome of the priority pollutant task group.
- Includes information about causes and sources that has been requested since the Stage I RAP was completed.
- Lists the specific pollutant dischargers for water year 1990.

3.1. International Joint Commission definition

The International Joint Commission (IJC) requires that each Remedial Action Plan include: "A definition and detailed description of the environmental problem in the Area of Concern, including a definition of the beneficial uses that are impaired, the degree of impairment and the geographic extent of such impairment.."

The International Joint Commission 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

For a more complete description of each use impairment, and its guidelines for listing and delisting in an Area of Concern, see the Stage I RAP, pages 4-2 and 4-3.

3.2. Update on activities regarding environmental impacts on human health (text adapted from the IJC Seventh Biennial Report)

Over the past few years, the reports of the International Joint Commission (IJC) have focused on the linkages between persistent toxic substances, environmental conditions and human health. This has been one impetus for the incorporation of human health considerations in the Rochester Embayment RAP (see the Chapter 5 section on "Additional information"). Recent IJC Biennial Reports contained summaries of pertinent research findings that document impacts to humans and a range of fish and wildlife species. Long-term exposure of fish, wildlife and humans to persistent toxic substances has been linked to:

- Reproductive, metabolic, neurological and behavioral abnormalities;
- Immunity suppression leading to susceptibility to infections and other life threatening problems;
- Increasing levels of breast and other cancers.

Available evidence also points to long-term reproductive and intergenerational effects.

There is growing concern about the effects on endocrine systems. Research has shown that persistent chemicals such as PCBs, dioxins, hexachlorobenzene, as well as other organochlorines, are strongly implicated in the disruption of endocrine systems, including estrogenic effects, in laboratory animals and in wildlife. The substances appear to act as environmental hormones that disrupt the normal balance of hormonal activity in animals.

Levels of these chemicals have been found in humans within the same range as those found in adversely affected animals, or in some cases at even higher levels. The biological reactions are known to be similar to those of animals. Many of these hormonally active chemicals are found in fish, wildlife and human tissues in the Great Lakes ecosystem.

A number of studies have indicated that even single doses of some substances at a critical time can affect the offspring of a pregnant animal. Various studies have also indicated increased infertility as well as cancers and other abnormalities in male reproductive systems. Human sperm counts, in some studies, have been reported to have declined by 50% over the past 50 years. Sperm samples tested in one recent Canadian study indicated the presence of several persistent organochlorine substances.

For the IJC, there is sufficient evidence *now* to infer a real risk of serious impacts in humans due to persistent toxic substances. It is the IJC's position that the limits on allowable quantities of these substances entering the environment must be effectively "zero", and that the primary means to achieve "zero" should be the prevention of their production, use and release rather than their subsequent removal.

Part of the IJC's virtual elimination strategy addresses two causes of water contamination that are often ignored: groundwater and incinerators.

3.2.1. Groundwater

Groundwater contamination by persistent toxic substances has been identified in many Great Lakes basin locations. These contaminants may derive from leaking waste disposal and other sites via a combination of natural and anthropogenic pathways. Groundwater discharge to the lake basins contributes to the cycling of toxic loads to and from contaminated sediments throughout the Great Lakes, including in most Areas of Concern.

3.2.2. Incinerators

Various pollutants, including heavy metals and other persistent toxic substances, enter the Great Lakes ecosystem through atmospheric fallout. A number of incinerators operate within the Great Lakes region, contributing significantly to the airborne load of contaminants, especially from the *low*-temperature incineration of industrial, commercial and household refuse containing plastics and solvents, coated papers and many other products. The IJC recognizes that the use of specialized, *high*-temperature incinerators, kilns and other technologies being developed for the programmed destruction of substances such as PCBs is important for eliminating the stockpiles of the substances.

3.2.3. Research Needs

The IJC points out a number of specific research needs for understanding the components and dynamics of the Great Lakes basin ecosystem that involve persistent toxic substances. These include:

- The effects of persistent toxic substances on humans and other biota, including biological and functional problems, particularly the disruption of endocrine, immune and nervous systems; identification of chemicals causing these impacts and their sources;
- The nature and quantity of contaminants in hazardous waste sites and extent of groundwater contamination from these sites;
- Persistence, transport and fate of pathogens and contaminants in and through groundwater;
- Impacts of land-use practices, including pesticide and fertilizer application, deicing, landfills, underground storage, and groundwater-source heat pumps.

Author: Carole Beal (text adapted from the IJC Seventh Biennial Report)

3.3. Use impairments identified in the Rochester Embayment (including the lower Genesee River)

Use impairments in the Rochester Embayment Area of Concern were identified during the preparation of the Stage I Remedial Action Plan. They are summarized in Table 3-1. Some of the use impairments are listed as "unknown". The Area of Concern includes the approximately six miles of the Genesee River that are influenced by lake levels, from the River's mouth to the Lower Falls.

Studies have been proposed or conducted to determine the status and/or unknown sources of use impairments (see Chapter 4, Studies required to complete identification of use impairments and describe pollutant sources). *No additional information has been collected between the publishing of the Stage I RAP and the drafting of the Stage II RAP that would change the status of a use impairment.*

Table 3-1
Use impairments identified in the Rochester Embayment

	Use Impairment	Lower Genesee River	Rochester Embayment
1.	Restrictions on fish and wildlife consumption	yes[1]	yes
2.	Tainting of fish and wildlife flavor	unknown	unknown
3.	Degradation of fish and wildlife populations	yes[2]	yes[2]
4.	Fish tumors or other deformities	unknown	unknown
5.	Bird or animal deformities or reproductive problems[1]	yes[2]	yes[2]
6.	Degradation of benthos	yes	unknown
7.	Restrictions on dredging activities	yes[3]	no
8.	Eutrophication or undesirable algae	not applicable	yes
9.	Drinking water consumption, taste & odor problems	not applicable	yes[4]
10.	Beach closings	not applicable	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

[1] There is no specific fish consumption advisory for the Genesee River. However, most fish species found in the Lower Genesee River spend part of their lifetimes in Lake Ontario and are subject to Lake Ontario contaminants.

[2] Mink reproductive problems

[3] Even if this use impairment were to be "delisted" according to IJC guidelines, it would be unwise to discontinue the restriction on overflow dredging. The restriction should continue indefinitely.

[4] Treated drinking water supplies in the Rochester Embayment watershed are safe. Some taste and odor problems are noticed by customers whose water intake is in the Embayment.

3.4. Evidence for Rochester Embayment use impairments

(Includes some updates of information in the Stage I RAP)

The Stage I RAP, Chapter 4, gives the status in the Rochester Embayment (impaired, not impaired, unknown) for each of the 14 use impairments. For each use impairment identified for the Embayment, the Stage I RAP also gives evidence to support the determination and describe the degree of impairment. A summary of the evidence is presented below. For more complete information, see the Stage I RAP, Chapter 4. The Stage I RAP also summarizes the linkage between each use impairment, and its causes and sources. (See the table on pages 6-2 through 6-5 of the Stage I RAP for the linkages. See also the section in this chapter on "Use impairments, causes and sources, Update of Stage I RAP, Chapter 6.)

Rochester Embayment use impairments

Use Impairment #1: Restrictions on fish and wildlife consumption
Status: Impaired
Evidence: The New York State Department of Health (NYSDOH) annually issues Health Advisories for Chemicals in Sportfish and Game. The most recent Advisory (1996-1997) includes the following recommendations for Lake Ontario, due to polychlorinated biphenyls (PCBs), mirex and dioxin:

Women of childbearing age, infants and children under the age of 15 should eat no fish from Lake Ontario.

Advice for other persons: Eat no more than one meal (one-half pound) per week of fish from the State's fresh waters, except as noted below.

- American eel, channel catfish, carp, lake trout, chinook salmon, rainbow trout, coho salmon over 21", brown trout over 20" - Eat none.
- White sucker, smaller coho salmon, brown trout, and white perch - Eat no more than one meal per month. (In the western half of Lake Ontario, which does not include the Rochester Embayment, the NYSDOH recommends eating no white perch.)
- Carp from Irondequoit Bay - Eat none.

Recent fish contamination data for Lake Ontario indicate that PCB and mirex levels increased significantly in rainbow trout collected from the Salmon River estuary between 1991 and 1993. As a result of these data, the 1996-1997 advisory for rainbow trout has been changed to "eat none". Before this change, the "eat none" advisory had only applied to rainbow trout more than 25 inches long. The cause(s) for the change are not known at this time (Skinner, 1995).

NYSDOH also recommends the following restrictions for consumption of wildlife:

- Snapping turtles: Discard the fat, liver and eggs prior to cooking or making soup. Women of childbearing age, infants and children under the age of 15 should avoid eating snapping turtles or soups made with their meat. The contaminant of concern is PCBs.

- Wild waterfowl: Mergansers should not be eaten. Other wild waterfowl should be skinned and all fat removed before cooking. No more than two meals per month should be eaten. Contaminants of concern are PCBs, mirex, chlordane and DDT.

Use impairment #2: Tainting of fish and wildlife flavor
Status: Unknown
Evidence: The NYSDEC has received a few complaints from anglers, but survey results have not identified examples of tainting.
Need for study: See Chapter 4 study on "Verify whether or not fish in the Area of Concern have a chemical flavor or odor" and Chapter 10 section on "Studies and Monitoring Task Group".

Use impairment #3: Degradation of fish and wildlife populations
Status: Impaired for mink
Evidence: A study by Foley et al. (1988) found fish from Lake Ontario and the Genesee River with PCB concentrations in the range known to have harmful effects on mink and to cause reproductive failure. Very few mink are found within two miles of Lake Ontario, but mink are found in other urbanized areas away from the Lake. It is unlikely that the absence of mink near the Lake is attributed solely to land use changes.
Need for further study: Prior to completion of the Stage I RAP, the New York State Department of Environmental Conservation (NYSDEC) had received reports of a fishless segment in the Genesee River downstream of the Lower Falls and upstream of the Riverside Cemetery. A study on this topic has been done. The NYSDEC Lower Genesee River Study (1995) reported that scientists using fish finder sonar did not observe a fishless segment during the summers of 1992 and 1993 (see Chapter 3 section on "Lower Genesee River Study"). The NYSDEC Study suggested that the Rochester Embayment RAP Committee may wish to recommend further exploration of the possibility of a fishless segment using an intensive hydroacoustic fishery survey, or continuous monitoring with strategically placed caged fish. A study on this topic has been proposed herein (see Chapter 4 section on "Verify whether a fishless segment exists in the lower Genesee River" and Chapter 10 section on "Studies and Monitoring Task Group").

Use impairment #4: Fish tumors or other deformities
Status: Unknown
Evidence: Fish examined for visible deformities during SUNY Brockport studies and fish examined for tumors or deformities as part of Rochester Gas and Electric Corporation studies have not shown an abnormally high incidence of these problems. Anglers have not complained about tumors or deformities.
Need for study: See Chapter 4 study on "Incidence of fish tumors or other deformities in the Rochester Embayment watershed" and Chapter 10 section on "Studies and Monitoring Task Group".

Use impairment #5: Bird or animal deformities or reproductive problems
Status: Impaired reproduction for mink; unknown for bird or animal deformities
Evidence: See use impairment #3 above.

Need for further study: Even though some bird deformities have been observed, no study has been recommended to attribute the cause. Because the birds are migratory, it would be difficult to attribute a cause to conditions in the Rochester Embayment watershed.

Use Impairment #6: Degradation of benthos
Status: Impaired for the lower Genesee River, unknown for the Rochester Embayment
Evidence: Sediment bioassays using the benthic macroinvertebrate *Hexagenia limbata* (burrowing mayfly) were performed in 1990 with sediments from the Genesee River and the Embayment. Results indicate that the sediments fit into the "moderately polluted" category at the 12 sites tested, as shown by 10-50% mortality of *H. limbata* on exposure to sediments for 96 hours (Aqua Tech, 1990).

The NYSDEC Lower Genesee River Study, published in 1995, reported on sampling and analyses for two sites below the Lower Falls as well as a few sites above the Falls (up to the Ballantyne Bridge). The two sites below the Falls were:

- Downstream of the Merrill Street storm sewer near Seneca Park (Figure 3-8, site #5).
- Just upstream from the cement dock and barge area, about one mile upstream from the Turning Basin (Figure 3-8, site #6).

Toxicity testing was performed in 1992 (a high-flow year for the River) and 1993 (a normal year) for sediment toxicity and sediment porewater toxicity. The macroinvertebrates that were used in one or both types of tests were:

Hyalella azteca (sideswimmer)
Chironomus tentans (red midge)
Ceriodaphnia dubia (water flea)
Photobacterium phosphoreum (Microtox®)

Tests results are shown in the following two tables.

Table 3-2. Sediment Toxicity to Macroinvertebrates

	1992	1993
Site #5		
C. tentans	Low	Low
H. azteca	Low	Low
Microtox®	Moderate	Low
Site #6		
C. tentans	Low	Low
H. azteca	Low	Low
Microtox®	Moderate	Low

Table 3-3. Sediment Porewater Toxicity to Macroinvertebrates		
	1992	1993
Site #5		
H. azteca	Low	Low
C. dubia, acute	Low	High, due to ammonia
C. dubia, chronic	Moderate	Could not be measured due to death of *C. dubia* in acute test
Microtox®	Low	Low
Site #6		
H. azteca	Low	Low
C. dubia, acute	Low	Low
C. dubia, chronic	Low	Low
Microtox® (Cultures were purchased from Microbics™ Corp., Carlsbad, CA)	Low	Low

For further information about the Study, see the section in this chapter on "Lower Genesee River Study".

Need for study: See Chapter 4 section on "Does the Lake Ontario portion of the Rochester Embayment suffer from degradation of benthos?" and Chapter 10 section on "Studies and Monitoring Task Group".

Use impairment #7: Restrictions on dredging activities
Status: Impaired in the Genesee River
Evidence: At the request of Monroe County, the NYSDEC has restricted the type of dredging allowed in the Rochester Harbor. Overflow dredging, which allows low density sediments to overflow at the dredging site, is prohibited. Overflowing sediments release nutrients, fecal coliform and other contaminants to the water to a greater extent than other dredging techniques. These restrictions should be maintained even if sediment quality is improved, in order to prevent excessive turbidity at beaches.

Use impairment #8: Eutrophication or undesirable algae
Status: Impaired in Lake Ontario
Evidence: The nearshore areas of Lake Ontario experience massive blooms of *Cladophora* and

other algae. When the *Cladophora* breaks away from its attachments, it accumulates along and on the shore, where it promotes the growth of coliform bacteria as it decomposes. This use impairment leads to other use impairments:

- #9, drinking water taste and odor problems
- #10, beach closings
- #11, degradation of aesthetics
- #13, degradation of phytoplankton and zooplankton populations

Use impairment #9: Restrictions on drinking water consumption or taste and odor problems
Status: There are no restrictions on drinking treated water anywhere in the Rochester Embayment watershed. However, there are occasional taste and odor problems with treated drinking water.
Evidence: There are occasional reports to the Monroe County Water Authority of taste and odor problems in water drawn from the Embayment and treated. The problems occur primarily in August, when prolonged hot temperatures promote blue-green algae growth.

Use impairment #10: Beach closings
Status: Impaired
Evidence: Ontario Beach, just west of the mouth of the Genesee River, was closed from 1967 until 1976 because it could not meet public health standards for fecal coliform bacteria. Since 1976, the beach has been open unless monitoring and weather-based models predict unacceptable water quality. The accumulation of *Cladophora* algae provides a breeding ground for coliform bacteria. Beach closure information for the past four years is shown in the following table:

Table 3-4. Summary of Ontario Beach Closure Statistics: 1992-1995

Year	Season	Total # days	Open* # days (%)	Closed** # days (%)
1992	6/27 - 9/1	67	29 (43%)	38 (57%)
1993	6/25 - 8/30	67	51 (76%)	16 (24%)
1994	6/24 - 9/5	74	40 (54%)	34 (46%)
1995	6/23 - 9/4	74	39 (53%)	35 (47%)
1996	6/22 - 92	73	39 (53%)	34 (47%)

* Includes days during which the beach was open, but with restricted areas.
** Includes days during which the beach was open initially, then later closed.

Use impairment #11: Degradation of aesthetics
Status: Impaired

Evidence:

- *Cladophora* algae washes onshore, causing a visual impairment and odor, as it decomposes.
- The presence of silt often gives the Genesee River and the Embayment a muddy look.
- Waterborne litter is observed, primarily after storms.
- Odors from a chemical seep at the Lower Falls of the River have been occasionally evident.
- At times, alewives in Lake Ontario experience massive die-offs and accumulate on beaches.
- The remains of salmonids are sometimes observed in the lower Genesee River after they have died naturally or after they have been caught and discarded.

Use impairment #12: Added costs to agriculture or industry
Status: Impaired due to zebra mussels
Evidence: Zebra mussels in Lake Ontario and the lower Genesee River have resulted in extra water treatment costs, primarily for industrial and municipal water users. The cost to the Monroe County Water Authority for installation of a control system at its water intake was $800,000. The cost to Rochester Gas and Electric Corporation for installation of control systems for cooling water at two generating stations was $170,000. In addition to installation costs, there are operating and maintenance costs. (See the Chapter 6 section on "Zebra mussel control systems".) Zebra mussels can also be a high cost to agriculture and other uses, such as residences and golf courses.

Use impairment #13: Degradation of phytoplankton and zooplankton populations
Status: Impaired in the lower Genesee River; unknown for the Rochester Embayment
Evidence: NYSDEC Rotating Intensive Basin Studies (RIBS) data for zooplankton (*Ceriodaphnia dubia*) have indicated occurrences of significant chronic toxicity at some sites in the Genesee River. (NYSDEC RIBS, Appendix C, 1992)
Need for study: See the Chapter 4 section on "Are phytoplankton and zooplankton populations in the Lake Ontario portion of the Rochester Embayment impaired?" and Chapter 10 section on "Studies and Monitoring Task Group".

Use impairment #14: Loss of fish and wildlife habitat
Status: Impaired
Evidence: Habitat has been lost due to filling of wetlands, deforestation and agriculture and urban/suburban development.
Need for study: See the Chapter 3 section on "Contaminant impacts on black tern populations in the Rochester Embayment watershed" and Chapter 10 section on "Studies and Monitoring Task Group".

Author: Carole Beal

3.5. Ranking of High Priority Chemical Pollutants

(An update of information in the Stage I RAP)

The Stage I RAP included a list of 84 priority chemical pollutants. The list of 84 includes those associated with impaired uses, eleven critical pollutants identified by the IJC Water Quality Board; the pollutants that were exceeding criteria in Lake Ontario, additional pollutants identified in the Niagara River Toxics Management Plan, and those supplemented by a subcommittee of the RAP Technical Group (the Loading Task Group).

In 1992, a Priority Pollutant Task Group was established. The initial charge was to prioritize the list of 84 pollutants noted above. It was thought that a ranked list of pollutants would be useful in setting priorities for further study and/or action. As work of the Task Group progressed, the individuals in the Group (listed below in Step #2) conducted a list reduction that identified pollutants from the list of 84 that they deemed most important (see Step #2 below). From this exercise, a list of 21 pollutants was included in the Stage I RAP (page 5-40). The Task Group then modified a set of criteria developed by the Ontario Ministry of the Environment and used those criteria to rank the 21 pollutants (see Step #3 below).

The first two steps in developing a ranked list of High Priority Chemical Pollutants were completed before the Stage I RAP was published in August 1993. (See Stage I RAP, page 5-1.) The third step was not completed until 1994.

Step #1

A list of 84 Priority Chemical Pollutants for the Rochester Embayment was developed for the Stage I RAP. (See Stage I RAP, page 5-39 and Appendix D.)

Step #2

A technical group, the Priority Pollutant Task Group, was formed to determine which of the 84 pollutants are of the greatest concern to the Embayment. The members of the Task Group included:

Richard Burton, Monroe County Environmental Health Laboratory
Tom Cullen, New York State Department of Environmental Conservation (NYSDEC), Albany
Richard Elliott, Monroe County Department of Health
Thomas Gasiewicz, University of Rochester Medical Center
James Haynes, SUNY Brockport Biology Department
Bruce Kroening, Eastman Kodak Company
Margaret Peet, Monroe County Department of Health
Ken Robillard, Eastman Kodak Company
Michael Schifano, Monroe County Department of Environmental Services
Paul Schmied, NYSDEC, Avon

In order to reduce the list to a manageable number, each member was asked to review the list of 84 and identify the pollutants that they felt were of greatest concern based on their own professional knowledge and experience. All together, 12 different factors were used to develop the initial list of 21. The factors included IJC priorities, large quantities of discharge, toxicity, linkage with use impairments, etc. The Task Group decided to include in their list reduction exercise all of the substances that were suggested. So the outcome of this step was a preliminary list of High Priority Chemical Pollutants. (See Stage I RAP, page 5-40.)

Eighteen chemical pollutants are listed as known or possible causes of use impairments in the Rochester Embayment. (See Table 3-19, Rochester Embayment Use Impairments, Causes and Sources.) They are PCBs, mirex, dioxin, chlordane, DDT, phenols, mercury, PAHs, cadmium copper, iron, nickel, silver, fuel oil, chemical seeps (benzene, toluene, xylene), and chloride (in road salt). Of these, nine are on the list of High Priority Chemical Pollutants: PCBs, mirex, dioxin, chlordane, DDT, mercury, benzo(a)pyrene (a PAH), cadmium, and silver.

Step #3

The third step was to rank the list of 21 pollutants. A procedure was developed to use three criteria:

- Potential for adverse effects
- Point and nonpoint discharges
- Linkage to known use impairments

The outcome represents an indication of the relative ranking of a manageable list of pollutants identified by the Task Group as having high priority.

It was agreed by the Task Group to apply criteria developed by the Ontario Ministry of the Environment to determine the potential of contaminants of concern in the Rochester AOC to have adverse effects ("A Scoring System for Assessing Environmental Contaminants", March 1990) and "Candidate Substance List for Bans or Phase Outs", April 1992). The Ontario Ministry of the Environment's Scoring System was used as a base for general principles of the scheme. However, all data was checked to make sure that the ranking had some relationship to the relevant data available.

A portion of the third step, ranking of the High Priority Chemical Pollutants, was facilitated by Al Innes from WRITAR (Waste Reduction Institute for Training and Applications Research, Inc.), as part of a grant from the Great Lakes Protection Fund to advance pollution prevention in Areas of Concern (AOCs).

The remaining criteria and the formula for determining the final ranks were developed by the Task Group. The criteria are outlined below.

Criterion 1, Potential for Adverse Effects

• Sub-criterion 1A: Potential for Toxicity. The following factors were considered to score toxicity: 1) Carcinogenicity, scoring 0,2,4,6,8,10 for known or potential human carcinogens. 2) Sub-lethal effects scoring 0,2,4,6,8,10 based on available data for a determined "no observed adverse effect level" (NOAEL) in experimental animals. 3) Teratogenicity, scoring 0,2,4,6,8,10 with a weight of evidence for genotoxicity/teratogenicity. 4)EPA Potency Factor scoring 1-10, with relative potency transformed to an order of magnitude (log) scale. The four scores were averaged. The results are shown in Table 3-5.

• Sub-criterion 1B: Environmental Effects. The following factors were considered to score environmental effects: 1) Aquatic lethality, scoring 0,2,4,6,8,10 and based on LD50 or LC50 data; 2) Sublethal effects on non-mammals, scoring 0,2,4,6,8,10 and based on EC50 data; and 3) Sublethal effects on plants scoring 0,2,4,6,8,10 and based on EC50 data. The three scores were averaged. The results are shown in Table 3-6.

• Sub-criterion 1C, Bioaccumulation and Persistence. The following factors were considered to score bioaccumulation and persistence: 1) Bioaccumulation (high in fish & wildlife,) scoring 0,4,7,10 and based on bioconcentration factors and/or log of octanol-water partition coefficient. 2) Persistence scoring 0,4,7,10 based on biological half-life data. These two factors were averaged. The results are shown in Table 3-7.

To arrive at an overall score for each pollutant for potential for adverse effects, the scores for the first three criteria were added (see Figure 3-1, Potential for Adverse Effects) and Table 3-8, Criterion 1, Summary, Potential for Adverse Effect.

In applying the sub-criteria, a "worst-case" scenario was assumed regarding chemical speciation. Different forms or species of a metal, the metallic form or one or more ionic forms, may exhibit different potentials for toxicity, environmental effects, or bioaccumulation and persistence. Although the worst case was assumed, it may not be reality. In some cases, the worst case may not be bioavailable.

Criterion 2, Point and Nonpoint Discharges

Task Group members used pollutant loading information from the Rochester Embayment Stage I RAP to develop a scoring system to apply this criterion (see Figure 3-2, Point and Nonpoint Discharges). A ranking of pollutants based on discharge was calculated based on actual wastewater discharge data (page 5-41 of Stage I RAP), and air deposition/air emission data (Pages 5-42 - 5-45 of Stage I RAP).

- Sub-criterion 2A, Air Pathways. Because of disparities between the air discharge and various air deposition data, the information on air sources was averaged (See Table 3-9). The averaged air discharge data was then transformed to an order of magnitude (log) scale.

- Sub-criterion 2B, Wastewater Discharges. Wastewater discharge data from the State Pollution Discharge Elimination System as reported in the Stage I RAP was used for this calculation. The wastewater discharge data was transformed to an order of magnitude (log) scale.

The order of magnitude scores for air pollutants entering the system through air pathways and wastewater discharges were added together. As a result of this calculation, a point and nonpoint discharge rank was established. (See Table 3-10). The calculation assumes that 100% of atmospheric deposition and air emissions that fall to the ground is washed off into waterways. The Priority Pollutant Task Group recognizes that this is the worst possible scenario and is not likely in reality, but these emissions do enter into water somewhere in the world.

Criterion 3, Linkage to use impairments

This scoring system considered two primary factors:

- Whether a use impairment was known or possible, and
- Whether a linkage between the chemical, and a use impairment was known, possible, or unknown.

Data provided in Chapter 4 of the Stage I RAP, and new information contained in the remainder of this chapter are the primary references for determining the scores. The scoring system assigns the greatest score to a known linkage and a known use impairment and lesser scores to those situations where less is known. An effort was made to do this in a stepped fashion. A summary of this information is shown in Table 3-19. The grid shown below outlines the scoring method that was used to develop scores in Table 3-11.

Linkage	Use Impairment	Score
Known	Known	1
Possible	Known	0.5
Unknown	Known	0.1
Known	Possible*	0.2
Possible	Possible*	0.1
Unknown	Possible*	0.05

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*In the case of use impairments, "unknown" use impairments that are identified in Table 3-19 are considered to be "possible" use impairments.

Final Ranking Calculation

The final rank is a combination of the potential for adverse effect rank and the point & nonpoint discharges rank. This total was divided by the linkage to use impairments score, and a final value for prioritization was determined. The lowest value equated to the highest priority.

Phosphorus received the highest priority. The chemical dioxin (2,3,7,8-TCDD) was very high because it had a very high effect rank as well as being associated with one use impairment. (See Figure 3-3, Final Ranking Calculation.) The final ranking as a result of the ranking process is outlined in Table 3-12.

Final Ranking Cautions

The end result of this effort could be considered to be shown in Table 3-12. However, the display of data in this chart alone does not fully represent the relative magnitude of the potential impact of the various pollutants. For example, looking at Table 3-10, which summarizes the discharges of the pollutants, phosphorus is ranked number 1 and benzo(a)pyrene (a PAH) as 9. However, the total discharge of phosphorus is in excess of 1 million pounds per year, while benzo(a)pyrene is only 28 pounds.

Table 3-12 (High Priority Chemical Pollutant List) and Table 3-19 (Use Impairments, Causes and Sources) were created independently of each other. The High Priority Chemical Pollutant List includes some chemicals that are not specifically named in Table 3-19. Many substances, such as sediment and algae, are listed as causes of use impairments in Table 3-19, but are not specifically named on the High Priority Chemical Pollutant List (although they may be related to one or more chemicals on the list.)

To compare the High Priority Chemical Pollutant List with the chemicals for which standards are being developed under the Great Lakes Water Quality Guidance, see the Chapter 6 section on "Great Lakes Water Quality Guidance (6.4.2.1)."

Step #4

As a result of comments on the final ranking that were received during the Stage II RAP review process, the Task Group met again in late 1996 to discuss the comments. Because of the complexity of the issues, no changes to the final ranking or the final ranking process were made at the meeting. Instead the Task Group decided to meet again early in 1997 to review the ranking process and to deal with specific chemical issues. It was agreed that it may be beneficial to reconsider the ranking periodically in light of new information, perhaps annually. Some of the issues that will be considered beginning in 1997 include:

- Ask the International Joint Commission Science Advisory Board to review the silver, methylene chloride and phthalate ester figures that were used in the analysis.
- Conduct a full analysis of all of the pollutants of concern in the Rochester Embayment.
- Amend the existing list of 84 pollutants of concern to include any new information that has been made available. Examples of new information include the need to consider adding ammonia and anthracene to the list of 84 pollutants.
- Add a representative to the Task Group who has toxicological background and who represents an environmental group.
- Ask the NYSDEC Bureau of Monitoring and Assessment to resample midges in the

lower Genesee River using "clean" methods of tissue analysis to determine whether or not silver is in the tissues.

- Re-evaluate "degradation of benthos" as a use impairment designation in the Genesee River with respect to factors other than oxygen depletion. Chironomid deformities and benthic diversity may be considered as indicators of a possible impairment.
- The Task Group should consider appropriate delisting criteria and provide its findings to the WQMAC and its subcommittees which will be developing delisting criteria for the use impairments.

Author: Margy Peet

Table 3-5
Criterion 1, Potential for Adverse Effects, Sub-Criterion 1A, Potential for Toxicity

Substance	Carcinogenicity	Sublethal Effects	Teratogenicity	EPA Potency Factor	Toxicity Score (Average)
Dioxin (2,3,7,8-TCDD)	8	10	10	10	9.50
Furan (2,3,7,8-TCDF)	8	10	10	10	9.50
Mirex	8	8	6	5	6.75
PCBs	8	10	10	5	8.25
DDT	8	10	8	4	7.50
Aldrin	2	10	6	6	6.00
Dieldrin	2	10	6	6	6.00
Toxaphene	10	6	4	5	6.25
Mercury	8	8	8	ND	8.00
Benzo(a)pyrene	10	ND	8	5	7.67
Hexachloro-benzene	10	10	6	5	7.75
Alkylated lead	8	10	10	ND	9.33
Cadmium	10	8	8	ND	8.67
Silver	0	ND	0	ND	0
Di (2-ethyl-hexyl) phthalate	8	4	2	2	4.00
Di-n-octyl phthalate	8	4	2	2	4.00
Heptachlor	8	8	6	5	6.75
Chlordane	8	10	8	5	7.75
Phosphorus	0	2	0	ND	0.67
Cyanide	ND	4	6	ND	5.00
Methylene chloride	10 [1]	0	2	1	3.25

ND=no data

[1] Based on evidence provided by OSHA and the Ontario Ministry of the Environment. The ranking process will be reviewed in the future.

Table 3-6
Criterion 1, Potential for Adverse Effects, Sub-Criterion 1B, Environmental Effects

Substance	Aquatic Toxicity	Sublethal Effects, Animals	Sublethal Effects, Plants	Environmental Effects Score (Average)
Dioxin (2,3,7,8-TCDD)	10	10	ND	10
Furan (2,3,7,8-TCDF)	10	10	ND	10
Mirex	8	6	10	8
PCBs	10	10	8	9.33
DDT	10	10	8	9.33
Aldrin	10	10	8	9.33
Dieldrin	10	10	8	9.33
Toxaphene	10	6	6	7.33
Mercury	8	6	10	8
Benzo(a)pyrene	10	ND	ND	10
Hexachlorobenzene	4	6	8	6
Alkylated lead	ND	ND	ND	ND
Cadmium	10	ND	10	10
Silver	1.9 [1]	ND	ND	1.9
Di (2-ethylhexyl) phthalate	0	8	0	2.67
Di-n-octyl phthalate	0	0	0	0
Heptachlor	10	6	8	8
Chlordane	10	10	8	9.33
Phosphorus	N/A	N/A	N/A	10 [2]
Cyanide	6	ND	4	5
Methylene chloride	2	2	0	1.33

ND = No Data   N/A = Not Applicable

[1] Based on the formula (.10 x 10) + (.90 x 1*) = 1.9. The .10 and .90 refer to estimated proportions of ionic and non-ionic silver suggested by Eastman Kodak and the 10 and 1* refer to toxicity and represent orders of magnitude. *For the score of 1, the Task Group presented a range of 0-2. "1" was selected.

[2] Phosphorus environmental effects score reflects major environmental effects (not toxic effects). The score of 10 indicates relative potential for effecting change and persisting in the ecosystem.

Table 3-7
Criterion 1, Potential for Adverse Effects, Sub-Criterion 1C, Bioaccumulation/Persistence

Substance	Bioaccumulation	Persistence	Score (Average)
Dioxin (2,3,7,8-TCDD)	10	10	10
Furan (2,3,7,8-TCDF)	10	10	10
Mirex	10	10	10
PCBs	10	10	10
DDT	10	10	10
Aldrin	10	10	10
Dieldrin	10	10	10
Toxaphene	10	10	10
Mercury	10	10	10
Benzo(a)pyrene	7	10	8.5
Hexachlorobenzene	10	10	10
Alkylated lead	4	10	7
Cadmium	0	10	5
Silver	0 [1]	9 [2]	4.5
Di (2-ethylhexyl) phthalate	4	4	4.0
Di-n-octyl phthalate	4	4	4.0
Heptachlor	10	10	10
Chlordane	7	10	8.5
Phosphorus			5 [3]
Cyanide	0	0	0
Methylene chloride	0	7	3.5

[1] Based on the 1998 study (accepted for publication) "Toxicity of silver sulfide-spiked sediments to the freshwater amphipod Hyalella azteca" by Marianne Hirsch, Health and Environmental Laboratory, Eastman Kodak Company.
[2] Based on the formula (.10 x 0) + (.90 x 10) = 9. The .10 and .90 refer to the estimated proportions of ionic and non-ionic silver suggested by Eastman Kodak and the 0 and 10 refer to persistence scores. Non-ionic silver is very persistent and ionic silver is not.
[3] Phosphorus has major environmental effects, though not toxic ones. A score was assigned based on best judgement of the relative potential of phosphorus for effecting change and persisting in the ecosystem.

Figure 3-1, Potential for Adverse Effects

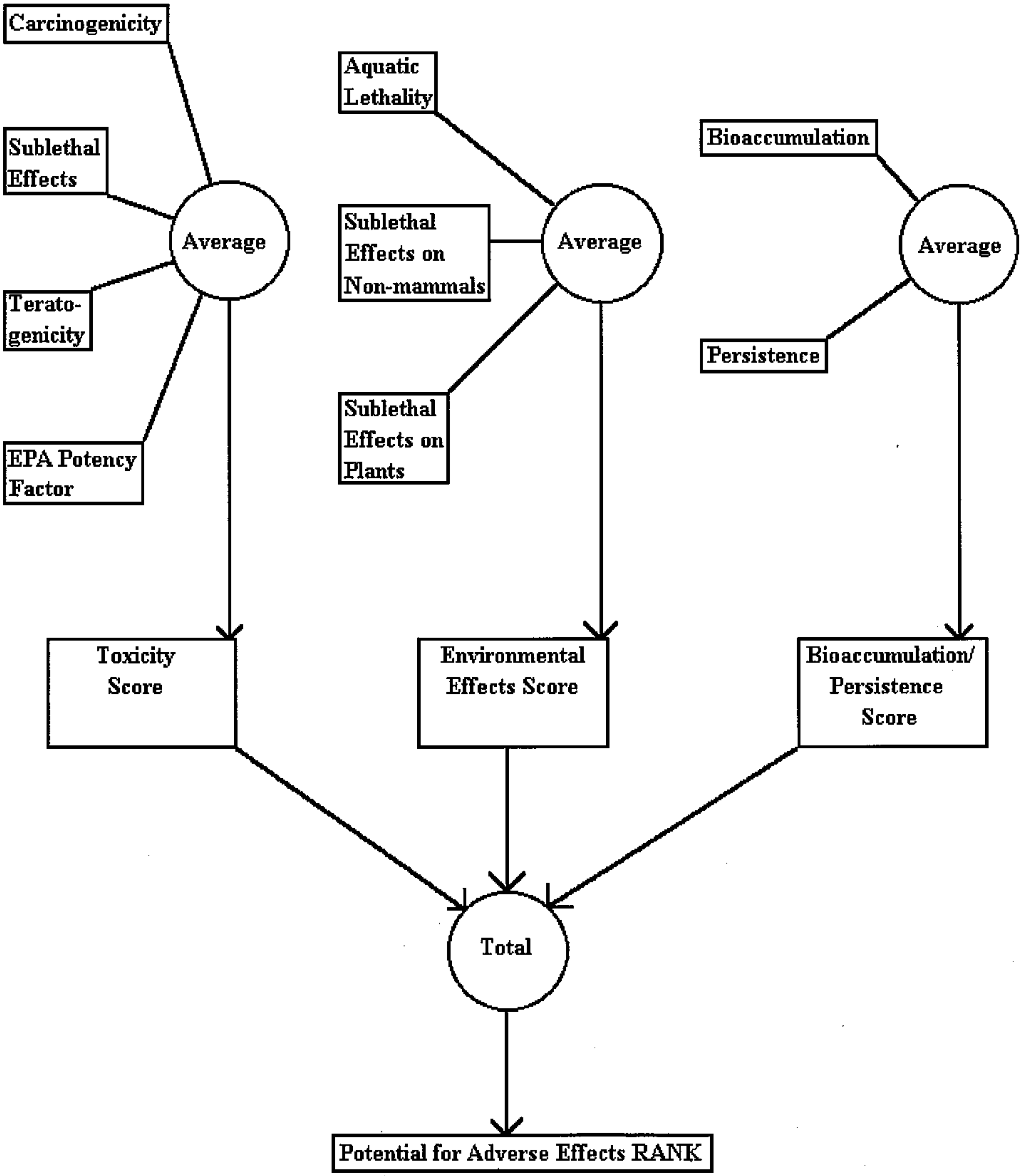

Table 3-8
Criterion 1, Summary, Potential for Adverse Effect

21 Priority Pollutants	Toxicity Score	Environmental Effects Score	Bioaccum./ Persistence Score	Total Score	Effect Rank
Dioxin (2,3,7,8-TCDD)	9.5	10.00	10.00	29.5	1
Furan (2,3,7,8-TCDF)	9.5	10.00	10.00	29.5	1
Mirex	6.75	8.00	10.00	24.75	10
PCBs	8.25	9.33	10.00	27.58	3
DDT	7.50	9.33	10.00	26.83	4
Aldrin	6.00	9.33	10.00	25.33	8
Dieldrin	6.00	9.33	10.00	25.33	8
Toxaphene	6.25	7.33	10.00	23.58	14
Mercury	8.00	8.00	10.00	26.00	6
Benzo(a)pyrene	7.67	10.00	8.50	26.17	5
Hexachlorobenzene	7.75	6.00	10.00	23.75	12
Alkylated lead	9.33	not scored	7.00	16.33	15
Cadmium	8.67	10.00	5.00	23.67	13
Silver	0.00	1.90	4.50	6.40	21
Di (2-ethylhexyl) phthalate	4.00	2.67	4.00	10.67	17
Di-n-octyl phthalate	4.00	0	4.00	8.00	20
Heptachlor	6.75	8.00	10.00	24.75	10
Chlordane	7.75	9.33	8.50	25.58	7
Phosphorus	0.67	10.00	5.00	15.67	16
Cyanide	5.00	5.00	0.00	10.00	18
Methylene chloride	3.25	1.33	3.50	8.08	19

Figure 3-2, Point & Nonpoint Discharges

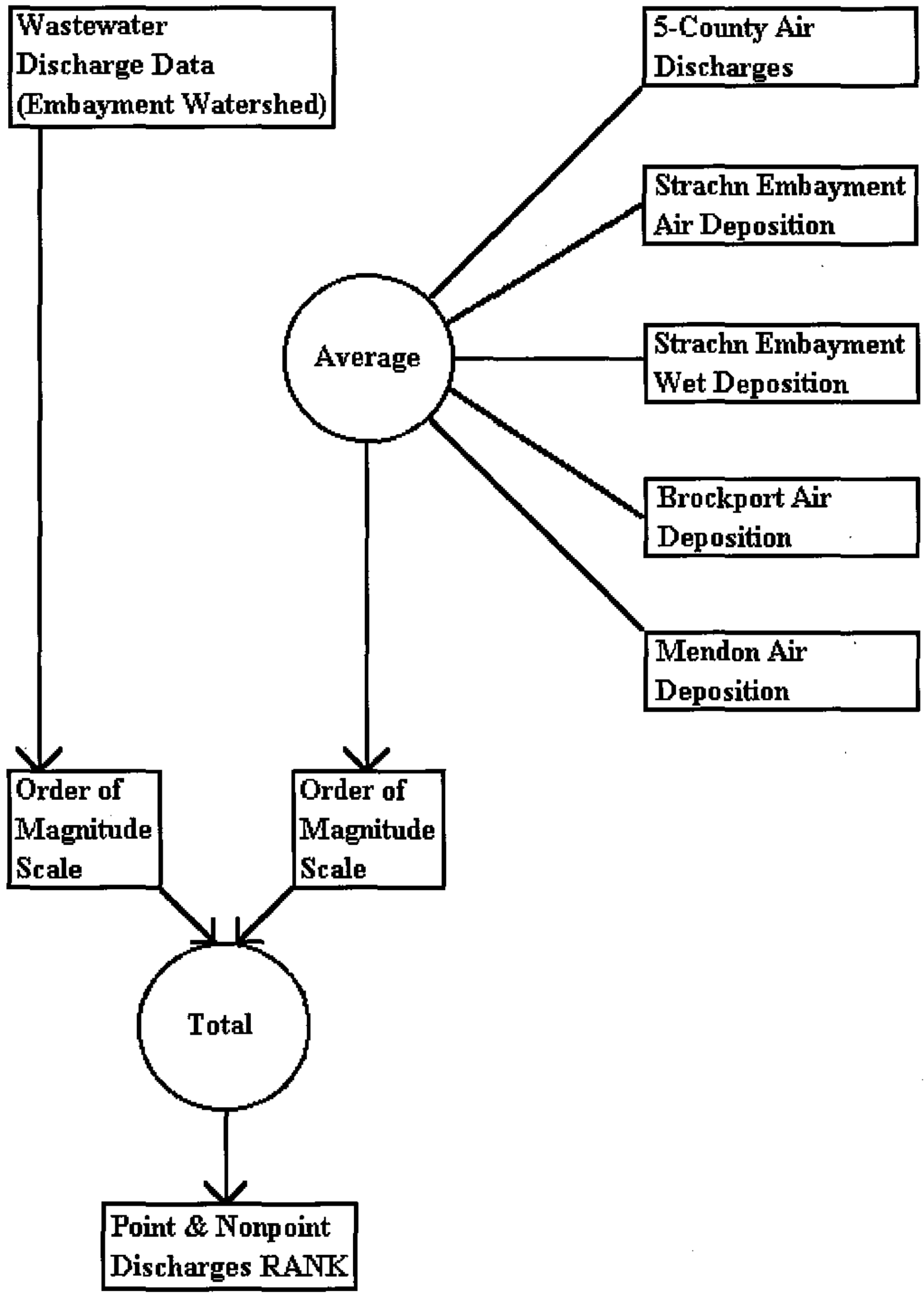

Table 3-9
Criterion 2, Point and Non-Point Discharges: Sub-criterion 2A, Air Pathway Discharges Calculation

Substance	5-County Air Dis-charges lbs/yr	Strachan Air Deposi-tion lbs/yr	Strachan Embayment Wet Deposi-tion, lbs/yr	Brockport Air Deposition lbs/yr	Mendon Air Deposi-tion lbs/yr	Average of air pathways ∑ divided by number of values rounded
Phosphorus	ND	ND	ND	707,692	641,455	674,474
Methylene chloride	9,135,714	ND	ND	ND	ND	9,135,714
Silver	29,338	ND	ND	ND	ND	29,338
Alkylated lead	2,890	41,675	ND	178,461	93,520	79,137
Cadmium	2	2,856	ND	36,923	ND	19,890
Mercury	0	497	ND	ND	ND	249
Di-n-octyl phthalate	10,660	ND	ND	ND	ND	10,660
PCBs	0	37	ND	ND	ND	19
Benzo(a)pyrene	ND	27	ND	ND	ND	27
Di (2-ethylhexyl) phthalate	ND	ND	ND	ND	ND	ND
Dioxin (2,3,7,8-TCDD)	ND	ND	1.23	ND	ND	1
Chlordane	ND	3.1	ND	ND	ND	3
DDT	ND	8.4	ND	ND	ND	8
Dieldrin	ND	1.2	ND	ND	ND	1
Heptachlor	ND	1.9	ND	ND	ND	2
Hexachloro-benzene	ND	0.97	ND	ND	ND	1
Toxaphene	ND	4.16	ND	ND	ND	4
Mirex	ND	ND	ND	ND	ND	ND
Furan (2,3,7,8-TCDF)	ND	ND	.34	ND	ND	.3
Aldrin	ND	ND	ND	ND	ND	ND
Cyanide	ND	ND	ND	ND	ND	ND

ND = No Data

Table 3-10
Criterion 2, Point and Nonpoint Discharges, Summary

Substance	Estimated Direct Wastewater Discharges lbs./yr	Waste Water Order of Magnitude	Average of Air Pathways (from Table 3-9)	Air Order of Magnitude (from Table 3-9)	Total Air and Water Order of Magnitude	Discharge Rank
Phosphorus	392,051	7	674,574	7	14	1
Methylene chloride	4,735	5	9,135,714	8	13	2
Silver	7,536	5	29,338	6	11	3
Alkylated lead	4,100	5	79,136	6	11	3
Cadmium	542	4	19,889	6	10	5
Mercury	25.9	3	249	4	7	6
Di-n-octyl phthalate	0	1	10,660	6	7	6
PCBs	0	1	19	3	4	8
Benzo(a)pyrene	0	1	28	3	4	8
Di (2-ethyl-hexyl) phthalate	71.8	3	No data	1	4	8
Dioxin (2,3,7,8-TCDD)	0	1	2	2	3	11
Chlordane	0	1	3	2	3	11
DDT	0	1	8	2	3	11
Dieldrin	0	1	1	2	3	11
Heptachlor	0	1	2	2	3	11
Hexachloro-benzene	0	1	1	2	3	11
Toxaphene	0	1	4	2	3	11
Mirex	0	1	no data	1	2	18
Furan (2,3,7,8-TCDF)	0	1	.3	1	2	18
Aldrin	0	1	no data	1	2	18
Cyanide	0	1	no data	1	2	18

In this table, average of air pathways from table 3-9 is converted to an order of magnitude scale. The air order of magnitude scale is added to the water discharge order of magnitude scale to get a total which is converted to ranking for calculation of final value.

Table 3-11. Criterion 3, Linkage to Use Impairments

Substance	Linkage/Use Impairment (#)	Score	Total
Phosphorus	Known/Known (8) Known/Known (9) Known/Known (10) Known/Known (11) Possible/Known (13)	1 1 1 1 0.5	4.5
PCB	Known/Known (1) Possible/Known (3) Possible/Known (5) Possible/Known (6)	1 0.5 0.5 0.5	2.5
Dioxin	Known/Known (1)	1	1
Chlordane	Known/Known (1) Possible/Known (6)	1 0.5 [1]	1.5
DDT & metabolites	Known/Known (1)	1 [1]	1
Mercury	Possible/Known (3)	0.5 [1]	0.5
Mirex & photomirex	Known/Known (1)	1	1
Cadmium	Possible/Known (6)	0.5 [1]	0.5
Benzo(a)pyrene	Possible/Possible (4)	0.1	0.1
Silver	Unknown/Known (6)	0.1 [2]	0.1
Alkylated lead	Unknown/Possible	0.05	0.05
Furan	Unknown/Possible	0.05	0.05
Dieldrin	Unknown/Possible	0.05	0.05
Heptachlor	Unknown/Possible	0.05	0.05
Methylene chloride	Unknown/Possible	0.05	0.05
Hexachlorobenzene	Unknown/Possible	0.05	0.05
Toxaphene	Unknown/Possible	0.05	0.05
Di-(2-ethylhexyl) phthalate	Unknown/Possible	0.05	0.05
Aldrin	Unknown/Possible	0.05	0.05
Di-n-octyl phthalate	Unknown/Possible	0.05	0.05
Cyanide	Unknown/Possible	0.05	0.05

[1] Revision due to the updating of Table 3-19

[2] Based on the 1998 study (accepted for publication) "Toxicity of silver sulfide-spiked sediments to the freshwater amphipod Hyalella azteca" by Marianne Hirsch, Health and Environmental Laboratory, Eastman Kodak Company.

Figure 3-3, Final Ranking Calculation

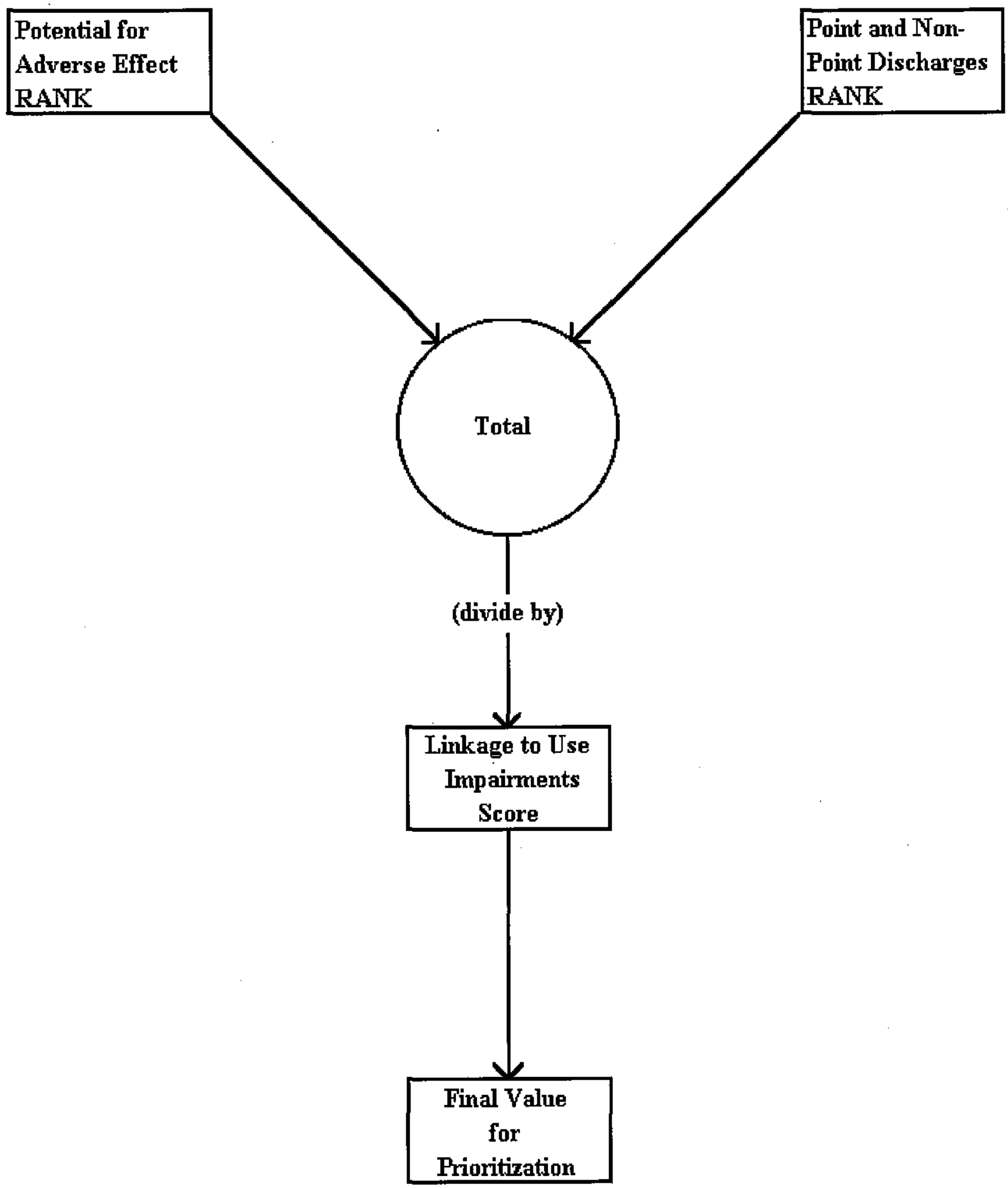

Table 3-12. Rochester Embayment Remedial Action Plan Top 21 Chemical Pollutants as Recommended by the Priority Pollutant Task Group Revised: May 19, 1997

Substance	Adverse Effects Rank	+	Discharge Rank	/	Linkage Score	=	Final Value
Phosphorus	16		1		4.5		3.8
PCBs	3		8		2.5		4.4
Dioxin	1		11		1		12
Chlordane	7		11		1.5		12
DDT & metabolites	4		11		1		15
Mercury	6		6		0.5		24
Mirex & photo	10		18		1		28
Cadmium	13		5		0.5		36
Benzo(a)pyrene	5		8		0.1		130
Silver	21		3		0.1		240
Alkylated lead	15		3		0.05		360
Furan	1		18		0.05		380
Dieldrin	8		11		0.05		380
Heptachlor	10		11		0.05		420
Methylene chloride	19		2		0.05		420
Hexachlorobenzene	12		11		0.05		460
Toxaphene	14		11		0.05		500
Di-(2-ethylhexyl) phthalate	17		8		0.05		500
Aldrin	8		18		0.05		520
Di-n-octyl phthalate	20		6		0.05		520
Cyanide	18		18		0.05		720

Pollutants at the top of the list are of highest priority.

3.6. Air loading data

(An update of information in the Stage I RAP)

Table 3-13 below is an update of Table 5-5 in the Stage I Rochester Embayment Remedial Action Plan. Table 3-13 displays the 1994 stack[1] and fugitive[2] emissions for the priority pollutants (Table 3-20) by county for five counties within the Rochester Embayment watershed. Note that Table 3-13 lists only those priority pollutants for which emissions were reported. The emissions data was compiled by the New York State Department of Environmental Conservation (NYSDEC) by conducting a search of the Toxics Release Inventory (TRI) database. Certain facilities that use or manufacture certain quantities of listed chemicals are required to report TRI information to the United States Environmental Protection Agency (USEPA) and the appropriate state agency under Title III of the Superfund Amendments and Reauthorization Act of 1986.

Although the TRI database is widely used, it has several limitations. Only those facilities that meet all of the following criteria are required to submit TRI information.

- The facility has 10 or more full-time employees
- The facility is included in Standard Industrial Classification (SIC) Codes 20 through 39
- The facility manufactures, processes, or otherwise uses any listed toxic chemical in quantities greater than the established threshold in the course of the calender year

The TRI data is also limited because the list of reportable chemicals does not include every chemical of concern and companies subject to reporting are only required to estimate the releases and transfer of the listed chemical.

A comparison of Table 5-5 (Stage I RAP) and Table 3-13 reveals that there have been a number of changes in reported emissions of priority pollutants in the five county area. Possible explanations for these changes include the following.

- Pollution prevention programs
- Improved reporting accuracy
- Changes in reporting methodology
- Delisting of some chemicals
- Changes in production level or manufacturing output
- Introduction of new process technology or different raw materials

An analytical comparison of the Stage I and Stage II air emissions data has been included in the Chapter 11 list "Remedial Measures, Studies, and Monitoring Methods to be Evaluated in 1997".

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[1] The term "stack emissions", or point air emissions, refers to the release of chemicals to the air via stacks, vents, ducts, pipes, or other confined air streams.

[2] "Fugitive emissions", or non-point air emissions, are defined as releases of chemicals to the air that are not released through stacks, vents, ducts, pipes, or other confined air streams. These may include (1) fugitive equipment leaks from valves, pump seals, flanges, compressors, sampling connections, open-ended lines, etc.; (2) evaporative losses from surface impoundments and spills; (3) releases from building ventilation systems; and (4) any other fugitive or point air emissions.

This list was developed so that new remedial measures, studies, and monitoring methods that were proposed during the development of the Stage II RAP will receive the same consideration for potential implementation as the proposals presented in Chapters 4, 7, and 9.

Author: Todd Stevenson

Table 3-13. 1994 Air Emissions (A.E.) of Priority Pollutants: Stack Emissions (S.E.) and Fugitive Losses (F.L.) by County in Pounds

	Allegany Co.		Genesee Co.		Livingston Co.		Monroe Co.		Orleans Co.		Total S.E.	Total F.L.	Total AE
	S.E.	F.L.	S.E.	F.L.	S.E.	F.L.	S.E.	F.L.	S.E.	F.L.			
Inorganics:													
Barium compounds							801	5			801	5	806
Chromium		27	6			255	863	516			869	798	1,667
Chromium compounds							78	2			78	2	80
Cobalt							11				11	0	11
Copper							322	3,903			322	3,903	4,225
Copper compounds							490				490	0	490
Lead							97	18			97	18	115
Lead compounds							270				270	0	270
Manganese		250				6,800	345	516			345	7,566	7,911
Manganese compounds			1	7			2,255	5			2,256	12	2,268
Nickel (metal)		1				255	786	520			786	776	1,562
Nickel compounds							306				306	0	306
Selenium compounds							255				255	0	255
Silver							4	6			4	6	10
Silver compounds							11,000	2			11,000	2	11,002
Zinc			1	26							1	26	27
Zinc compounds							5,889	135			5,889	135	6,024
Organics:													
Carbon tetrachloride							132	5,951			132	5,951	6,083
Chloroform							3,835	241			3,835	241	4,076
Methyl ethyl ketone					7,990	465	119,969	20,072			127,959	20,537	148,496
Methylene chloride							2,274,744	379,855	255	255	2,274,999	380,110	2,655,109
Phenol							86	28			86	28	114
Tetrachloroethylene			17	34,824							17	34,824	34,841
Toluene							275,574	29,615	255	255	275,829	29,870	305,699
Trichloroethylene							34,088	11,100			34,088	11,100	45,188

3.7. Cyanide loadings to air

(An update of information in the Stage I RAP)

In the discussion of pollutants definitely or possibly causing impairments in the AOC, the Stage I RAP states: "We were not able to obtain air loading data [for cyanide] in time to include in this document" (page 5-16). Since the Stage I RAP was completed, the New York State Department of Environmental Conservation (NYSDEC) searched the Toxics Release Inventory (TRI) database for cyanide releases, in a manner similar to that for other chemicals as shown on page 5-45 of the Stage I RAP. The results showed that there were NO cyanide releases reported in the Rochester Embayment watershed counties for either 1990 or 1991.

Cyanide is not known to be causing any impairments in the AOC (Stage I RAP, page 5-16). However, it is listed on the Preliminary List of High Priority Chemical Pollutants for the Rochester Embayment (see Stage I RAP, page 5-40 and Stage II RAP, Chapter 3).

Author: Carole Beal

3.8. Monroe County air deposition monitoring

(An update of information in the Stage I RAP)

Monroe County atmospheric deposition monitoring data for 1990 are shown in Table 5-4 of the Stage I Remedial Action Plan, page 5-42. The table below for 1995 updates this data for two sites, Mendon Ponds Park and SUNY Brockport, and adds data for a third site, Empire Blvd. wetlands. The Empire Blvd. site was installed in spring of 1992. The site is located south of Empire Blvd. and north of the Tryon Slough narrows. (For further information about the Monroe County air deposition monitoring program, see the Chapter 9 section on "Local atmospheric deposition monitoring".)

As in the Stage I RAP, the data has been used to extrapolate atmospheric deposition on the Rochester Embayment, on the Genesee River basin, and on the Rochester Embayment watershed. Such extrapolations are within an order of magnitude.

Table 3-14. Air Loading Data for Monroe County

Location and Parameter (1995 data)	Mean Monthly Loading mg/m^2	Deposition on Embayment lbs/yr	Deposition on Genesee Basin lbs/yr	Deposition on Embayment Watershed lbs/yr
Mendon Ponds Park				
Lead	0.34	820	58,000	70,000
Total phosphorus	3.33	7,980	561,000	684,000
Zinc	1.72	4,130	290,000	354,000
SUNY Brockport				
Lead	0.39	950	66,000	81,000
Total phosphorus	3.74	8,960	631,000	768,000
Zinc	2.00	4,800	337,000	411,000
Empire Blvd. Wetlands				
Lead	0.36	860	60,000	73,000
Total phosphorus	3.53	8,460	595,000	725,000
Zinc	1.45	3,480	245,000	298,000

The data from the SUNY Brockport station and the phosphorus data from the Mendon Ponds Park station are very similar for 1995 and 1990 (the year reported in the Stage I RAP). Deposition reported for lead and zinc at Mendon Ponds in 1995 is about one-third of that in

1990. This decrease is considered to be within normal variability and, taken by itself, should not be considered as evidence of a trend. It is possible that the change in lead content of gasoline may be contributing to a decrease in lead deposition.

Author: Carole Beal

3.9. Ambient air monitoring update

(An update of information in the Stage I RAP)

3.9.1. New York State Department of Environmental Conservation

The New York State Department of Environmental Conservation (NYSDEC) maintains a monitoring site for lead at 1693 East Avenue, in the City of Rochester, and a site for volatile organic compounds at Merrill Street, in the City of Rochester, where Kodak has a separate monitoring site that uses different sample collection and analysis methods. NYSDEC closed a monitoring site for volatile organic compounds at Jefferson Middle School, in the City of Rochester, in summer 1996. NYSDEC data is shown for lead and volatile organic compounds for the latest years available.

	1994 Annual Geometric Mean ($\mu g/m^3$)
*Lead (1693 East Ave.)	0.04

*Alkylated lead is on the Rochester Embayment Remedial Action Plan list of high priority chemical pollutants.

	1993 Annual Averages (ppb)	
	Jefferson Middle School	Merrill Street
Benzene	0.62	0.69
Carbon tetrachloride	0.31	0.26
Chlorobenzene	0.02	0.03
Chloroform	0.09	0.10
m-Dichlorobenzene	0.16	0.28
o-Dichlorobenzene	0.01	0.01
p-Dichlorobenzene	0.01	0.02
1,2-Dichloroethane	0.12	0.03
Ethylbenzene	0.33	0.36
*Methylene chloride	0.55	20.70
Tetrachloroethylene	0.22	0.10
Toluene	1.87	2.52
1,1,1-Trichloroethane	0.62	0.77
1,1,2-Trichloroethane	0.02	0.02
Trichloroethylene	0.03	0.04
m,p-Xylene	0.74	10.79
o-Xylene	0.25	0.29

*On the Rochester Embayment Remedial Action Plan list of high priority chemical pollutants

Note: Merrill Street is at the northern edge of Kodak Park. Jefferson Middle School is at Edgerton Park, between one and two miles southeast of Kodak Park.

3.9.2. Industry

Ambient air monitoring data for Eastman Kodak Company and Xerox Corporation are shown in the Stage I RAP, pages 5-46 and 5-47. Updated information for Eastman Kodak follows in Tables 3-15 and 3-16. Xerox is not required by the New York State Department of Environmental Conservation (NYSDEC) to conduct ambient air monitoring, and the Xerox data shown in the Stage I RAP is the latest data available.

Atmospheric contaminants can be transported to the Rochester Embayment Area of Concern (AOC) from areas that are hundreds of miles upwind, and they can be transported from the AOC to areas that are downwind. However, it is important to recognize local atmospheric discharges because each area contributes to the problem as a whole and because they can be controlled locally.

Kodak's dichloromethane ambient air monitoring data for fourth quarter 1991 (Stage I, page 5-46) and for first quarter 1996 were compared. The arithmetic means from monitoring locations School 41, Rand Street and Ridgeway Avenue showed statistically insignificant increases of ambient air levels (see 95% confidence interval about the mean). Monitoring sites at Koda Vista, Merrill Street and Hanford Landing Road showed statistically significant decreases in ambient air concentrations. Monitoring at the Irondequoit location was discontinued on December 31, 1995.

Author: Carole Beal

Table 3-15
Eastman Kodak Company Ambient Air Monitoring Dichloromethane (Methylene chloride) Statistical Results (ppbv)
First Quarter, 1996

Location	Number of Samples	Arithmetic Mean (ppbv)	Median (ppbv)	95% Confidence Interval about the mean (ppbv)
School 41	14	2.4	0.99	±2.1
Rand Street	15	3.9	1.7	±2.5
Koda Vista	15	6.2	5.5	±2.8
Merrill Street	15	11	3.1	±11
Ridgeway Avenue	14	0.26	0.11	±0.19
Hanford Landing Road	15	7.2	4.3	±3.8
Trip Blank	8	0.019	0.005*	±0.014

Notes:
* Result is below method detection limit (MDL) of 0.01 ppbv
ppbv = parts per billion by volume
In all cases where the compound was not detected in one of the samples, one-half the MDL was used for all calculations. 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 are analyzed using the same methods as for field samples.

Table 3-16
Eastman Kodak Company Ambient Air Monitoring 1,2-Dichloropropane Statistical Results (ppbv)
First Quarter, 1996

Location	Number of Samples	Arithmetic Mean (ppbv)	Median (ppbv)	95% Confidence Interval about the mean (ppbv)
School 41	14	0.066	0.027	±0.049
Rand Street	15	0.096	0.098	±0.047
Koda Vista	15	0.018	0.005*	±0.014
Merrill Street	15	0.14	0.061	±0.14
Ridgeway Avenue	14	0.0050*	0.005*	NA
Hanford Landing Road	15	0.15	0.067	±0.10
Trip Blank	8	0.0050*	0.005*	NA

Notes:
* Result is below method detection limit (MDL) of 0.01 ppbv
ppbv = parts per billion by volume
NA=not available
In all cases where the compound was not detected in one of the samples, one-half the MDL was used for all calculations. 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 are analyzed using the same methods as for field samples.

3.10. Nonpoint sources

Pollutant loadings to the Rochester Embayment can be categorized as:
1. Point source loadings to the Genesee River basin.
2. Nonpoint source loadings to the Genesee River basin.
3. Point source loadings to the watersheds of other streams that flow into the Embayment.
4. Nonpoint source loadings to the watersheds of other streams that flow into the Embayment.
5. Point source loadings directly to the Embayment.
6. Nonpoint source loadings directly to the Embayment.
7. Loadings from upstream Lake Ontario.

Dredging is not considered to be a loading in this categorization, because it is a moving of sediments from one location in the Embayment to another location in the Embayment, and its impacts are temporary.

The Stage I RAP, Chapter 5, compares the importance of point source loadings and nonpoint source loadings for the Genesee River basin (items #1 and #2 above). Data from the Stage I RAP, Tables 5-12, 5-13 and 5-14, are repeated in Table 3-17, at the end of this section, to show the relative contribution of point sources and, therefore, nonpoint sources.

In Table 3-17:

- Column #1 represents State Pollution Discharge Elimination System (SPDES) point source loadings to the Genesee River or a tributary for October 1989-September 1990. (See Stage I RAP, Table 5-13.)
- Column #2 represents the total loading from the Genesee River. It was calculated based on U.S. Geological Survey concentration data for the mouth of the Genesee River during October 1989-September 1990 and flow data for a period of years. (See Stage I RAP, Tables 5-12 and 5-14.)

It can be seen that, for all parameters represented, except silver, point sources contribute less than one-fifth of the total loading to the Rochester Embayment and, therefore, nonpoint sources contribute more than four-fifths of the total loading.

When a loading study for the Rochester Embayment is repeated, all of the seven contributors to Rochester Embayment total loading can be estimated:
1. Point source loadings to the Genesee River basin: SPDES data.
2. Nonpoint source loadings to the Genesee River basin: Calculate total loading using concentrations at the mouth of the Genesee River and flow data. Subtract point source loading from total loading to estimate nonpoint loading.
3. Point source loadings to the watersheds of other streams that flow into the Embayment: SPDES data.
4. Nonpoint source loadings to the watersheds of other streams that flow into the Embayment: Estimate in a manner similar to “2" using concentration data from a few of the streams.

5. Point source loadings directly to the Embayment: SPDES data.
6. Nonpoint source loadings directly to the Embayment: Estimate based on atmospheric deposition measurements taken in the Province of Ontario.
7. Loadings from upstream Lake Ontario: Estimate using discharge data from the Niagara River.

Author: Carole Beal

Table 3-17
Estimated Pollutant Loadings to the Rochester Embayment from the Genesee River
October 1989 - September 1990

Parameter	#1 Loading from SPDES Discharges in the Genesee Basin tons/year	#2 Total Loading from the Genesee Basin tons/year
Arsenic[1]	0	2.7
Cadmium	0.25	2.6
Copper	2	30
Lead	1.4	20.2
Manganese	0.05	400
Mercury	0.013	.0.25[2]
Nickel	1.1	23.5
Silver[1]	3.3	Not detected
Zinc	16	111
Total suspended solids	13,277	662,277
Total phosphorus	44	368

Notes:
1 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.
2 This value assumes that mercury was present at half the detection limit at those sites where it was not detected.

3.11. Inactive hazardous waste sites

(An update of information in the Stage I RAP)

Table 3-18 is an update of Table 5-8 which begins on page 5-48 of the Stage I RAP. Table 3-18 lists the inactive hazardous waste sites in the Rochester Embayment watershed that have been found to contaminate or are suspected of contaminating groundwater, soil or sediment near the site. The contaminants are chemicals that are on the Rochester Embayment Priority Pollutant list or mixtures that are likely to include these chemicals. (See the Chapter 3 section on "Point source discharges within the Rochester Embayment watershed" for the Priority Pollutant list.) The information in the table is taken from the New York State Department of Environmental Conservation (NYSDEC) publication, Inactive Hazardous Waste Sites in New York State (also known as "The Registry"). There is additional information for Monroe County which has been taken from the files of the Monroe County Department of Health and the Monroe County Environmental Management Council.

There are 20 sites in the Rochester Embayment watershed that have been "delisted" from the Registry either before or after the publication of the Stage I RAP. The sites were delisted for one of two reasons (see following list):

- Remediation has taken place (2 sites).
- There is no documented disposal of hazardous *waste* by a hazardous waste generator that must register its waste disposal under the U.S. Resource Conservation and Recovery Act, and there is no proven reason that the site should be on the list (18 sites). However, the sites may contain hazardous *substances*.

The delisted sites are:

Facility	County
Brighton Town Landfill, Browncroft Blvd., Brighton [3]	Monroe
Carter St., SW corner of Carter St. & Ridge Rd., Rochester [1]	Monroe
Clarkson Landfill, Redman Rd., Clarkson [1]	Monroe
Flynn Road Landfill, Flynn Rd., Greece [3,4]	Monroe
Gates Dump, Hinchey Rd., Gates [1]	Monroe
Genesee Gorge, Upper Falls to Lower Falls, Rochester [1]	Monroe
Genesee Scrap and Tin, 80 State St., Rochester [2]	Monroe
Monarch Sand and Gravel, Ridge Rd., Parma [3]	Monroe
NYSDOT, Pittsford [1]	Monroe
Ogden Landfill, Lyell St., Ogden [1]	Monroe
Old Rochester City Landfill, Pattonwood Dr., Irondequoit [3]	Monroe
Parma 6, Ridge Rd. At Manitou Rd., Parma [1]	Monroe
Tom Paxton Chevrolet, 3722 Scottsville Rd., Wheatland [3]	Monroe
Railroad Car Shops, Despatch Dr., East Rochester [3]	Monroe
Rush Landfill, Route 251, Rush [3]	Monroe
Scottsville Rd. - Chili 2, Scottsville Rd., Chili [3]	Monroe
Trimmer Rd. Landfill, Trimmer Rd., Parma [1]	Monroe
Route 19 Drum Disposal (McGinnis), Route 19, LeRoy [3]	Genesee
Genesee Sand and Gravel, 748 Phillips Rd., Victor [3]	Ontario

W. Almond Pesticide, North of County Rt. 2A, W. Almond [2]	Allegany

[1] Delisted before Stage I was published.
[2] Delisted due to remediation since Stage I was published.
[3] Delisted for documentation reason since Stage I was published.
[4] Leakage was detected in 1996, which may change the status of this landfill.

There are 17 facilities that are new to this list since the Stage I RAP was published. They are included in Table 3-18. One site, the Pittsford Town Dump in Monroe County, has been "relisted" since the Stage I RAP.

The definitions of the Site Classifications are as follows:

- 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.

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Table 3-18
Inactive Hazardous Waste Sites in the Rochester Embayment Drainage Basin Containing Area of Concern (AOC) Priority Chemicals

Waste Site Name and Location	Registry I.D. & Site Classification	Drainage Basin or Nearest Waterway	Rochester Embayment AOC Priority Chemical Pollutants Identified (See Table 3-20 for complete list.)	
Monroe County				
Autohaus of Rochester 99 Marsh Rd. Perinton	828084 2	Irondequoit Creek (Central Basin)	Acetone Benzene Methyl ethyl ketone Methylene chloride	Tetrachloroethylene 1,1,1-Trichlororethane Trichloroethylene
Bausch & Lomb Frame Center 465 Paul Rd. Chili	828061 2	Black Creek (Genesee Basin)	Benzene Benzo(a)anthracene Benzo(b)fluoranthene Benzo(k)fluoranthene Benzo(a)pyrene Chrysene Fluoranthene Pyrene Toluene 1,1,1-Trichloroethane	Trichloroethylene Cadmium Chromium Lead Mercury Nickel Silver Vanadium Zinc
Beehler & Radford 600 Burritt Rd. Parma	828054 2a	Salmon Creek (West Basin)	Metahydroxide sludges Arsenic Barium	
(Former Black & Decker & former General Electric) Kleenbrite 200 State St. Brockport	828003 2	Brockport Creek (West Basin)	Trichloroethylene Chromium Iron Nickel	
Brockport Landfill Canal Rd. Sweden	828038 2	Brockport Creek (West Basin)	Acetone Benzene Di-N-octyl phthalate Toluene Trichloroethylene Aluminum Arsenic Barium	Cadmium Cobalt Copper Iron Lead Manganese Vanadium Zinc
Burroughs/Unisys Site 1225 Ridgeway Ave. Rochester	828075 2	Tributary of Genesee River	Acetone Methyl ethyl ketone Toluene	

Waste Site Name and Location	Registry I.D. & Site Classification	Drainage Basin or Nearest Waterway	Rochester Embayment AOC Priority Chemical Pollutants Identified (See Table 3-20 for complete list.)	
Chemical Sales Corp. (Chemco) 190 Lee Rd. Gates	828086 2	Erie Canal	Acetone Hexane Methylene chloride Methyl ethyl ketone	Tetrachloroethylene Toluene 1,1,1-Trichloroethane Trichloroethylene
Davidson's Collision 399 Gregory St. Rochester	828091 2a	Genesee River	Ethylbenzene Toluene Xylene	Waste paint thinners
Davis Howland Oil Corp. 200 Anderson Ave. Rochester	828088 2	Genesee Basin	Acetone Methylene chloride Methyl ethyl ketone Trichloroethylene	Toluene 1,1,1-Trichloroethane Cadmium Lead
Dearcop Farm Dearcop Dr./Varian Lane Gates	828016 2	Erie Canal	Benzene Trichloroethylene Aluminum Arsenic	Cadmium Lead Manganese Silver
Delphi Automotive Systems 1000 Lexington Ave. Rochester	828064 2	Genesee River	Benzene Tetrachloroethylene 1,1,1-Trichloroethane Trichloroethylene	Toluene Lead
(Former Dollinger Corp.) American Filtrona Corp. 1 Townline Circle Brighton	828078 4	Red Creek (Genesee Basin)	Trichloroethylene	
Eastman Kodak Co. Kodak Park East, KPE 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 (West Basin)	Acetone Methylene chloride	
Eastman Kodak Co. KPW 1669 Lake Ave. Rochester	828074 2	Genesee River	Cyclohexane Methylene chloride Silver	

Waste Site Name and Location	Registry I.D. & Site Classification	Drainage Basin or Nearest Waterway	Rochester Embayment AOC Priority Chemical Pollutants Identified (See Table 3-20 for complete list.)	
Eastman Kodak Co. KPX 1669 Lake Ave. Rochester	828092 2	Genesee River	Acetone Benzene Ethylbenzene Methylene Chloride	Xylene
Eastman Kodak Co. Weiland Rd. Landfill 1669 Lake Ave. Greece	828002 2a	Paddy Hill Creek (West Basin)	Electroplating waste sludge Incinerator residue Photograph developer	
Emerson St. Landfill Emerson St. Rochester	828023 3	Erie Canal Storm sewers (West Basin)	Acetone Benzene Bis (2-ethylhexyl) phthalate Chlordane 4,4'-DDT' Di-N-octyl phthalate Toluene	Trichloroethylene Aluminum Chromium Iron Lead Manganese Zinc
Erdle Perforating 100 Pixley Industrial Pkwy. Gates	828072 2	Little Black Creek (Genesee Basin)	Tetrachloroethylene Trichloroethylene	
General Circuits 95 Mt. Read Blvd. Rochester	828085 2	Genesee River	Acetone Tetrachloroethylene Toluene	Trichloroethylene Chromium
Golden Rd. Disposal Site Golden Road Chili	828021 2	Little Black Creek (Genesee Basin)	Benzene PCBs Tetrachloroethylene Toluene 1,1,1-Trichloroethane Arsenic	Barium Chromium Lead Manganese Zinc
Hamlin Town Dump Brick Schoolhouse Rd. Hamlin	828032 2	Sandy Creek (West Basin)	Paint and ink sludges	
High Acres Landfill Perinton Pkwy. Perinton	828014 3	Thomas Creek (Central Basin)	Acetone Benzene Phenol	Toluene Cyanide

Waste Site Name and Location	Registry I.D. & Site Classification	Drainage Basin or Nearest Waterway	Rochester Embayment AOC Priority Chemical Pollutants Identified (See Table 3-20 for complete list.)	
(Former Jarl Extrusions, Inc.) Alcan Aluminum Corp. 860 Linden Ave. Pittsford	828005 2	Irondequoit Creek (Central Basin)	Aluminum Chromium Copper Iron	Lead Nickel Zinc
Jasco Sun Heat Treating Co. 820 Turk Hill Rd. Perinton	828090 3	Thomas Creek (Central Basin)	Barium chloride wastes Nonchlorinated solvents	
Little League Lynden Rd. Perinton	828026 3	Thomas Creek (Central Basin)	Acetone Chloroform PCBs Aluminum Cadmium	Copper Cyanide Iron Lead Zinc
(Former 3M/Dynacolor) Brockport Cold Storage 98 Spring St. Brockport	828066 2	Brockport Creek (West Basin)	PCBs Cadmium Cyanide Silver Zinc	
NYSDOT 938 West Linden Ave. Pittsford	828045 2a	Irondequoit Creek (Central Basin)	Acetone Benzene Endosulfan Fluoranthene Methylene chloride Phenanthrene	Pyrene Toluene Chromium Iron Lead Manganese
Olin Chemicals 100 McKee Road Rochester	828018A 2	Erie Canal	Benzene Carbon tetrachloride Chloroform Dibromochloromethane 1,2-Dichlorobenzene 1,3-Dichlorobenzene	1,4-Dichlorobenzene Methylene chloride Tetrachloroethylene Toluene 1,1,1-Trichloroethane
Perinton Landfill Perinton Pkwy. Perinton	828033 3	White Brook (Central Basin)	Barium Cadmium Chromium	Cyanide Silver
Pittsford Town Dump Marsh Rd. Pittsford	828048 3	Erie Canal, Irondequoit Creek (Central Basin)	Arsenic Barium Cyanide Lead	Manganese Zinc

Waste Site Name and Location	Registry I.D. & Site Classification	Drainage Basin or Nearest Waterway	Rochester Embayment AOC Priority Chemical Pollutants Identified (See Table 3-20 for complete list.)	
R.D. Specialties 560 Salt Rd. Webster	828062 4	Four Mile Creek (Central Basin)	Chromium	
George A. Robinson & Co., Inc. 477 Whitney Rd. Perinton	828065 2	Tributary of Irondequoit Creek (Central Basin)	Trichloroethylene	
Rochester Fire Academy 1190 Scottsville Rd. Rochester	828015 2	Genesee River	Benzene Benzo(a)pyrene Benzo(b)fluoranthene Benzo(k)fluoranthene Bis (2-ethylhexyl) phthalate Chloroform Chrysene Methyl ethyl ketone PCBs	Pyrene Tetrachloroethylene Toluene Cadmium Copper Lead Silver Zinc
Roehlen Engraving 701 Jefferson Rd. Henrietta	828077 2	Red Creek (Genesee Basin)	Methylene chloride Trichloroethylene Chromium	Lead
Former Romeo Ford 933 Ridge Rd. Webster	828096 3	West Creek (Central Basin)	Acetone Benzene Chlorobenzene	
Scobell Chemical 1 Rockwood Place Brighton	828076 2	Grass Creek (tributary of Irondequoit Bay, Central Basin)	Tetrachloroethylene Toluene	
Sigismondi Landfill 870 Linden Ave. Pittsford	828011 2	Irondequoit Creek (Central Basin)	1,1,1-Trichloroethane Chromium Lead	
Stuart-Oliver-Holtz 39 Commerce Dr. Henrietta	828079 2	Red Creek (Genesee Basin)	Methylene chloride Tetrachloroethylene 1,1,1-Trichloroethane	Trichloroethylene
Sweden-3, Chapman Beadle Rd. Sweden	828040 2	Salmon Creek (West Basin)	Acetone Benzene Bis (2-ethylhexyl) phthalate 4,4'-DDT Methylene chloride Tetrachloroethylene Trichlorethylene	Toluene Cadmium Chromium Cyanide Lead Mercury

Waste Site Name and Location	Registry I.D. & Site Classification	Drainage Basin or Nearest Waterway	Rochester Embayment AOC Priority Chemical Pollutants Identified (See Table 3-20 for complete list.)
Taylor Instruments 95 Ames St. Rochester	828028A 4	Genesee River	Mercury
Village of Spencerport Dump Trimmer Rd. Ogden	828025 3	Buttonwood Creek (West Basin)	Beta BHC Iron Manganese
Former Ward's Scientific East Ridge Rd. Irondequoit	828098 2a	Irondequoit Bay	Trichloroethylene
Xerox Landfill 800 Phillips Rd. Webster	828013 4	Four Mile Creek (Central Basin)	Acetone Carbon tetrachloride Chloroform Tetrachloroethylene 1,1,1-Trichloroethane Toluene Arsenic Selenium
Xerox - Salt Rd. 800 Phillips Rd. Webster	828067 2	Four Mile Creek (Central Basin)	Tetrachloroethylene Trichloroethylene Toluene
Xerox - Bldg. 201 800 Phillips Rd. Webster	828080 2	Mill Creek (Central Basin)	Tetrachloroethylene 1,1,1-Trichloroethane Trichloroethylene Arsenic Chromium Nickel Selenium
Xerox - Henrietta 1350 Jefferson Rd. Henrietta	828069 2	Allen's Creek (Central Basin)	Methylene chloride Tetrachloroethylene 1,1,1-Trichloroethane
Xerox - Nursery Area Bldg. 119 San Jose Blvd. Webster	828083 2	Four Mile Creek (Central Basin)	Tetrachloroethylene Toluene 1,1,1-Trichloroethane Trichloroethylene
Xerox - Bldg. 209 800 Phillips Rd. Webster	828068 2	Four Mile Creek (Central Basin)	Tetrachloroethylene 1,1,1-Trichloroethane Trichloroethylene

Waste Site Name and Location	Registry I.D. & Site Classification	Drainage Basin or Nearest Waterway	Rochester Embayment AOC Priority Chemical Pollutants Identified (See Table 3-20 for complete list.)	
Orleans County (All in West Basin)				
(Former Ag-Chem) J.I. Case property 3922 Allis Rd. Ridgeway	837010 2	Oak Orchard Creek	DDD, DDT, DDE Chlordane Dieldrin Endrin	Arsenic
Diaz Chemical Corp. 40 Jackson St. Holley	837009 2	Erie Canal	2-Bromopyridine Ethylene chloride Methylene chloride	
Fisher-Price, Inc. 711 Park Ave. Medina	837008 2	Oak Orchard Creek	1,1,1-Trichloroethane Trichloroethylene Trichlorofluoromethane	
FMC Corp. Dublin Rd. Shelby	837001 2	Erie Canal	DDT Other pesticides Arsenic	Mercury Lead
Haight Farm 4879 Upper Holley Rd. Clarendon	837006 2	Sandy Creek	Trichloroethylene Other solvents	
Lyndonville - West Ave. West Ave. Lyndonville	837002 2	Erie Canal	Carbon tetrachloride DDT Methoxychlor PCBs	1,1,1-Trichloroethane Heavy metals
McKenna Landfill N. of Yeager Rd. Albion	837003 2	Erie Canal	Benzene Cleaning solvents Barium	Manganese Other industrial waste
Genesee County (all in Genesee Basin)				
Lapp Insulator Co. 130 Gilbert St. LeRoy	819017 2a	Oatka Creek	Tetrachloroethylene Trichloroethylene	
Lehigh Valley RR Derailment Gulf Rd. & Lehigh Valley RR crossing LeRoy	819014 2	Oatka Creek	Trichloroethylene Cyanide	
Target Products, Inc. Lent Ave. LeRoy	819015 2a	Oatka Creek	Tetrachloroethylene Toluene 1,1,1-Trichloroethane	

Waste Site Name and Location	Registry I.D. & Site Classification	Drainage Basin or Nearest Waterway	Rochester Embayment AOC Priority Chemical Pollutants Identified (See Table 3-20 for complete list.)
Wyoming County (all in Genesee Basin)			
ETE Sanitation and Landfill Broughton Rd. Gainesville	961005 2	Cotton Creek (tributary of Oatka Creek)	Carbon tetrachloride Lead
Robeson Industries, Inc. Buffalo Rd. Castile	961008 2	Oatka Creek	1,1,1-Trichloroethane
Warsaw Village Landfill Industrial St. Warsaw	961006 3	Oatka Creek	Toluene Lead Plating wastes
Livingston County (All in Genesee Basin)			
William Benson Landfill 7440 Richmond Mills Rd. Livonia	826007 2	Honeoye Creek	Ester, ethers, alcohols Halogenated aliphatics Halogenated aromatics Inorganic salts
Enarc-O Machine Products 1175 Bragg St. Lima	826011 2	Honeoye Creek	1,1,1-Trichloroethane Trichloroethylene Halogenated solvents Other solvents
Foster-Wheeler Corp. RD #3 N. Dansville	826001 2	Canaseraga Creek	Bis (2-ethylhexyl) phthalate Chloroform Methylene chloride PCBs Waste paint
Jones Chemical 100 Sunny Sol Blvd. Caledonia	826003 2	Spring Creek	Methylene chloride Tetrachloroethylene 1,1,1-Trichloroethane Trichloroethylene Xylene
(Former Lucidol) Atochem N. America Route 63 Piffard	826006 2a	Genesee River	Ash Sludges Chloroformates Organic peroxides
New York State Electric & Gas Ossian St. Dansville	826012 2a	Mud Creek	Chlorinated VOCs Reactive sulfides Tar sludges Waste tars

Waste Site Name and Location	Registry I.D. & Site Classification	Drainage Basin or Nearest Waterway	Rochester Embayment AOC Priority Chemical Pollutants Identified (See Table 3-20 for complete list.)	
Tennessee Gas Pipeline Station 233 Dow Rd. & Federal Rd. York	826014 2a	Bidwells Creek	PCBs	
Allegany County (All in Genesee Basin)				
Deming Electroplating Route 305 New Hudson	902007 2a	Black Creek	Cadmium Lead Heavy metal sludges	
Cuba Municipal Waste Disposal Jackson Hill Rd. Cuba	902012 2	Black/Van Campen Creeks	Chlorinated solvents Paint sludges PCBs Cyanide	
Friendship Foundries 10 Howard St. Friendship	902015 2	Van Campen Creek	PCBs Ignitable liquid waste solvents	
Sinclair Refinery Brooklyn Ave. Wellsville	902003 2	Genesee River	PCBs Pesticides Petroleum	Lead Nickel
Wellsville-Andover Landfill Snyder Hill Rd. Wellsville and Andover	902004 2	Duffy Hollow Creek (tributary of Chenunda)	Methylene chloride VOCs SVOCs Resins, solvents Chromium	Cyanide Zinc Metals

3.12. Rochester Embayment use impairments, causes and sources

(An update of information in the Stage I RAP)

The Stage I RAP, pages 6-2 through 6-5, displays a table showing the linkages between impaired uses, pollutants causing impaired uses, and sources of pollutants. The Stage I table was reviewed in 1996 by the Monroe County Water Quality Coordinating Committee and the Monroe County Water Quality Management Advisory Committee. Because of information obtained since the publication of the Stage I RAP, a few revisions to the table were necessary. The revised table is shown below (Table 3-19).

Table 3-19 was created independently of the High Priority Chemical Pollutant List (see Table 3-12). When the High Priority Chemical Pollutant List was developed, Rochester Embayment use impairments were considered, but many other factors were considered also. Therefore, the High Priority Chemical Pollutant List includes some chemicals that are not specifically named in Table 3-19. On the other hand, many substances, such as sediment and algae, are listed as causes of use impairments in Table 3-19, but are not specifically named on the High Priority Chemical Pollutant List (although they may be related to one or more chemicals on the list).

Author: Carole Beal

Table 3-19
Rochester Embayment Use Impairments, Causes and Sources

INDICATOR (Use Impairment)	LOCATION Genesee River	LOCATION L.O./Embayment	CAUSES (Known)	CAUSES (Possible)	SOURCES[1] (Known)	SOURCES[2] (Possible)
Restrictions on fish and wildlife consumption	Yes	Yes	PCB[7]		-Scrapyards -Disposal sites -Recycling through sediments, water, air	-Electrical equipment in storage -Electrical equipment still in use.
			Mirex[7]		-Niagara River area -Oswego area	
			Dioxin[7]		-Atmospheric deposition/ -Incineration -Niagara River area	
			Chlordane[7] (waterfowl only)		-Past agricultural and residential use	
			DDT[7] (waterfowl only)		-Past insecticide use -Atmospheric deposition	
Tainting of fish and wildlife flavor	Unknown	Unknown		Phenols		-Atmospheric deposition -Industrial and municipal wastewater
Degradation of fish and wildlife populations (mink reproductive problems)	Yes (for mink; unknown for other species)	Yes (for mink; unknown for other species)		PCB[7]	-Scrapyards -Disposal sites -Recycling through sediments, water, air	-Electrical equipment in storage -Electrical equipment still in use
				Mercury[7]	-Industrial wastewater -Abandoned industrial sites	-Atmospheric deposition -Abandoned industrial sites
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 (mink reproductive problems)	Yes (mink)	Yes (mink)		PCB[7] (see Degradation of fish & wildlife populations)	-Scrapyards -Disposal sites -Recycling through sediments, water, air	-Electrical equipment in storage -Electrical equipment still in use

INDICATOR (Use Impairment)	LOCATION Genesee River	LOCATION L.O./Embayment	CAUSES (Known)	CAUSES (Possible)	SOURCES[1] (Known)	SOURCES[2] (Possible)
Degradation of benthos	Yes	Unknown	Oxygen depletion		-CSOs and other past discharges (lasting effects in sed.)[3] -Industrial and municipal wastewater -Stormwater	
				Cadmium[7]	-Industrial and municipal wastewater	
				Copper	-Nonpoint sources -Industrial and municipal wastewater	
				Iron	-Nonpoint sources -Disposal sites	
				Nickel	-Nonpoint sources -Industrial and municipal wastewater	
				Silver[7]	Eastman Kodak Co.	
				Fuel oil		-Unknown
				Sediment toxics	-Nonpoint sources -Industrial and municipal wastewater -Disposal sites	
				PCB[7]	-Scrapyards -Disposal sites -Recycling through sediments, water, air	-Electrical equipment in storage -Electrical equipment still in use
				Chlordane[7]		-Merrill St. storm sewer
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	

INDICATOR (Use Impairment)	LOCATION Genesee River	LOCATION L.O./Embayment	CAUSES (Known)	CAUSES (Possible)	SOURCES[1] (Known)	SOURCES[2] (Possible)
Restrictions on dredging activities (continued)			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[7])		-Agricultural runoff -Atmospheric deposition -CSOs[3] -Dredge spoil -On-site waste disposal systems -Municipal and industrial wastewater -Urban stormwater	
Drinking water taste and odor problems	N/A[5]	Yes	Algae (phosphorus[7])		-Agricultural runoff -Atmospheric deposition -CSOs[3] -Dredge spoil -On-site waste disposal systems -Municipal and industrial wastewater -Urban stormwater	
			Turbidity and temperature changes		-Weather conditions agitate lakewater	
Beach closings	N/A[6]	Yes	Algae (phosphorus[7])		-Agricultural runoff -Atmospheric deposition -On-site waste disposal systems -Municipal and industrial wastewater -CSOs[3] -Dredge spoil -Urban stormwater	
			Fecal coliform		-CSOs and stormwater (Genesee River)[3] -Decomposing algae -Dredging (distributes bacteria from sediments) -Sewer cross-connections -Stormwater runoff (West Sub-basin)	

INDICATOR (Use Impairment)	LOCATION Genesee River	LOCATION L.O./Embayment	CAUSES (Known)	CAUSES (Possible)	SOURCES[1] (Known)	SOURCES[2] (Possible)
Beach closings (continued)			Turbidity (Sediment)		-Agricultural runoff -Construction sites -CSOs[3] -Dredging -Natural causes -Streambank erosion -Urban stormwater	
Degradation of aesthetics	Yes	Yes	Algae (phosphorus[7])		-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	
			Litter		-CSO[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 conditions agitate lakewater

INDICATOR (Use Impairment)	LOCATION Genesee River	LOCATION L.O./Embayment	CAUSES (Known)	CAUSES (Possible)	SOURCES[1] (Known)	SOURCES[2] (Possible)
Degradation of phytoplankton and zooplankton populations	Yes	Unknown		Eutrophication (excess phosphorus[7])	-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	
				Road salt	-Winter highway salting	
				Lack of fluctuation in lake levels	Lake level management	

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 of the Stage I RAP. 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 to 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, including times 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.

[6]There are no beaches on the Lower Genesee River.

[7]A chemical that is specifically named on the Rochester Embayment High Priority Chemical Pollutant List.

3.13. Point source discharges within the Rochester Embayment watershed

New York State industrial and municipal facilities that hold State Pollution Discharge Elimination System (SPDES) permits to discharge to waterways are required to submit flow and either chemical concentration or loading data regularly to the New York State Department of Environmental Conservation (NYSDEC). (See also the Chapter 6 section on "State Pollution Discharge Elimination System".) The data is stored in a database, but the database is not designed to calculate annual loadings (unit of weight per year). However, estimates of annual loadings can be made by manually searching reports sent by facilities to NYSDEC and performing the necessary calculations. (Concentration multiplied by flow and a conversion factor equals loading.) The NYSDEC performed these calculations for the Stage I RAP, but were not able to repeat the process to provide an update for the Stage II RAP.

Table 5-3 in the Stage I RAP (page 5-41) shows the *total* loadings of certain chemicals from facilities within the Rochester Embayment watershed during water year 1991 (October 1990 - September 1991). The parameters chosen for the table were:

- Wastewater discharges of the pollutants on the priority chemical pollutant list for the Rochester Embayment. (The priority chemical pollutant list is shown below in Table 3-20. The process for choosing the priority chemical pollutants is described in the Stage I RAP on page 5-1 and Appendix D.) The list of pollutants in the Stage I table does not totally parallel the priority chemical pollutant list because not every priority chemical pollutant is measured or found in wastewater. The presence of one of the priority chemical pollutants in a facility's discharge does not necessarily indicate that there is a linkage to a Rochester Embayment use impairment. The priority chemical pollutant list includes chemicals for which linkages to use impairments are unknown as well as chemicals with known and possible linkages to use impairments.
- 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 discharges directly to the Lake (see Table 3-21). Therefore, it includes the three major municipal wastewater treatment plants along the lakeshore, but excludes dischargers within the West and Central Sub-basins that discharge to smaller streams (whose contributions to the Lake are relatively minor).

While the table shown in the Stage I RAP gives the *total* loadings of each chemical from *all the facilities* during water year 1991, Table 3-22 below shows the loadings of each chemical from *each facility* during the same year.

A "0" in Table 3-22 means that an analysis for a chemical was performed and the results were below detection limits, or that under current operating conditions, analysis is not required. An example of the latter is a sewage treatment plant that must report phosphorus concentration only if the flow at the plant is one million gallons per day or more. Results that are below detection limits may also be denoted as "<DL." A blank means that there was no analysis required.

Five facilities that were required to report one or more chemicals on Table 3-20 are not included in Table 3-22. These facilities reported "0" or below detection limit (<DL) for each of the chemicals. The facilities are:

Facility	Chemical Loadings Reported as "0" or <DL
Conesus Treatment Plant	Phosphorus
DOT	Toluene, benzene
Geneseo Treatment Plant	Phosphorus
Warsaw Treatment Plant	PCBs (The Warsaw Treatment Plant has been required to monitor once a year for PCB-1248 in *effluent* since a *sludge* analysis in the late 1980s contained 40 ppm of the PCB.)
Wegmans	Toluene, benzene, dichlorobromo methane

Additional notes on Table 3-22:

- *The sum of the facility phosphorus loadings does not equal the total as shown in Stage I RAP Table 5-3. The discrepancy cannot be resolved.
- **The sum of facility phosphorus loadings does not equal the total as shown in Stage I RAP Table 5-3. The contribution of one facility was omitted in the Stage I data.
- The Stage I RAP included *total* loading data for suspended solids. Data for suspended solids loading *from each facility* could not be located to present in Table 3-22.

Author: Carole Beal

Table 3-20
Priority Chemical Pollutants for the Rochester Embayment Area of Concern

Inorganics

Metals
Aluminum
Arsenic
Barium
Cadmium
Chromium
Cobalt
Copper
Iron
Lead
Manganese
Mercury
Molybdenum
Nickel
Selenium
Silver
Strontium
Vanadium
Zinc

Other inorganics
Alkylated lead
Cyanide
Phosphorus
Sediment

Organics

Pesticides
Aldrin
Chlordane
DDT and metabolites
Dieldrin
Endosulfan, total
Endrin
Heptachlor & epoxide
Hexachlorocyclohexane, total
Methoxychlor
Mirex & photomirex
Toxaphene

Other organics
Acetone
Benzene
Benzo (a) anthracene
Benzo (b) fluoranthene
Benzo (k) fluoranthene
Benzo (a) pyrene
Bis (2-ethylhexyl) phthalate
Carbon tetrachloride
Chlorinated dibenzofurans
Chloroform
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

Other organics (cont'd)
Dioxin (2,3,7,8-TCDD)
Fluoranthene
Furan (2,3,7,8-TCDF)
Haptanone
Hexachlorobenzene
Hexachlorobutadiene
Hexane
Methyl ethyl ketone
Methylene chloride
Octachlorostyrene
Pentachlorobenzene
Pentachlorophenol
Phenol
Polychlorinated biphenyls
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
Trichloroethylene
2,4,5-Trichlorophenol
2,4,6-Trichlorophenol
2,3,6-Trichlorotoluene
2,4,5-Trichlorotoluene

Table 3-21
Facilities within the Rochester Embayment watershed that discharged at least one substance on the Rochester Embayment list of priority chemical pollutants from October 1990 to September 1991

Discharger	NYSDEC Description	County	Receiving Water
Agway Petroleum Corp.	Petroleum bulk stations & terminal	Monroe	Erie Canal
Atochem N.A., Organic Peroxides	Industrial organic chemicals	Livingston	Genesee R
Avon	Sewerage systems	Livingston	Genesee R
Beebee Station, Station #3	Electricity & other services combined	Monroe	Genesee R
Bradley, Walter W., TP (Webster)	Sewerage systems	Monroe	L Ontario
Dansville TP	Sewerage systems	Livingston	Canaseraga Ck
Eastman Kodak Company	Photographic equipment & supplies	Monroe	Genesee R
Enarc-o Machine Products, Inc.	Metal coating & allied services	Livingston	Honeoye Cr & groundwater
Foster Wheeler Energy Corp.	Nonclassifiable establishment	Livingston	Canaseraga Ck
Friendship Dairies	Condensed & evaporated milk	Allegany	VanCampen Ck
Gates-Chili-Ogden TP	Sewerage systems	Monroe	Genesee R
General Electric	Sanitary services	Monroe	Erie Canal
Groveland Correctional Facility	Services	Livingston	Keshequa Ck
Hess Light Terminal	Petroleum bulk stations & terminal	Monroe	Groundwater
Hydramec Inc.	Plating & polishing	Allegany	Groundwater
Markin Tubing, Inc.	Steel pipe and tubes	Wyoming	Groundwater
Monroe County Water Authority	Water supply	Monroe	Round Pond
Morton Salt	Chemicals & chemical prep.	Wyoming	Wolf Ck
Northwest Quadrant Pure Waters District	Sewerage systems	Monroe	L Ontario
Travelport	Trucking terminal facility	Livingston	Groundwater
Union Processing Corp.	Petroleum bulk stations & terminal	Monroe	Black Cr Trib
Van Lare, Frank E., TP	Sewerage systems	Monroe	L Ontario
Wayland TP	Sewerage systems	Steuben	Marl Bed Pond trib
Wellsville TP	Sewerage systems	Allegany	Genesee R
Xerox Corporation Wilson Center	Photographic equipment & supplies	Monroe	Mill Ck Trib

*TP = Wastewater treatment plant

Table 3-22. SPDES Mass Loading Data: Water Year 1991 (10/01/90 - 09/30/91)

(Data in lbs) Facility	Aluminum Total	Arsenic Total	Cadmium Total	Hexavalent Chromium	Chromium Total	Copper Total	Cyanide
Agway							
Akzo							1,232.8
Atochem					13.7	7.3	
Avon TP							
Beebee Stn.		<DL	<DL	<DL	<DL	0.9	
Bradley TP					0	196.2	
Dansville TP							
Eastman Kodak			492.8		2,278.3	3,876.9	2,150.5
Enarc-o						0.2	
Foster Wheeler							
Friendship Dairy							
GCO TP							
General Electric							
Groveland	314.9						
Hess							
Hydramec				0.012	0.108		
Markin Tubing						10.1	
Monroe Co. Water Authority	5, 477					0	
Morton							
NW Quadrant TP							
Travelport							
Union Processing						7.7	
Van Lare TP			48.7		647.9	8,553.2	3,510.1
Wayland TP						3.7	
Wellsville TP							
Xerox		2.1			3.5	90.8	35.3
Total	5,792	2.1	542	0.012	2,944	12,747	6,929

Table 3-22. SPDES Mass Loading Data: Water Year 1991 (10/01/90 - 09/30/91)

(Data in lbs) Facility	Iron Total	Lead Total	Man-ganese Total	Mercury Total	Nickel Total	Phosphorus Total	Selenium Total	Silver Total
Agway								
Akzo								
Atochem					5.5	4,492.8		5.9
Avon TP						730		
Beebee Stn.	141.1	<DL	1.5		0.3		<DL	
Bradley TP		29.8		0	469.9	12,717.9	14.6	0
Dansville TP						1,293.7		
Eastman Kodak	25 762.9	2 862.2		25.9	2,159.6	25,078.1		6,539.6
Enarc-o	1.7							
Foster Wheeler								
Friendship Dairy						14,560.2		
GCO TP						23,122.6		
General Electric	4.3							
Groveland	51							
Hess								
Hydramec	0.9							
Markin Tubing		0.6						
Monroe Co. Water Auth.		0						
Morton	14,671.2							
NW Quadrant TP						37,942.8		
Travelport								
Union Processing		9.1						
Van Lare TP	90,261.5	1,183.2			5,266.6	254,551.3		990.1
Wayland TP		15						
Wellsville TP						2,097.4		
Xerox					46.7			
Total	130,895	4,100	1.5	25.9	7,949	*376,587	14.6	7,536

Table 3-22. SPDES Mass Loading Data: Water Year 1991 (10/01/90 - 09/30/91)

(Data in lbs) Facility	Zinc Total	Benzene	Benzene, Toluene, Xylene	Bis (2-ethyl-hexyl) Phthalate	Chloroform	Dichloro-bromo-methane	Di-N-octyl Phthalate	Methylene Chloride
Agway		13.2	7.4					
Akzo								
Atochem	23.7			71.8			0	
Avon TP								
Beebee Stn.	1.6							
Bradley TP	428.9							39.2
Dansville TP								
Eastman Kodak	32,706				514			2,658.4
Enarc-o	0.2							
Foster Wheeler								
Friendship Dairy								
GCO TP								
General Electric								
Groveland								
Hess		1.08						
Hydramec	3.3							
Markin Tubing	25.3							
Monroe Co. Water Auth.								
Morton								
NW Quadrant TP								
Travelport		1.7						
Union Processing	22.8		0.6					
Van Lare TP	15,272							2,034.9
Wayland TP	27.6				0			
Wellsville TP								
Xerox						17.6		1.2
Total	48,512	16	8	71.8	514	17.6	0	4,734

Table 3-22. SPDES Mass Loading Data: Water Year 1991 (10/01/90 - 09/30/91)

(Data in lbs) Facility	Phenol Single	Phenols	Phenolic Total	Tetrachloro-ethylene	Toluene	1,1,1-Trichloro-ethane	Trichloro-ethylene
Agway					0.9		
Akzo							
Atochem		51.1	158.6				
Avon TP							
Beebee Stn.		<DL					
Bradley TP						0	
Dansville TP							
Eastman Kodak							
Enarc-o							
Foster Wheeler						73.7	
Friendship Dairy							
GCO TP							
General Electric				0.4		0.01	0.01
Groveland							
Hess					0.32		
Hydramec							
Markin Tubing							
Monroe Co. Water Auth.							
Morton							
NW Quadrant TP							
Travelport					1.7		
Union Processing					0.3		
Van Lare TP		1,960.4		0	0		
Wayland TP			2.1				
Wellsville TP							
Xerox			5.2	1.9	0.7	3.4	24.9
Total	0	2,012	166	2.3	3.9	**77	24.9

3.14. Water loading data from the Toxic Release Inventory

Shown in Table 3-23 are discharges to water in 1994, as reported in the Toxic Release Inventory (TRI), for Livingston, Genesee and Monroe Counties. The database was also searched for Allegany and Orleans Counties. However, there were no water discharges reported for 1994 in these two counties. There were no underground injection discharges reported for any of the five counties.

The number of facilities that are required to report to the Toxic Release Inventory is much smaller than the number of facilities that have a New York State Department of Environmental Conservation State Pollution Discharge Elimination System (SPDES) permit to discharge to surface water or groundwater. However, TRI data is generally considered to be a more accurate representation of the discharge for the facilities that do report TRI data.

The releases reported in Table 3-23 are those for chemicals that are on *both* of the following lists:

- The Rochester Embayment list of Priority Pollutants (see Table 3-20).
- Chemicals required to be reported by the federal Superfund Amendments and Reauthorization Act (SARA) Title III.

The releases, as reported, include stormwater discharge.

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Table 3-23
Discharges (Loading) to Water as Reported in the Toxic Release Inventory

	Eastman Kodak Co. Monroe County		Elf Atochem Livingston County		Lapp Insulator Co.[1] Genesee County		Sabin Metal Corp.[1] Monroe County	
	Pounds 1994	Receiving water	Pounds 1994	Receiving water	Pounds 1994	Receiving water	Pounds 1994	Receiving water
2-Butanone (methyl ethyl ketone)	1,300	Genesee	45	Genesee				
Chlorinated phenols	2	Genesee						
Methylene chloride (dichloromethane)	4,700	Genesee						
Phenol	170	Genesee						
Toluene	560	Genesee						
Barium compounds	5,200	Genesee						
Chromium compounds	1,200	Genesee						
Copper					20	Oatka Cr.	32	Oatka Cr.
Copper compounds	2,100 1	Genesee Paddy Hill						
Lead							11	Oatka Cr.
Lead compounds	850 21	Genesee Paddy Hill						
Manganese compounds	36,000 1	Genesee Paddy Hill						
Silver compounds	5,800 74	Genesee Paddy Hill						
Zinc compounds	30,000 240	Genesee Paddy Hill						

1 Not included in the list of SPDES dischargers in the Chapter 3 section on "Point source discharges within the Rochester Embayment." It is a discharger within the Lake Ontario West Basin that discharges to a stream and that discharge was excluded from the calculations.

3.15. Trackdown of Chemical Contaminants to Lake Ontario from New York State Tributaries

3.15.1. Background:

From October 1993 to November 1994, the New York State Department of Environmental Conservation (NYSDEC) sampled surface water and wastewater along major tributaries of Lake Ontario and sites within their basins. Included in this sampling program were the Genesee River, Irondequoit Creek, Allen's Creek, the Barge Canal (Erie Canal) and Little Black Creek. The purpose of the sampling program was to learn more about sources of toxic substances to Lake Ontario from New York tributaries. The program sampled at locations not routinely monitored as part of federal and state programs. The results of the sampling and analysis program are reported in the NYSDEC document Trackdown of Chemical Contaminants to Lake Ontario from New York State Tributaries (April 1996).

3.15.2. Sampling parameters and methods:

Sampling and analysis were performed for the following (each parameter was not analyzed for every site):

- Polychlorinated biphenyls (PCBs)
- Chlorinated pesticides:
    - Hexachlorocyclohexanes (sum BHC)
    - Heptachlor and Heptachlor epoxide (sum Heptachlor)
    - Aldrin/Dieldrin/Endrin (including Endrin ketone, Endrin aldehyde)
    - Endosulfans
    - DDT and DDE (sum DDT)
    - Chlordanes
- Mercury

Dioxins and furans, mirex, and polynuclear aromatic hydrocarbons (PAHs) were also analyzed for a very limited number of sites. Most of the samples were taken from the water column as dissolved or suspended solids samples. A few samples were taken from sediment or soil.

PCBs and pesticides in the dissolved phase of the water column were sampled using passive in-situ chemical extraction samplers (PISCES) which remained in the water for approximately two weeks. PISCES data are semi-quantitative and are best used to provide an indication of the presence and relative abundance of substances. (The NYSDEC report and this section denote the uncertainty of the measurements by expressing the units with quotation marks: "ng/L". The expression *ng/L* means one billionth of a gram of a substance in one liter of water.) Samples for mercury analysis were collected directly into bottles. A pressure-filtration method was used to sample suspended solids. Sediments were collected using either a Petite-Ponar dredge or a stainless steel spoon.

3.15.3. Sampling sites:

Sampling locations are shown on Maps L, M, N, and O from the NYSDEC report (see Figures 3-4 through 3-7).

3.15.4. Chemical Results:

<u>PCBs - Dissolved phase, PISCES method</u>

Each PCB value represents a sample taken over one period of approximately two-weeks during the timeframe March-November 1994. (Note that the PISCES data are considered to be weak measurements.)

Table 3-24. PCB concentrations ("ng/L") in Genesee basin surface waters

Map # and Location		ng/L PCBs
L1	Irondequoit Creek	3.5
L2	Irondequoit Creek	5.7
L5	Allen Creek at Harley School	2.4
L6	Allen Creek tributary at Oak Hill Country Club	2.0
L9	Barge Canal at Brockport	11
M1	Genesee River at Turning Point Park (several samples)	2-19 (range)
M16	Barge Canal at Scottsville Rd.	9.8
M17	Little Black Creek	4.7
M20	Barge Canal at Kendrick Rd.	2.7
M21	Genesee River at Ballantyne Bridge	5.2
N1	Genesee River above Sinclair Refinery	1.4
N2	Genesee River below Sinclair, in Wellsville	3.2
O1	Van Campen Creek below Friendship	1.5
O2	Van Campen Creek above Friendship	1.3

PISCES instruments were placed in influents and effluents from the Gates-Chili-Ogden and Frank E. Van Lare Treatment Plants and in three pump stations. However, usable data were not obtained. Results from Irondequoit Creek show an increase in PCB concentration going downstream (#L5 and #L6 to #L2, then to #L1), but concentrations were low. PCBs in the Barge Canal at upstream Brockport (#L9) and downstream Scottsville Road (#M16) have a similar PCB composition and concentration, indicating no important sources between them. Strong similarities in PCB composition and concentration are also seen in the Genesee River at Ballantyne Road (#M21) and in Little Black Creek (#M17).

The NYSDEC characterizes the PCB concentration as "moderate" in the Genesee River and the Barge Canal in Monroe County, as "low" in Irondequoit Creek, and as "uncertain" in the Rochester sewers.

PCBs - Suspended solids phase, pressure filtration method

Samples were taken from only one site, #M1, the Genesee River at Turning Point Park. (The ng/L value is the total number of nanograms of PCB recovered from the filters divided by the number of liters filtered.)

Table 3-25. PCB Sampling at Turning Point Park

Date	ng/L PCBs	μg PCBs/g suspended solids
4/27/94	9.78	0.11
6/09/94	3.34	
6/22/94	1.85	0.04
7/14/94	7.16	0.51
7/27/94	2.13	0.21
8/09/94	1.64	0.16
8/31/94	3.45	0.10
9/14/94	1.88	0.16
9/27/94	1.08	0.10
10/28/94	1.81	0.13
11/09/94	1.44	0.02
11/21/94	0.62	0.03

Loading of PCBs from the Genesee River to Lake Ontario

The PCB loading estimate is the sum of the PCB concentrations at Turning Point Park from the two media (dissolved and suspended solids) multiplied by a *published* mean stream flow (not a measured stream flow). The *estimate* for the Genesee River is about 40 g/day.

Pesticides - Dissolved phase, PISCES

Each pesticide value represents a sample taken over one period of approximately two weeks during the timeframe July-November 1994. Pump station samples are wastewater samples. (Note that PISCES data are considered to be weaker measurements than the PCB data. The PISCES was calibrated only for PCBs, and there were many "nondetects" for pesticides. The pesticide data was not considered to be sufficiently sound to calculate loadings.)

Table 3-26. Pesticide concentrations ("ng/L") from Genesee basin surface waters and Monroe County sewers

ND = Not detected

Map # and Location	Sum BHCs	Sum Hepta-chlor	Aldrin Dieldrin Endrin	Sum Endosul-fans	Sum DDT	Sum Chlordane
L1 Irondequoit Creek	1.1	0.5	1.8	5.9	ND	0.59
L5 Allen's Creek-Harley School	2.3	0.65	0.98	9.0	1.8	ND
L6 Allen's Creek trib-Oak Hill Count. Club	18	1.0	6.1	3.6	ND	ND
M1 Genesee R. at Turning Pt. Park (range of 6 samples)	0.10 - 0.45	ND-0.20	ND-1.6	ND-1.8	ND	ND-0.21
M2a Van Lare influent	240	12	48	24	21	36
M2c Van Lare effluent	90	2.5	30	54	9.3	34
M6 Hastings St. pump station to Van Lare	1100	24	ND	410	110	190
M7 Cliff St. pump station to Van Lare	14	4.9	19	4.9	4.5	4.6
M16 Barge Canal at Scottsville Rd.	2.2	ND	3.1	0.94	ND	ND
M17 Little Black Cr.	ND	0.67	12	9.7	4.8	6.2
M19 Johns St. pump station to GCO	22	ND	ND	ND	ND	ND
M20 Barge Canal-Kendrick Rd.	0.49	0.80	ND	ND	ND	0.46
M21 Genesee R.-Ballantyne Br.	3.1	ND	ND	6.3	ND	3.8
N2 Genesee R. below Sinclair, Wellsville	1.1	ND	ND	0.38	ND	ND
O2 Van Campen Cr. above Friendship	2.6	ND	ND	ND	ND	ND

NYSDEC aquatic and human health standards for the pesticides are shown in the following table:

Table 3-27. Health Standard for Pesticides

	ng/L	
	Aquatic	Human Health
a-BHC	10	20
g-BHC	10	20
Heptachlor + Heptachlor epoxide	1	9
Aldrin + Dieldrin	1	0.9
Endrin	2	200
a-Endosulfan	9	NA
Total DDT	1	10
Chlordane	2	20

Pesticide concentrations from Monroe County sewer samples were some of the highest values seen in the project. Particularly high concentrations were seen in both influent and effluent samples from the Van Lare Wastewater Treatment Plant, #M2a and #M2b. Several pesticides showed elevated concentrations in the Hastings Street pump station sample, #M6. Elevated pesticides were also detected below the Oak Hill Country Club, #L6.

Pesticides - Suspended solids phase, pressure filtration method

Samples were taken from only one site, #M1, the Genesee River at Turning Point Park. (The ng/L value is the total number of nanograms of pesticide recovered from the filters divided by the number of liters filtered.)

Table 3-28. Pesticide concentrations (ng/L) in the Genesee River, Turning Point Park

Date	Sum BHCs	Sum Hepta-chlor	Aldrin Dieldrin Endrin	Sum Endosul-fan	Sum DDT	Sum Chlordane
7/27/94	0.29	0.08	0.13	ND	ND	0.05
8/09/94	0.46	ND	0.15	0.21	0.22	0.68
8/31/94	2.88	ND	0.81	ND	ND	1.11
9/14/94	2.20	0.96	1.24	ND	ND	4.09
9/27/94	0.22	0.09	ND	0.05	ND	0.44
10/28/94	ND	0.14	0.04	0.04	ND	0.08

Mercury

Samples for the analysis of mercury concentrations (ng/L) in surface waters and wastewaters were taken during the time period March - October, 1994.

Table 3-29. Mercury Concentrations in Surface Waters and Wastewaters

Map # and Location		ng/L Mercury
L7	Oatka Creek, bridge at Rt. 36, Mumford	0.408
L8	Oatka Creek, Circular Hill Rd.	1.79
L11	Brockport interceptor to Northwest Quadrant Treatment Plant	148
L12	Grease interceptor, Northwest Quadrant Treatment Plant	372
L10a	Northwest Quadrant Treatment Plant influent	389
L10b	Northwest Quadrant Treatment Plant effluent	5.31
M1	Genesee River at Turning Point Park (range of 9 samples)	2.4-8.97
M2a	Van Lare Treatment Plant influent	660
M2b	Van Lare Treatment Plant recirculation line	81.6
M2c	Van Lare Treatment Plant effluent	8.22
M3	Genesee River at Route 31, right bank	3.23
M3	Irondequoit pump station (to Van Lare)	280
M4	Irondequoit Creek	2.664
M4	Sewer at Ferris St. and Cover Lane	133
M5	Sewer at Norton Ave. and Hollenbeck St.	262
M6	Sewer at Hasting St. pump station (to Van Lare)	257
M7	Sewer at Cliff St. pump station (to Van Lare)	427
M8	Sewer at Dix St.	87.5
M9	Sewer downstream of Taylor Instrument site	16,469
M10	Sewer upstream of Taylor Instrument site	53.4
M11	Hutchinson Hall, Univ. of Rochester campus	134
M12	Central utilities, Univ. of Rochester	352
M13	Sewer, south wing, Medical Center, Univ. of Rochester	149
M14	Sewer, Eastman Dental School	7,451
M15	Sewer, Strong Memorial Hospital	831
M19	Sewer at John St. pump station (to GCO)	168
M21	Genesee River at Route 252	5.36
M18a	Sewer, Gates-Chili-Ogden Treatment Plant preinfluent manhole	173
M18b	Sewer, Gates-Chili-Ogden Treatment Plant preinfluent, "the pit"	76.4
M18c	Gates-Chili-Ogden Treatment Plant influent	50.5
M18d	Gates-Chili-Ogden Treatment Plant effluent	2.93
N1	Genesee River above Wellsville	1.98
N3	Genesee River at Scio	1.94
O2	Van Campen Creek below Friendship, Route 31	1.43

The proposed Great Lakes Initiative (GLI) water quality standard for whole water mercury (dissolved phase + suspended solids phase) for the protection of wildlife is 1.3 ng/L. The current New York State standard is 200 ng/L.

Mercury levels in Monroe County wastewater effluents were high, as compared with the proposed GLI standard and with other areas in the State (Litten, personal communication). The Lockport Sewage Treatment Plant is the only treatment plant outside Monroe County that is represented in the report. Data for Lockport can be compared with data for the three Monroe County treatment plants:

Table 3-30. Mercury Concentrations at Three Monroe County Wastewater Treatment Plants

	Mercury, ng/L	
Treatment Plant	Influent	Effluent
Northwest Quadrant	389	5.31
Van Lare	660	8.22
Gates-Chili-Ogden	50.5	2.93
Lockport	96.1	1.88

The influent concentration at the largest Monroe County treatment plant, Van Lare (#M2a), was 660 ng/L. Removal efficiency at the plant was greater than 98%, but the plant effluent still had a mercury concentration more than six times above the proposed 1.3 ng/L GLI standard. The highest wastewater mercury concentrations seen in the project were in Monroe County: 16,469 ng/L in a sewer below a former mercury thermometer factory (#M9) and 7,451 ng/L in a sewer below a dental facility (#M14).

Loading of mercury from the Genesee River to Lake Ontario

The mercury loading for the Genesee River is the sum of the median mercury concentration at Turning Point Park multiplied by the *published* mean stream flow. It is *estimated* to be between 21 and 22 g/day.

Dioxins and Furans

Dioxin and furan analyses were performed on a limited number of sediment samples that were taken on August 9, 1994. Results are expressed in 2,3,7,8-TCDD toxic equivalents (2,3,7,8-TCDD TEQ). Because the amount of organic material in a sediment affects its affinity with dioxins and furans, the data below has taken into account the sediment total organic carbon (TOC) content so that sites can be compared. No water column or flow data were recorded and, therefore, no loading was calculated.

Table 3-31. Dioxins and Furans in Sediments

Map # and Location		ng 2,3,7,8-TCDD TEQ/g TOC
#L2	Irondequoit Creek	0.022
#M1	Genesee River, Turning Pt. Park	5.300

Mirex

Dissolved-phase and suspended solids-phase samples were taken from the Genesee River at Turning Point Park. No mirex was found in the suspended solids phase. The "ng/L" values for mirex in the dissolved phase were:

Table 3-32. Mirex Concentration in the Dissolved Phase

Date	"ng/L"
6/22-7/14	0.10
7/27-8/9	0.13

The NYSDEC ambient water quality standard for mirex is 1 ng/L.

PAHs in sediments

Sediments were sampled at two Monroe County sites for PAHs on August 9, 1994. Underlined values are considered to be high contamination, according to New York State Department of Environmental Conservation Division of Water, Draft Interim Guidance: Freshwater Navigational Dredging (October 1994). Concentrations are given in μg PAH/kg (parts/trillion) sediment.

Table 3-33. PAHs in Sediments

PAHs	L2 Irondequoit Creek	M1 Genesee River at Turning Point Park
Naphthalene	17	1100
Acenaphthylene	3	78
Acenaphthene	27	2500
Fluorene	48	3700
Phenanthrene	340	12,000
Anthracene	84	2100
Fluoranthene	30	8600
Pyrene	310	6500
Benz(a)anthracene	100	1700

PAHs	L2 Irondequoit Creek	M1 Genesee River at Turning Point Park
Chrysene	120	1500
Benzo(b)fluoranthene	92	830
Benzo(k)fluoranthene	81	800
Benzo(a)pyrene	85	830
Indeno(1,2,3-cd)pyrene	53	350
dibenz(ah)anthracene	ND	150
Benzo(ghi)perylene	57	310
Total PAH	1,400	43,000

The underlined, "high contamination" values for Monroe County sites are compared with the values from the other four sites in the project where sediments were analyzed for PAHs:

Table 3-34. Sediment Sampling for PAHs Outside of Monroe County

	μg PAH/kg sediment		
	Anthracene	Benz(a)anthracene	Total PAH
Genesee River, Monroe Co.	2,100	1,700	43,000
Black River, Jefferson Co.	82	190	1,600
Beals Cr., Orleans Co.	ND	200	1,722
Oak Orchard Cr., Orleans Co.	31	170	1,800
18-Mile Cr., Niagara Co.	100	610	8,100

ND = Not detected

3.15.5. NYSDEC Report recommendations:

The NYSDEC report makes the following recommendations for the Genesee River basin:

- Resample for PCBs at the Barge Canal in Monroe County and in Rochester sewers.
- Resample for mercury in the Rochester sewers.
- Resample for pesticides in the Genesee River, Irondequoit Creek at Oak Hill Country Club, Little Black Creek, the Barge Canal in Monroe County and Rochester sewers *if* more quantitative procedures can be used.

Author: Carole Beal

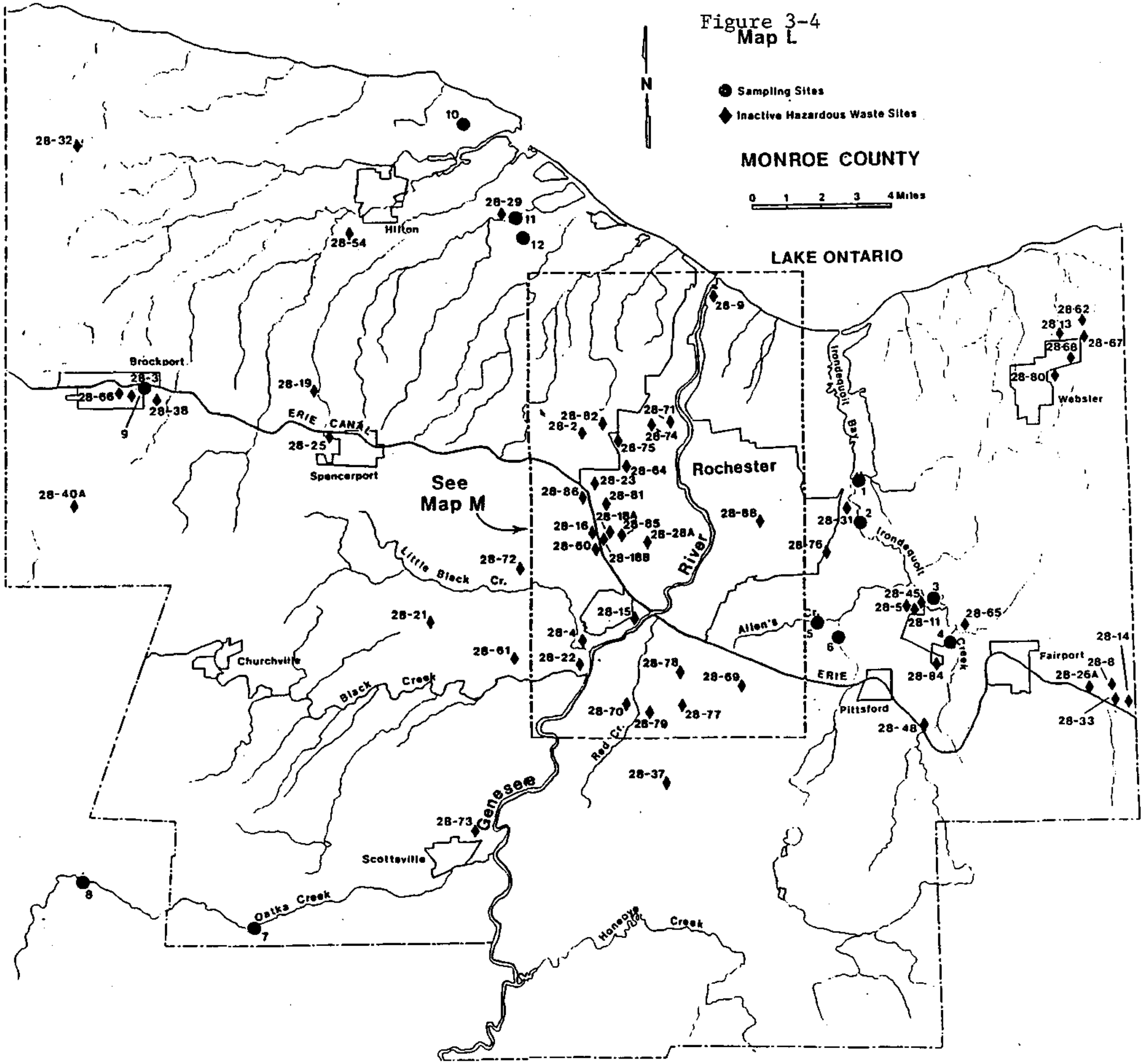
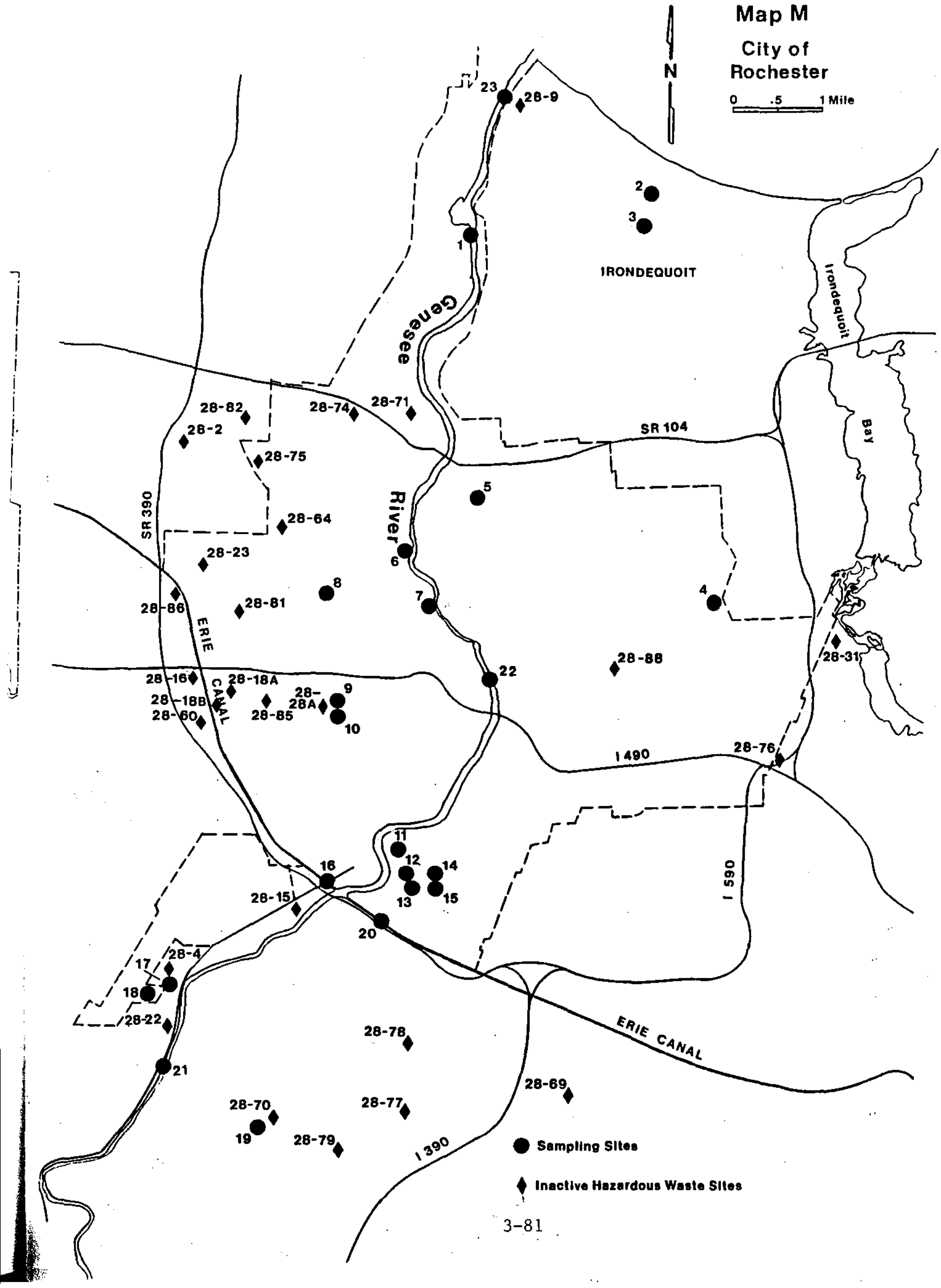


Figure 3-4
Map L

Figure 3 - 5



Map M
City of Rochester
N
0 .5 1 Mile
IRONDEQUOIT
Irondequoit
Bay
Genesee
River
SR 104
SR 390
ERIE CANAL
ERIE CANAL
I 490
I 590
I 390
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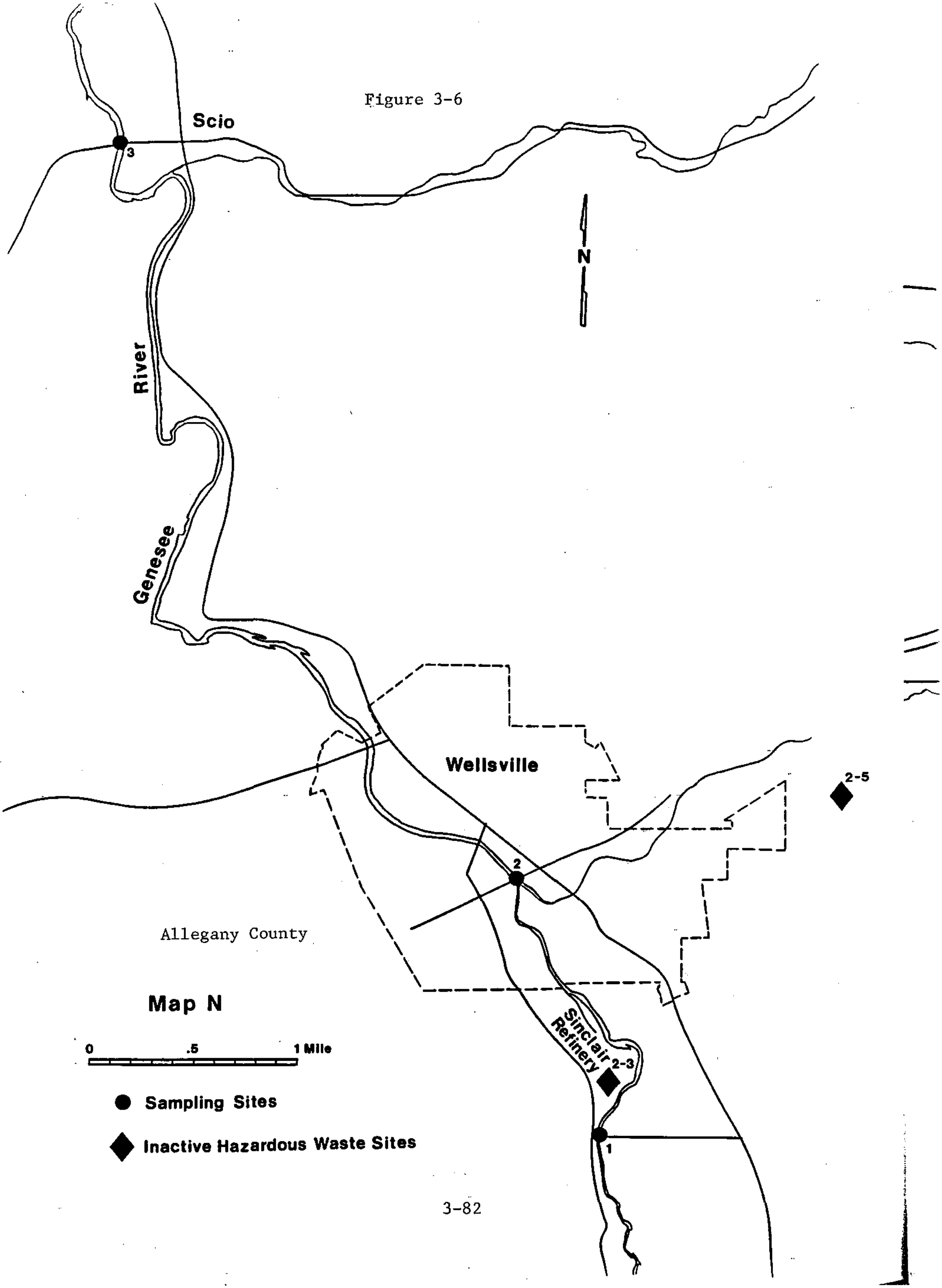
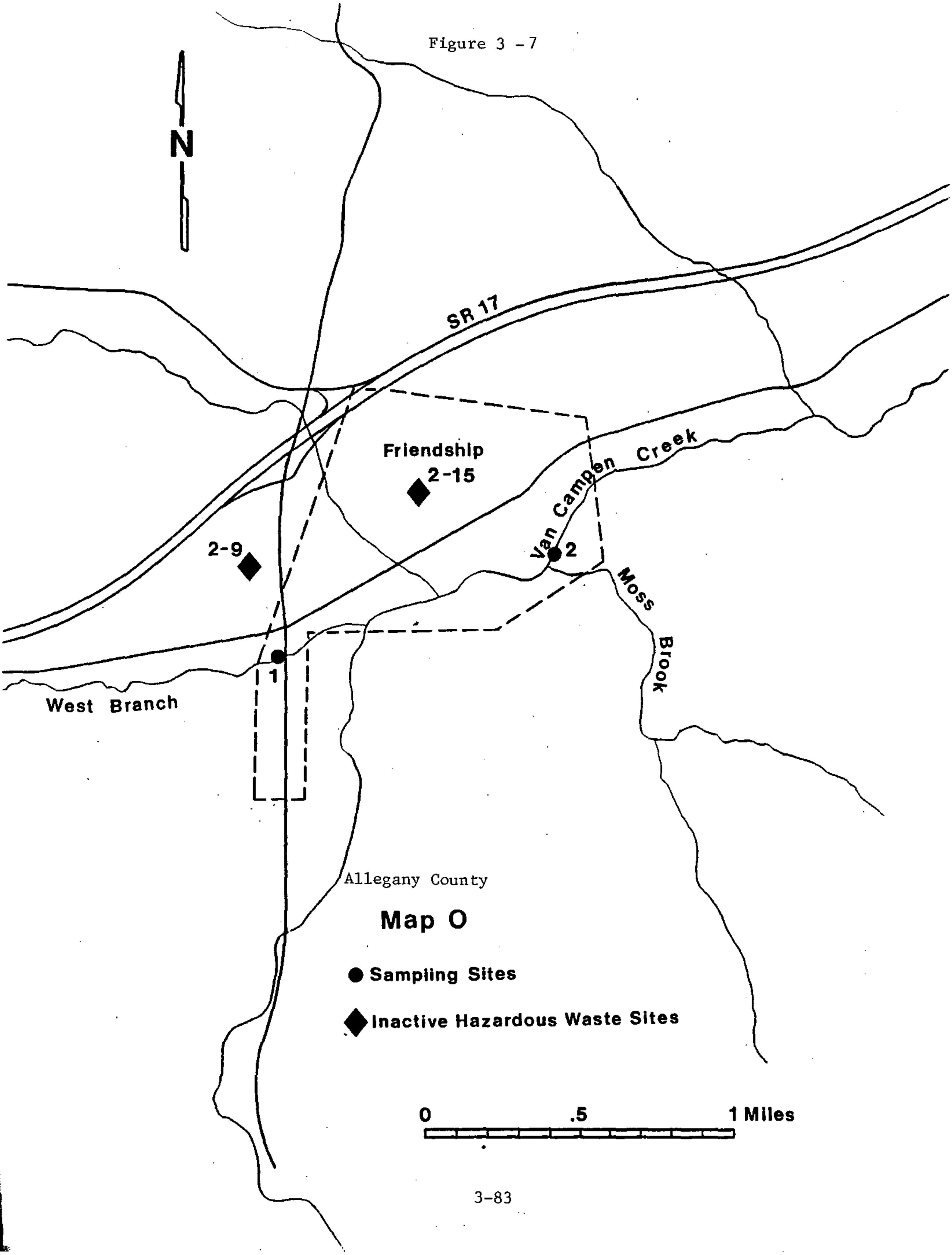
28-9
28-82
28-74
28-71
28-2
28-75
28-64
28-23
28-86
28-81
28-88
28-31
28-16
28-18A
28-18B
28-60
28-85
28-28A
28-76
28-15
28-4
28-22
28-78
28-77
28-69
28-70
28-79
Sampling Sites
Inactive Hazardous Waste Sites

Figure 3-6



Scio
3
N
River
Genesee
Wellsville
2
2-5
Allegany County
Map N
0
.5
1 Mile
Sinclair Refinery
2-3
1
Sampling Sites
Inactive Hazardous Waste Sites

Figure 3 -7


N
SR 17
Friendship
2-15
2-9
Van Campen Creek
2
Moss Brook
1
West Branch
Allegany County
Map O
Sampling Sites
Inactive Hazardous Waste Sites
0
.5
1 Miles

3.16. Lower Genesee River Study

Note: This section is a summary of the NYSDEC's Phase II-Final Report: Lower Genesee River Study, Summary of 1992, 1993 and 1994 Results (August 1995). Reviewer comments appear in this section. The statements motivating reviewer comments are marked with footnotes, and the comments are listed at the end of the section. The New York State Department of Environmental Conservation responded to the comments.

3.16.1. Background:

The major issues driving the New York State Department of Environmental Conservation (NYSDEC) Study were: (1) reports by fishermen that certain segments of the lower Genesee River are at times devoid of fish; and (2) whether or not sediments containing toxics cause impairments to the River.

Phase I was completed in 1992 and reported in 1993. Phase II was considered to be completed in 1993. However, some additional sampling took place in 1994. The final report on Phase I and Phase II was released in 1995.

The multi-disciplinary study took place mainly during May-October in 1992 and 1993. Phase I sampling locations were (see Figure 3-8):

1. Just downstream from Ballantyne Road Bridge, except for sediment sampling which was approximately 200-400 yards upstream from Ballantyne Road Bridge.
2. Near University of Rochester, downstream from the Elmwood Ave. Bridge and downstream from the Barge Canal.
3. Downstream from Veterans' Memorial Bridge (Route 104).
4. Downstream from the Eastman Kodak Company wastewater treatment plant discharge at King's Landing and upstream of Merrill Street storm sewer.
5. Downstream of Merrill Street storm sewer near Seneca Park.
6. Just upstream from the cement dock and barge area, about one mile upstream from the Turning Basin.

A seventh site was added for Phase II. It was site 1A, just upstream of the Barge Canal and across from the Rochester Fire Academy inactive hazardous waste site (see Figure 3-8).

3.16.2. Total cost:

	EPA	NYS	
Phase I:	$ 80,000	$110,000	
Phase II:	$107,319	$ 63,000	Total: (approximate) $360,000

3.16.3. Sources of funding: U.S. EPA, NYSDEC

3.16.4. Current responsible entity: NYSDEC

3.16.5. Study Results

Tables 3-35 an 3-36 at the end of this section give summaries of Phase I and Phase II results.

Water flow

1992 (Phase I) was a high-flow year and some results may have been uncharacteristic. The water flow during 1993 (Phase II) was much closer to the low flows found during typical summer conditions.

Conventional parameters

Phase I Dissolved oxygen was generally high at all sites throughout the six-month period. Temperature, pH and conductivity indicated no impairment.

Phase II During July the dissolved oxygen was depressed at site 1 and the temperature was stratified. The temperature at sites 2, 3, 4 and 5 at various positions in the water column during July was 29°C (85°F). This temperature, although not lethal to smallmouth bass or walleye, could cause fish avoidance. This temperature would be lethal to salmon and trout (the reason the River is not a year-round trout stream).

Fish population

Phase I Gillnetting (for large fish and in this Study conducted overnight) and electrofishing (for all fish) showed that the lower Genesee River, which is influenced by migrations from Lake Ontario up to an area just upstream of site 3 (at the Lower Falls), supports a diverse and moderately abundant community of fish. During all sample periods the electrofishing catch rate of smallmouth bass exceeded the New York State mean. Gillnetting, electrofishing and sonar all indicated a moderate absence of fish at the sites upstream of the Lower Falls (1 and 2). Fish finder sonar detected no significant difference in fish density among sites 3, 4, 5 and 6 (all "low absence").

Mortality tests with caged fish (fathead minnows) showed that there appeared to be acute toxicity occurring at sites 3 and 4, but this needed to be confirmed. (There was confirmed acute toxicity at site 3 for the zooplankter *Ceriodaphnia dubia.*)

Recommendations for Phase II The use of the fish finder sonar in Phase I to detect fish density was a budget compromise; a limiting factor of this instrument is its inability to detect fish very near the surface or on the bottom, especially in daytime. At times the chart recorder indicated low fish density at a site, but fish were being caught or seen surfacing nearby.

When the conductivity of the River water was high, it interfered with the correct operation of the electrofishing equipment.

Based on the results of Phase I, NYSDEC recommended changes for Phase II, including:

- Eliminate gillnetting during August and September unless a fishless zone develops. (This is because of the practice of "snatching." Hooks in the gill nets pose a danger to researchers, and results can be biased if fishermen tamper with the nets to retrieve their hooks.) To compensate, the frequency of electrofishing should be increased.
- Purchase a more powerful generator to handle the high water conductivity and a new boat to safely carry it.
- Add jaw-tagging of smallmouth bass in the lower River to determine the importance of the area as a nursery.
- Reduce the number of sonar measurements because the equipment is not powerful enough and the information is hard to interpret.
- Continue caged fish studies using healthy fish only, and set duplicate cages at each site.
- Conduct dye studies of selected discharges to determine mixing patterns.

Phase II Fish abundance was measured at sites 3-6 (the upstream sites were not measured) using the sonar during the low-flow period to determine if a fishless segment existed. There was no significant difference in fish density among these sites. If fishless events occurred during either 1992 or 1993, they were likely to have been infrequent. Researchers note that future investigations using sonar to document fish abundance must use sophisticated (and expensive) equipment capable of producing more reliable results.

The dye study showed that mixing of wastewater treatment plant effluent at King's Landing with River water was complete at site 4. During the dye study conducted on September 15, 1993, the temperature of the treatment plant effluent was 33°C (91°F). Fish, especially salmonids, would be expected to avoid such high temperatures. On September 14, the River temperatures at sites upstream (3) and downstream (4) of the effluent were 20°C (68°F)and 21°C (70°F) respectively, a 1°C (approximately 2°F) elevation of River temperature due to the effluent. However, a 1°C increase would not affect any fish species.

Smallmouth bass were jaw-tagged to determine the seasonal movements of the fish. Of the 14 that have been captured by anglers, nine were captured in the Genesee River and five were captured in Lake Ontario.

Duplicate fish cages were placed at each site throughout the study period. The only significant mortality occurred at one of the two cages placed at site 1. This mortality was attributed to low dissolved oxygen in the water column. No mortality occurred in any cages that could be attributed to toxic chemical exposure.

The electrofishing portion of the study was only conducted once during Phase II.
By the time the boat with the correct specifications arrived, the study was almost over.

Caged-fish tissue

Phase I Caged-fish tissues were analyzed for pesticides and PCBs. Lipid-adjusted PCBs (aroclor 1254/1260) exceeded the concentrations in control fish at all sites. Lipid-adjusted DDD* and DDE** concentrations generally also exceeded controls.

* dichlorodiphenyldichloroethane

** dichlorodiphenyldichloroethylene

Phase II Caged-fish tissues were analyzed for pesticides, PCBs and heavy metals. Lipid-adjusted concentrations of PCBs (aroclor 1016/1048) exceeded concentrations in control fish at most sites. Based on PCB concentrations, there may be a PCB input between site 1 and site 1A. Lipid-adjusted DDD and DDE also exceeded controls. In whole-fish analysis, without clearance of guts, silver was not detected at sites 1-3, but was substantially higher than detection limits at sites 4-6.

Sediment

As will be seen, sediment porewater metal concentrations did not correspond well with sediment metal concentrations for the same sites. Some metals may be bound to the sediment itself and not available to the porewater.

Phase I In sediment exposure tests, *Hyalella azteca* (sideswimmer) showed 100% mortality within 24 hours for site 4, which had the highest overall concentration of metals and #2 fuel oil. However, metals bound to sediments are not necessarily bioavailable. Fuel oil is highly toxic to aquatic organisms, and it is believed that the fuel oil was at least partly responsible for the response.

The response using the Microtox™ method (*Photobacterium phosphoreum*, luminescent bacterium) showed that there was some toxicity in sediments at all sites, but not at the control site, Spring Brook near Gloversville, NY.[1] The most relatively toxic response was at site 4.

Chironomus tentans (red midge) showed no significant difference in percent mortality compared to the control site.

At site 4 the metals concentration in sediment was significantly elevated compared to the other sites. Many of the metals concentrations at site 4 exceeded "heavily polluted" guidelines established by the EPA for classifying Great Lakes harbor sediments. The only metal concentration to approach the severe effect level to benthic organisms was cadmium at site 4. There was a high enough concentration of most metals at site 4 to "impair sediment use by some benthic organisms," but not high enough to "significantly impair use of sediment by benthic organisms". The highest concentrations of acid volatile sulfide, #2 fuel oil, ammonium, and total volatile solids were also found at site 4. Benzene/toluene/xylene and pesticides were not found in sediment samples from any site. PCBs were found at site 4 at levels well under the EPA "polluted" guideline.

Phase II As in Phase I, the sediment at site 4 was highly toxic to *H. azteca*. During Phase II, no bottom sediment was toxic to *C. tentans*. The sediments at sites 2 and 4 were highly toxic to *P. phosphoreum*, with all other sites being nontoxic.

During Phase II, there was a moderate concentration of metals and fuel oil in the bottom sediment at site 4. The only two metals that were substantially higher than the background site (1) were barium and cadmium at site 4. Phase II results are different from the Phase I results, when more metals were significantly higher at site 4 than at background sites (1 and 3). Only one of the bottom sediment metal concentrations, barium at site 4, exceeded "heavily polluted" guidelines established by the EPA for classifying Great Lakes harbor sediments. Some other metals concentrations exceeded the EPA "nonpolluted" guidelines.[2]

<u>Porewater (extracted from sediment samples) toxicity</u>

Phase I Porewater showed no significant toxicity effects for *H. azteca* or *P. phosphoreum*. *C. dubia* (water flea) showed a moderate acute toxicity at site 4 and a moderate chronic toxicity at site 5. Lead was detected in porewater at site 5. Zinc, copper, manganese, iron, arsenic and aluminum were detected at each site. (Manganese, iron and aluminum are common earth metals and naturally occur at high concentrations in bottom sediments.) Only zinc, manganese and iron were detected at concentrations higher than NYSDEC water quality standards.

Recommendation for Phase II Extra sediment should be collected so that there will be sufficient porewater to run a seven-day *C. dubia* chronic test.

Phase II Porewater was not toxic to *P. phosphoreum* or *H. azteca* at any site. There was a high acute toxicity to *C. dubia* at site 5. *C. dubia* chronic toxicity at site 5 could not be measured due to the death of *C. dubia* in the acute test. Elevated ammonia at site 5 could present problems to sensitive aquatic organisms such as *C. dubia*.

Porewater concentrations of zinc, manganese and iron were higher than NYSDEC water quality standards. Porewater concentrations of aluminum and lead exceeded the standards for Class B surface waters.

The results of porewater tests during Phases I and II were generally similar.

<u>Macroinvertebrates, multiplate sampling</u>

Phase I Based on multiplate sampling of the water column (a series of three plates suspended in the water column on which species colonize as they would on a rock or other hard substrate), the poorest water quality was seen at an auxiliary site upstream of the Barge Canal intersection (site 1A) where macroinvertebrate communities were dominated by saprophilic species, those which thrive in areas of high degradable organics. A possible source of degradable organics is the Gates-Chili-Ogden sewage treatment plant.[3] The site is also located across from the Fire

Academy waste site. The mixing of the canal water with River water had a beneficial effect on the multiplate fauna, restoring most macroinvertebrate indices (indicating species richness, diversity and tolerance) to levels found at site 1. Some species of midges and worms that are relatively tolerant to toxicity increased substantially at sites 4 and 5.

Recommendations for Phase II Because the poorest water quality in Phase I was found at auxiliary site 1A, this site was added to Phase II.

Phase II Severe impairment to macroinvertebrates was observed at site 1A. There was moderate impairment at sites 1, 2 and 6.

Macroinvertebrates, Ponar sampling

Phase I Based on Ponar (a sediment dredge) sampling of bottom sediments, the macroinvertebrates at all sites were almost entirely midges and worms that are tolerant to toxics and organic richness. Overall taxonomic richness was considered to be low relative to comparable rivers, especially at sites 1, 5 and 6, where water quality and/or sediment toxicity appeared to decrease the number of species compared to the other sites.[4]

There were insufficient numbers of benthic macroinvertebrates found to conduct a tissue analysis.

Phase II There was a severe impairment to benthic macroinvertebrates at site 4. There was a moderate impairment at sites 1A, 2 and 5. The results indicate organic and possibly toxic loadings upstream of site 1A, and possible toxic effects at site 4 believed to be at least partly due to fuel oil.

Zebra mussel tissues were analyzed during Phase II. Results indicated elevated levels of arsenic, selenium and nickel at site 2, low levels of chlordane and PCBs at sites 2 and 5, and much higher levels of chlordane and PCBs at site 6. Specimens of midge larvae were analyzed for morphological deformities at site 1 and 1A. The frequency of deformities indicated toxic conditions at site 1A in both the water column (multiplate samples) and the sediment (Ponar samples).

Differences between multiplate and Ponar sampling results reflect differences between sediment and water column quality.

Discharges to the River

After Phase I, it was recommended that effluent toxicity tests should be run on appropriate discharges: Merrill Street storm sewer, airport storm drains, Gates-Chili-Ogden wastewater treatment plant, seeps in the River gorge, Eastman Kodak's wastewater treatment plant.

In 1994, following the Phase I and Phase II studies, samples were collected of point and nonpoint sources of discharge to the River. Toxicity tests were conducted using *P. phosphoreum* and *C. dubia*, and samples were analyzed for metals, benzene, toluene, xylene, cyanide, ammonia and fuel oil. There was a high ammonia concentration measured in the effluent from a pipe located on the grounds of the Fire Academy waste site. Copper, chromium and zinc concentrations were also highest at this site. Barium was detected at all sites, but the highest was detected at Collingwood Drive, between sites 3 and 4. There was no *P. phosphoreum* toxicity measured at any site. The Merrill Street storm sewer effluent (upstream of site 5) and stormwater draining from the Fire Academy waste site were toxic to *C. dubia*.

Results of Phase I and II studies indicate that fuel oil entered the River somewhere near site 3. However no source was identified. The oil in the bottom sediment may have been due to an earlier spill.

3.16.6. Study Conclusions

1. The River below the Lower Falls supports a higher diversity of game fish than the upstream sites, and may serve as a smallmouth bass spawning and nursery area. (Jaw tagging of smallmouth bass is ongoing.)
2. No fishless segment was observed to occur during either the Phase I high-flow summer, or the Phase II normal low-flow summer.
3. The low dissolved oxygen and stratified temperature at site 1 may indicate the existence of a sulfur spring in the vicinity.
4. The high temperature at sites 2, 3, 4 and 5 during July in Phase II could cause fish avoidance.
5. Statistically significant mortality to *H. azteca* occurred at site 4 in the sediment study, which was believed to be at least partly due to fuel oil. Toxicity to *P. phosphoreum* was highest at site 4 during Phase I, and at sites 2 and 4 during Phase II.
6. During Phase I there was chronic porewater toxicity to *C. dubia* at site 5, and during Phase II there was significant mortality at this site. This mortality is attributed to ammonia concentration in the porewater.
7. Fuel oil was detected in high concentrations in bottom sediment at site 4 and at lesser concentrations at sites 3, 5 and 6, but it was not found in the porewater. This may explain why the sediment was toxic but porewater was not toxic at the same site. Phases I and II studies indicated that the fuel oil entered the river somewhere near site 3 (Veterans' Memorial Bridge, Route 104).
8. No source of fuel oil was identified during any of the point or nonpoint source sampling.
9. High flows during Phase I very positively affected the multiplate macroinvertebrate results. Phase II results showed much poorer macroinvertebrate communities. The decline in water quality from Route 104 to the Genesee docks was also greater in Phase II. Poor macroinvertebrate communities found at sites 1 and 1A point to organic loadings.
10. The source of acute toxicity in the Merrill Street storm sewer is not known.

3.16.7. Recommendations

1. Continue the fish tagging study of smallmouth bass.
2. Monitor water temperature to determine if temperature causes fish avoidance in the area near the Eastman Kodak wastewater treatment plant effluent.
3. Confirm toxicity to caged fish at sites 3 and 4 during Phase I under high-flow conditions.[5]
4. Analyze resident fish for tissue concentrations of silver. If resident species are accumulating silver, an evaluation of potential impacts on consumers should be conducted.[6]
5. Conduct a caged fish study at site 1A following remediation of the Fire Academy waste site.
6. Track down the source(s) of contamination to zebra mussel at sites 2, 5 and 6.
7. Investigate the cause of low dissolved oxygen, toxicity and macroinvertebrate impairment at site 1A.
8. Conduct additional sampling of the Merrill Street storm sewer to determine the cause of the acute toxicity measured in the discharge.
9. Investigate all possible sources of pollutants including storm sewers and stormwater runoff.
10. Identify the source of fuel oil at site 4.
11. Collect core samples of sediment near site 4 to determine whether these sediments should be remediated.[7]
12. Update the information on NYSDEC's Priority Water Problem List for segments of the River in the study.
13. The Rochester Embayment Remedial Action Plan committee may wish to recommend an intensive hydroacoustic fishery survey to further explore the possibility of periodic fishless segments. Continuous monitoring with strategically placed caged fish may prove more cost-effective in documenting short-term episodes that make some segments of the lower Genesee River temporarily unsuitable for fish survival.[8]

3.16.8. Reviewer comments:

1. The American Society for Testing and Materials' Subcommittees on Aquatic Toxicity and Sediment Toxicity have not approved the Microtox™ Standards for use in generating toxicity data because of a number of deficiencies in the procedure. The control site, more than 200 km from the Genesee River, has substantially different sediment characteristics than the Genesee. (Joseph Gorsuch, Eastman Kodak Company)
NYSDEC response: The Microtox test was intended for use as a screening test. Other tests were done on the sediment so that evaluation of the sediment could be done based on all the data. The control site was used simply to test sediment from a site that was free of industrial or municipal inputs. The Genesee River sites should be evaluated relative to one another.

2. At the American Society for Testing and Materials 1994 Symposium, a National Biological Service sediment expert stated that the action levels in the "heavily polluted" guideline, which he had helped prepare, were overly protective by as much as 50%. This is a common practice in setting all pollution standards. (Joseph Gorsuch, Eastman Kodak Company)
NYSDEC response: Categorizing sediment, or for that matter any medium based on degree of

contamination, is a task of dividing environmental concentrations into groups based on the range of contamination found elsewhere. This is done for means of relative comparison. Some people are conservative in establishing categories, often allowing a safety factor of tenfold, i.e., one order of magnitude. There really are no tried and true guidelines for establishing categories except to use common sense to make the results useful. A factor of 1.5-fold (±50%) is a relatively small difference separating categories.

3. The Gates-Ogden-Chili sewage treatment plant generates a high quality low organic strength discharge. Deicing fluid discharge from the Airport is a more likely source. (Michael Schifano, Monroe County Department of Environmental Services)
NYSDEC response: Any sewage treatment plant is capable of exceeding its design capacity or experiencing malfunctions. A discharge as sizeable as that of Gates-Ogden-Chili must be considered a probable contributor to the organics problem upstream of the Barge Canal. The airport deicing fluid discharge is also a possible contributor, although this would seem to be too seasonal and minor to cause the persistent impact found in the Genesee River.

4. It is not uncommon to find midge larva and oligochaete worms in sediment with these characteristics of heavy silt and organic matter content. The main channel of much of the lower Genesee River, sites 3-6, is bedrock, and therefore one would not expect to find many benthic macroinvertebrates. It is important to know whether or not the sediments/benthic habitat is similar in the Genesee River and "controls". (Joseph Gorsuch, Eastman Kodak Company)
NYSDEC response: Although it is true that midge larvae and oligochaete worms are common inhabitants of these types of sediments, indices measuring abundance, diversity and tolerance reveal definite impact. The midstream substrate at many of these sites may be bedrock, but the samples were taken in depositional areas of heterogeneous sediments, and diverse benthic communities should be expected. A "control" site community at Station 1 in 1993 provided reference conditions for comparison. Particle-size analysis was performed at all sites to ensure comparability of habitat.

5. There is little value in repeating the caged-fish studies under high-flow conditions, when the dilution is greater than when the River flow is at low normal summer conditions as it was in Phase II when no fish died. (Joseph Gorsuch, Eastman Kodak Company)
NYSDEC response: If toxicity occurred under high flow conditions, then it should be confirmed under high flow conditions. Perhaps the cause of toxicity was due to some condition occurring under high flow conditions such as runoff, storm sewer drainage or resuspension of sediment. I would also rerun the tests at low flow conditions. However, I would point out that, since we have no control over the flows, it would be difficult to plan a high or low flow exposure. It should be noted that water samples taken at station 3 at the time mortality was occurring in the fish cages were apparently toxic to Ceriodaphnia dubia.

6. It is believed that this recommendation is based upon the observation of whole-fish analysis without gut clearance, which is the incorrect procedure for determining the accumulation of a chemical in tissue. Eastman Kodak scientists have many studies that demonstrate that silver is

not a health issue. (Joseph Gorsuch, Eastman Kodak Company)
NYSDEC response: Resident predator species would be accumulating contaminants from whole fish prey including gut contents. Consequently, the whole fish burden should be known. I would agree that some portion of the caged fish in a future study be allowed to clear the gut to get an idea of the concentrations of contaminants in the flesh.

7. There is very little sediment in the River channel at this site, but cores could be obtained from the banks. (Joseph Gorsuch, Eastman Kodak Company)
NYSDEC response: Sediment sampling for the Lower Genesee River was not designed to determine the extent of contamination or distribution of elevated metals and fuel oil, but rather to identify toxic segments that might contribute to the understanding of the "black hole." More sediment sampling is needed to truly determine the extent of contaminated sediments. For example, downstream was a large bay or "turning basin" where materials could settle out and concentrate. Flows near Station 4 allowed only minimal areas for materials to settle and these only near shore. Once the extent of contamination is determined, then technical issues can be addressed such as: can this material be dredged without causing too much resuspension and making matters worse further downstream? Other issues, such as locating the source(s) for the fuel oil, cadmium and barium, should also be addressed so that future problems are minimized or eliminated. Core sampling near Station 4 was limited to nearshore areas. Some clean and shifting sands could be obtained in the swifter-moving waters in the middle of the River. However, we didn't collect these sands knowing they would be relatively clean and contain fewer macroinvertebrates for tissue analyses.

8. The intensive hydroacoustic fishery survey would be the better method to use. (Paul Sawyko, Rochester Gas and Electric Corporation; James Haynes, SUNY Brockport Department of Biology)
NYSDEC response: Experience gleaned from the Lower Genesee River Study suggests that, if fishless segment episodes still occur, they do so on a very infrequent basis. To detect such a short-term phenomenon, hydroacoustic sampling would be required on an extremely frequent basis, day and night. The cost of such intensive efforts would be enormous. A simple "canary-in-the-mine shaft" approach, utilizing strategically placed caged fish, would be the most efficient tool for detecting infrequent fishless segment episodes.

Author: Carole Beal

Map of Survey Area Showing Location of Phase I and II Sampling Sites

Figure 3-8

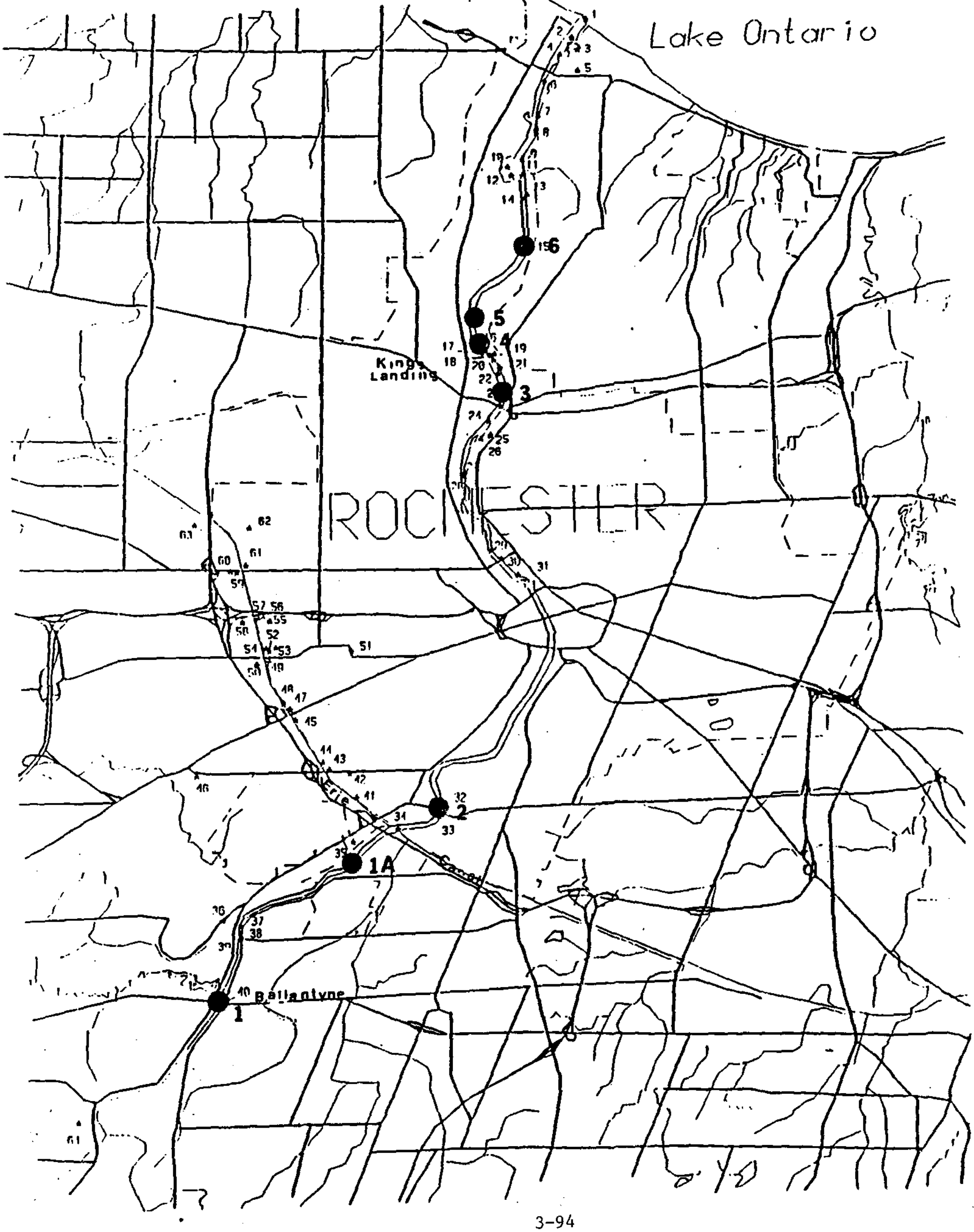


Table 3-35 Summary of 1992 Lower Genesee River Survey Results
Phase I

	Site 1	Site 2	Site 3	Site 4	Site 5	Site 6
Gill Netting **Absence of fish**	⊖	⊖	○	○	○	
Electrofishing **Absence of fish**	⊖	⊖	○	○	○	
Sonar **Absence of fish**	⊖	⊖	○	○	○	
Water Column Conventional Parameters **Degradation**	○	○	○	○	○	○
Caged fish **% mortality** September/October	○	○	⊖	●	○	○
Water Column *C. dubia* **Acute Toxicity**			●	⊖		
Water Column **Concentration of toxics**			○	○	○	
Sediment *C. tentans* **Toxicity**	○	⊖	○	⊖	○	○
Sediment *H. azteca* **Toxicity**	○	○	○	●	○	○
Sediment Microtox® **Toxicity**	⊖	⊖	⊖	●	⊖	⊖
Sediment Sampling **Concentration of toxics**	○	○	○	●	○	○
Porewater *H. azteca* **Toxicity**	○	○	○	○	○	○
Pore water *C. dubia* **Acute Toxicity**	○	○	○	⊖	○	○
Pore water *C. dubia* **Chronic Toxicity**	○	○	○	○	⊖	○
Pore water Microtox® **Toxicity**	○	○	○	○	○	○
Pore Water **Concentration of toxics**	○	○	○	○	○	○
Macroinvertebrates (Water) **Impairment**	○	○	○	○	○	○
Macroinvertebrates (Sediment) **Impairment**	⊖	⊖	⊖	⊖	⊖	⊖

● high ⊖ moderate ○ low

Table 3-36 Summary of 1993 Lower Genesee River Survey Results

Phase II

	Site 1	Site 1A	Site 2	Site 3	Site 4	Site 5	Site 6
Gill Netting **Absence of fish**							
Electrofishing **Absence of fish** [1]				O	O	O	O
Sonar **Absence of fish**				O	O	O	O
Water Column Conventional Parameters **Degradation**	⊖	O	O	O	O	O	O
Caged fish **% mortality**	⊖	O	O	O	O	O	O
Water Column *C. dubia* **Acute Toxicity**	O						
Water Column **Concentration of toxics**							
Sediment *C. tentans* **Toxicity**	O	O	O	O	O	O	O
Sediment *H. azteca* **Toxicity**	O	O	O	O	●	O	O
Sediment Microtox® **Toxicity**	O	O	●	O	●	O	O
Sediment Sampling **Concentration of toxics**	O	O	O	O	⊖	O	O
Porewater *H. azteca* **Toxicity**	O	O	O	O	O	O	O
Pore water *C. dubia* **Acute Toxicity**	O	O	O	O	O	●	O
Pore water *C. dubia* **Chronic Toxicity**	O	O	O	O	O	D	O
Pore water Microtox® **Toxicity**	O	O	O	O	O	O	O
Pore Water **Concentration of toxics**	O	O	O	O	O	O	O
Macroinvertebrates (Water) **Impairment**	⊖	●	⊖	O	O	O	⊖
Macroinvertebrates (Sediment) **Impairment**	O	⊖	⊖	O	●	⊖	O

● high ⊖ moderate O low

D all dead - reproductive chronic toxicity couldn't be measured

[1] only measured one time during the Phase II study

3.17. Impact of the Erie Canal on the Genesee River and streams

3.17.1. Discharges from the Erie Canal to Monroe County streams

The Erie Canal flows from west to east through Monroe County and the Rochester Embayment watershed, crossing many streams on its way, as well as the Genesee River. The Canal interacts with the streams in various ways:

- Weir: A notch at the top of the Canal bank that allows Canal water to overflow into a stream which has been carried beneath it in a culvert.
- Waste gate: An opening, low in the Canal, that can be closed or opened to release water to a stream which has been carried beneath it in a culvert.
- Culvert: A channel that carries natural drainage under the canal.
- Channel cut: An artificial channel created to carry Canal water to a natural stream.
- Siphon: A conveyance used by a farmer or golf course operator who has a permit to draw off water from the top of the Canal where it crosses a stream. The water eventually flows back to the stream.

Weirs and waste gates are located at several sites in Monroe County:

- Brockport weir and waste gate: Any discharge flows to Brockport Creek.
- Adams Basin weir and waste gate: Any discharge flows to Salmon Creek.
- Spencerport weir and waste gate: Any discharge flows to Northrup Creek.
- Greece weir and waste gate: The weir is abandoned. A site visit would be necessary to determine whether the waste gate directs water into Round Pond Creek or the old Erie Canal.
- Cartersville weir and waste gate: A channel cut would carry any Canal discharge to a tributary of Irondequoit Creek.
- Bushnell Basin waste gate: Sealed.
- Fairport weir and waste gate: A channel cut would carry any Canal discharge to Thomas Creek and eventually to Irondequoit Creek. At this waste gate water can flow either way during the winter months when the Canal water is low.

There are 19 culverts in Monroe County west of the Genesee River, and ten culverts in the County east of the River.

When the Canal was under the authority of the New York State Department of Transportation (NYSDOT), Monroe County had a Memorandum of Understanding (MOU) with the NYSDOT that had, as its purpose, minimization of discharges from the Canal to small streams. Now that the Canal is under the authority of the New York State Thruway Authority Canal Corporation, a MOU is again proposed with the same purpose. The MOU would:

- Identify contact people for communications between the County and the Canal Corporation.
- Include a notification system for any planned construction in the Canal, hydraulic modifications, problems, diurnal variations in discharge to the Genesee River.

- Update the inventory of permitted and unpermitted connections between the Canal and streams.
- Analyze water to detect the source of any leak or accident.

3.17.2. State Pollution Discharge Elimination System discharges to the Erie Canal in Monroe County

Some facilities and private residences have State Pollution Discharge Elimination System (SPDES) permits for discharges that may affect the Erie Canal and, therefore, streams to the east where there are weirs or waste gates. These facilities discharge to:

- The Erie Canal directly, or
- The Genesee River south of the Canal (the waters of the Canal and the River mix as they cross in Genesee Valley Park)..

The following facilities in Monroe County (excluding private residences) have SPDES permits for discharges to the Canal or to the Genesee River south of the Canal:

<u>In Gates</u>

W.W. Griffith Oil, 700 Brooks Ave., discharge to the Canal: Storm and tank test water.

Gates-Chili-Ogden Wastewater Treatment Plant, discharge to the Genesee River just upstream of the Canal: Treated sanitary sewage.

Agway Petroleum Terminal, 754 Brooks Ave., discharge to the Canal: Stormwater.

<u>In Henrietta</u>

Lyell Metal Reprocessing, 1515 Scottsville Rd., discharge to Genesee River upstream of the Canal: Treated sanitary sewage.

<u>In the City of Rochester</u>

Hess Heavy Terminal, 1 Hess Plaza, discharge to the Canal: Storm and tank test water.

Pfaudler U.S., Inc., 1000 West Ave., discharge to the Canal: Storm and non-contact cooling water.

Sun Refining and Marketing Corp., 1840 Lyell Ave., discharge to the Canal: Storm and tank test water.

United Refining, Chili Ave., discharge to the Canal: Storm and tank test water.

Alaskan Oil Terminal, 1935 Lyell Ave., discharge to the Canal: Storm and tank test water.

Mobil Oil Corp., 675 Brooks Ave., discharge to the Canal: Storm and tank test water.

3.17.3. Erie Canal loadings to the Irondequoit Bay drainage basin (adapted from a Monroe County Environmental Health Laboratory draft report)

The Erie Canal is a major manmade watercourse through the County of Monroe which has, in the past and present, served as an avenue for shipping, a source of water for irrigation and hydropower, a source of water for dilution of sewage treatment plant effluents, and a recreational resource for boating and fishing. Flowing in an easterly direction from Buffalo to Albany, the Canal has, as its initial source of water, Tonawanda Creek, which is used to draw water from Lake Erie into the Canal when it is filled in the spring. Some of this flow is discharged due to hydropower generation at Lockport. Water also enters the Canal from the Oak Orchard Creek system. The water quality of the Canal in the section between Buffalo and the western border of Monroe County is generally good. There are indications that it has improved as a result of nutrient removal by zebra mussels, which entered the system from Lake Erie in the late 1980s.

In Monroe County, the Canal intersects the Genesee River in Genesee Valley Park. At this location some of the water entering Monroe County from the west flows north through the Genesee River, and water from the Genesee River enters the eastern section of the Canal. Genesee River water often contains high levels of suspended solids and nutrients, such as nitrogen and phosphorus, so the mixing that occurs at the junction of the Canal and the River degrades the water quality of the Canal in the eastern portion of Monroe County. Within this section there are siphons and gravity-feed discharge pipes once employed to draw water from the Canal for dilution of sewage treatment effluents discharged to the Irondequoit Creek system during the low-flow summer months. These drainage points are also currently used for dewatering the Canal for winter maintenance activities, and to add water to parts of the Irondequoit Creek system for irrigation for downstream country clubs, or for aesthetic maintenance of flows. These discharge points degrade the water quality of the receiving streams during low-flow periods in the streams, because the nutrient content of the Canal water is higher than the streams due to the addition of Genesee River water, and the quantity of water added from the Canal is generally larger than the natural flow in the stream. Although the loads to the Irondequoit basin delivered by the Canal are not massive, they are nevertheless a significant contributor to overproductivity in Irondequoit Bay during the summer growing season when other loading sources are minimal. Reduction of these inputs is necessary to achieve the overall water quality goal of reducing external loads delivered to Irondequoit Bay.

The major discharge points in the eastern section of the County are:

- Three gravity-feed pipes at the Canal underpass at French Road in the Town of Brighton, discharging to the main branch of Allen's Creek.
- Two siphons at the Canal underpass just west of the NYS Department of Transportation compound on Monroe Avenue, discharging to the East branch of Allen's Creek.
- A waste gate normally used for dewatering the Canal located at Cartersville in the vicinity of Marsh Road in the Town of Pittsford, discharging to a channel that flows into Irondequoit Creek just south of the Route 490 crossing.
- A waste gate located off State Street in the Village of Fairport, discharging to Thomas Creek.

There are also manholes in the bottom of the Canal at French Road, and in the vicinity of Ayrault Road that have occasionally been opened to aid in dewatering the Canal in winter for maintenance activities.

Data on the discharge points from the Erie Canal to the Irondequoit Bay drainage basin have been collected during the summer months since 1984. Water quality samples are collected upstream and downstream from the discharges. Discharge measurements have been made on numerous occasions, while rudimentary stage measurements have been made on all visits. It was thought that the stage measurements could be used as reliable predictors of discharge, but correlation coefficients are not sufficiently high to allow inclusion of data collected without actual discharge measurement.

Average loading values for the period from 1984 through 1995 for the two sites that allow collection upstream and downstream of the discharges are shown in Tables 3-37 and 3-38. It should be noted that at French Road, from 52% to nearly 80% of the summertime baseload carried by Allen's Creek originates in the Canal. At the East Branch of Allen's Creek, from 70% to 90% of the baseload carried by the East Branch originates in the Canal.

In summary, it can be seen that elimination of dry weather discharges from the Canal to the streams of the Irondequoit Bay drainage basin would result in a significant movement toward achievement of the water quality goal for Irondequoit Bay of a maximum total phosphorus load of 14 kg/day.

Authors: Charles Knauf representing the Monroe County Environmental Health Laboratory, Carole Beal

Table 3-37
Summary of Loads for Allen's Creek at French Road, 1984-1995

Constituent	Average Load from the Canal, kg/day	% of Total Load in Allen's Creek
Total phosphorus, as P	0.77	72
Soluble reactive phosphorus, as P	0.12	67
Nitrate + nitrite, as N	0.93	71
Ammonia nitrogen, as N	0.90	69
Total Kjeldahl nitrogen, as N	8.95	67
Sulfate, as S	807.	74
Dissolved chloride	817.	53
Suspended solids	338.	80
Suspended volatile solids	46.	65

Table 3-38
Summary of Loads from the Erie Canal for East Branch of Allen's Creek, 1984-1995

Constituent	Average Load from the Canal, kg/day	% of Total Load in Allen's Creek
Total phosphorus, as P	1.68	77
Soluble reactive phosphorus, as P	0.78	71
Nitrate + nitrite, as N	14.2	77
Ammonia nitrogen, as N	1.25	83
Total Kjeldahl nitrogen, as N	12.0	73
Sulfate, as S	2039.	79
Dissolved chloride	1366.	73
Suspended solids	336.	91
Suspended volatile solids	161.	76

3.18. Contaminant Impacts on Black Tern Populations in the Rochester Embayment Watershed

Note: This section was originally written for Chapter 4, Studies Required to Complete Identification of Use Impairments and Describe Pollutant Sources. However, the Studies and Monitoring Task Group concurred with the Monroe County Water Quality Management Advisory Committee recommendation that a study is not needed. Therefore, this section is included in this chapter as new information. (See Chapter 10 for more information about the Studies and Monitoring Task Group.)

3.18.1. Background:

In the Stage I Rochester Embayment Remedial Action Plan, the decline of black tern (*Chlidonias niger*) populations was cited as evidence that the "Loss of Fish and Wildlife Habitat" is a Use Impairment in the Rochester Embayment Watershed. The causes of this population decline were listed as boat wakes, the spread of purple loosestrife, and the greater presence of people in the vicinity of critical habitats. However, some concern was expressed that toxins in fish, or other unknown causes, might be affecting black tern populations. Therefore, as part of the Stage II RAP, a number of wildlife experts were contacted in order to determine if a study of contaminant impacts on black tern populations should be recommended.

3.18.2. Summary of Information Collected:

In general, very little research has been conducted on the effects of contaminants on black tern populations. Locally, Heidi Firstencel, a M.S. student at SUNY Brockport, conducted a study of the black tern colony at Yanty Creek Marsh in order to determine if there were factors within the breeding area that may be adversely affecting this species. As a result of this study and research conducted by the NYSDEC, there appears to be a consensus that factors other than contaminants are responsible for black tern population declines.

Firstencel Study

Heidi Firstencel's study of the black tern colony at Yanty Creek Marsh was conducted during the 1983 and 1984 breeding seasons. As part of this research, the following contaminant levels were detected:

Table 3-39. Levels of Selected Contaminants of Black Tern Samples Collected from Yanty Creek Marsh

PCB = polychlorinated biphenyls. DDE = dichlorodiphenyl dichloroethylene.
HCB = hexachlorobenzene. OCS = Octachlorostyrene.

Sample	Total PCB (mg/kg)	DDE (mg/kg)	HCB (ug/kg)	OCS (ug/kg)	Mirex (mg/kg)
Chick from Nest #10 (1983)	0.54	0.30	2.21	2.70	0.02
3 eggs from Nest #4 (1984)	2.07	1.14	35.07	20.93	0.01
2 eggs from Nest #14 (1984)	6.39	2.53	58.80	90.70	0.04
2 eggs from Nest #1 (1984)	2.07	4.83	51.43	19.15	0.01

The contaminant levels in the black tern samples collected at Yanty Creek Marsh were reported to be substantially higher than samples collected in Lake Michigan. In her report, Firstencel stated that the higher contaminant levels in the samples from Yanty Creek Marsh may reflect higher levels of certain contaminants in Lake Ontario relative to the other Great Lakes. Firstencel expressed concern regarding the high concentrations of PCBs and DDE detected in the black tern samples. DDE contamination has been associated with shell thinning and PCBs have been linked to embryo mortality and chick deformity. However, measurement of eggshell thickness was not conducted as part of this study. Firstencel stated that black terns may be exposed to DDT (DDE is a component of DDT) at their wintering grounds in Central and South America. In regards to chick deformities, none were observed as part of this study.

Sediment analysis was also conducted as part of Firstencel's study. Analysis of two sediment samples (one near the Lake Ontario Parkway and one near the mouth of the marsh) revealed less than 1 ppb of PCBs or DDT. According to Firstencel, this suggests that the terns are not picking up these compounds from emergent insects within the marsh but rather from fish.

In conclusion, based upon the relatively high (50%) black tern nesting success rate at Yanty Creek Marsh, and other research on the subject, Firstencel stated that one might conclude that contaminants are not having a serious effect on black tern populations at Yanty Creek Marsh.

B. NYSDEC Research

The NYSDEC also conducts research on black tern populations. The primary goals of this research are to locate and characterize breeding habitat and to identify factors responsible for the decline of this species. This research indicates that black tern populations in New York State have declined substantially over the last 15-20 years. However, since 1989 the population of black terns breeding in New York State has remained relatively stable (approximately 250 pairs), although well below historically reported levels. For information regarding black tern populations in the Rochester Embayment Watershed, see Table 3-40. This research also indicates that high quality black tern habitat along the south shore of Lake Ontario (such as Braddock Bay and Yanty Creek Marsh) could support larger numbers of black terns than currently exist (B. Miller).

Table 3-40. Estimated Number of Black Tern Nesting Pairs at the Primary Colony Sites in the Rochester Embayment Watershed

Site	1989	1990	1991	1994
Braddock Bay WMA	6	0	3	3
Buck Pond	7	9	3	12
Cranberry Pond	4	0	*	2
Salmon Creek	9	6	10	13
Yanty Creek	3	0	*	0
Total	34	17	16	30

* Site not surveyed

The NYSDEC has identified a number of factors that are contributing to the decline of this species. For example, the spread of purple loosestrife (*Lythra salicaria*) has contributed to the loss of black tern habitat in New York State. This extremely invasive exotic species fills in open water areas that serve as critical foraging areas for black terns. Problems with the black tern's wintering grounds in Central and South America are also suspected as a factor in the decline of this species (B. Miller).

In the Rochester Embayment Watershed, wetland successional changes at Rose's Marsh (Lake Ontario West Basin) and the loss of cattail stands in Salmon Creek (Lake Ontario West Basin), low nesting success rates, predation, and flooding have been identified as the primary factors contributing to the decline of black terns. The decline of alewife populations (an important food source) in Lake Ontario, may also be impacting local black tern populations. In the Rochester Embayment Watershed, the invasion of purple loosestrife and boat wakes are not considered to be primary factors contributing to the decline of black terns (S. Skelly).

3.18.3. Recommendations:

1. As part of the development of this section, wildlife experts at the NYSDEC, SUNY Brockport, The Nature Conservancy, and the Audubon Society were consulted. From these discussions, it became clear that a number of factors, as detailed above, have been identified as contributing to the decline of black tern populations in the Rochester Embayment Watershed and

across New York State. However, contaminants are not considered to be a primary factor contributing to the decline of black tern populations. Therefore, it would not be appropriate to recommend, as part of the Stage II Rochester Embayment RAP, that a study of the effects of contaminants on black terns be conducted.

2. However, because of the substantial population declines experienced by this species, the continued monitoring of black tern populations and habitats by the NYSDEC should be supported as part of the RAP.

3. Efforts to enhance and protect fish and wildlife habitat, including black tern habitat, should be implemented as part of the RAP. These are a number of possible actions outlined in Chapter 7 that would address the loss of fish and wildlife habitat.

Author: Todd Stevenson

3.19. Effect of zebra mussels on water quality and the food chain

Note: This section was originally written for Chapter 4, Studies Required to Complete Identification of Use Impairments and Describe Pollutant Sources. However, the Studies and Monitoring Task Group concurred with the Monroe County Water Quality Management Advisory Committee recommendation that a study is not needed. Therefore, this section is included in this chapter as new information. (See Chapter 10 for more information about the Studies and Monitoring Task Group.)

3.19.1. Background:

The possible impact of zebra mussel populations on water quality and the food chain is a question that is not unique to the Rochester Embayment or to Lake Ontario. Zebra mussels exist in all of the Great Lakes. (However, they are not expected to present a major problem in Lake Superior, except possibly in localized protected areas.)

Following are brief summaries of recent studies on the impact of zebra mussels on water clarity, nutrients, and chemical contaminants in the food chain. The studies answer some questions and raise other questions. All the results cannot currently be fully explained. There are many variables that affect the ecosystems that were studied. The variables contribute to results that are difficult to explain and to inconsistency of results between water bodies. The variables include:

- The loading rates for nutrients and the sources of nutrients to the water body (the form may be different from different sources).
- The flushing time and mixing characteristics of the water body.
- The mixing characteristics of the water body and the degree to which solids may be resuspended.
- The pre-zebra mussel nutrient status of the water body.
- The composition of the phytoplankton and zooplankton communities.
- How close the ecosystem is to equilibrium.

3.19.2. Water Clarity (Fahnenstiel et al., 1995)

In expectation of a zebra mussel infestation, a large-scale study of Saginaw Bay, Lake Huron, was initiated in 1990 and continued through 1993. Zebra mussel colonization began in summer and fall of 1991. In inner Saginaw Bay, where the most zebra mussels were found, chlorophyll and total phosphorus values decreased during the study period. Three measurements of water clarity - Secchi disk transparency, underwater light extinction and light transmission - showed an increase in clarity during the period due to zebra mussel filtering. (It is possible for the three measurements to show differing trends.) For the period 1979-1990, the mean annual values for water quality parameters had been similar to each other. Data suggest that, in Saginaw Bay, zebra mussel filtering is the major cause of the change in clarity.

The authors point out that, while zebra mussels may seem to change the trophic condition in

Saginaw Bay, they really are shifting production and resources from the pelagic (open water) region to the benthic region. These changes are demonstrated by substantial decreases in phytoplankton productivity and increases in benthic algae productivity and macrophyte distribution. Unless phosphorus loading declines or phosphorus is permanently buried or removed from the system, there can be no real change in the trophic condition of Saginaw Bay.

The authors note that the recent water quality changes may be transitory and that the long-term response may be different. Water quality parameters should continue to be monitored.

3.19.3. Nutrients

Study by Johengen et al. (1995)

Changes in concentrations of particulate nutrients and dissolved nutrients also changed in Saginaw Bay over the time period 1990 to 1993. Annual mean concentrations for total suspended solids, particulate organic carbon, particulate phosphorus, and particulate silica were significantly lower after zebra mussel introduction than before.

Annual mean concentrations for the dissolved nutrients nitrate, ammonium and silica were more variable than for particulate nutrients. They increased significantly in the inner bay from 1991 to 1992, then decreased again in 1993 to near-1991 levels. The annual mean concentration for dissolved organic carbon (DOC) decreased continuously during the study period.

The annual mean concentration for *total dissolved* phosphorus increased like the other dissolved nutrients in 1992, then remained the same in 1993. In contrast, the annual mean concentration of *soluble reactive* phosphorus (phosphates) decreased continuously during the study period, but the differences were not statistically significant. A phosphorus budget indicated that zebra mussels were a significant sink for phosphorus and played a major role in reducing total phosphorus levels within the water column. Phosphorus is efficiently retained within zebra mussels and the benthic region, and is not rapidly recycled into the water column.

Zebra mussels reduce concentrations of particulate nutrients by filtering and either assimilating the nutrients or depositing them onto the sediment as feces (digested matter) and pseudofeces (undigested matter). They filter much more material than they consume, so their effect on abundance of nutrients is much greater than that needed to simply maintain their growth and reproduction. The filtering activity has the direct effect of reducing nutrients which are associated with particles and phytoplankton. The reduction in phytoplankton abundance may have reduced the demand for dissolved nutrients, except soluble reactive phosphorus, within the water column. Also, zebra mussels excrete nutrients at a much higher N:P ratio than that utilized by phytoplankton and bacteria. Therefore, they may alter the N:P ratio available to the microbial community and potentially alter species abundance and composition.

Nutrient concentrations in Saginaw Bay can be affected by several physical and biological processes. The interaction of these processes makes it difficult to evaluate the effects of any one factor, such as the establishment of zebra mussel. However, the data strongly suggest that zebra mussels had a significant impact on nutrient dynamics in Saginaw Bay.

Study by Holland et al. (1995)

For Hatchery Bay, western Lake Erie, water quality data from 1984-1987 for soluble reactive phosphorus, silica, nitrate, ammonium and chloride were compared with that from 1990-1993. The concentrations of these major nutrients and chloride increased after the establishment of the zebra mussel in 1988. The authors suggest that zebra mussels filter phytoplankton rapidly and efficiently and, therefore, there is a diminished need for dissolved nutrients by phytoplankton that is not counterbalanced by the nutritional needs of the larger plants (that obtain nutrients mainly from the sediment region).

Total phosphorus concentration changed little. Zebra mussels accumulate nitrogen and phosphorus in their shells and soft tissues in amounts similar to those stored by macrophytes or fishes in the same lake. A much larger proportion of the nitrogen and phosphorus processed by zebra mussel is expelled into the water as feces and pseudofeces than is accumulated. In a polymictic system (mixes several times per year), such as Hatchery Bay, feces and pseudofeces not utilized by the benthos would be resuspended. The relative steadiness in total phosphorus concentration may reflect this sediment resuspension from zebra mussel feces and pseudofeces. The aggregates of feces and pseudofeces would contribute to the total nutrient pool, but do not have a lot of impact on water clarity.

3.19.4. Two studies on chemical contaminants by Bruner et al. (1994)

Zebra mussels bioaccumulate hydrophobic (not dissolving readily in water) contaminants, such as polychlorinated biphenyls, chlorinated insecticides, and polycyclic aromatic hydrocarbons in lipid (fat) tissue. Their low position in the food chain gives zebra mussels great potential to affect contaminant cycling to higher trophic levels. There are two major ways in which this could happen:

- Increasing the contaminant concentration in sediments through biodeposition of contaminated feces and pseudofeces and subsequently increasing the contaminant concentration in benthic organisms.
- Increasing trophic transfer of contaminants to zebra mussel predators.

All zebra mussels can significantly accumulate hydrophobic, nonpolar contaminants. However, small ones have faster rates of uptake and accumulate greater contaminant concentrations than larger ones. Pre-spawning zebra mussels have a higher lipid content than post-spawning ones and, therefore, accumulate more contaminants.

Gammarus fasciatus, a benthic amphipod, feeds on contaminated excrement and detritus generated by the zebra mussels, and is prey for most Lake Erie fish species at some point in its life cycle. Gammarids which feed on zebra mussel feces have hexachlorobiphenyl (HCBP) concentrations 20 times higher than tissue from the zebra mussels that expelled the feces and pseudofeces. The indirect transfer of HCBP via the detrital food chain is expected to funnel significantly more contaminant to higher trophic levels than by direct consumption of zebra mussel by its prey. Recent reductions in breeding success of herring gulls and bald eagles which feed in Lake Erie have been attributed to the transfer of PCBs from zebra mussel through the food chain. (There is only one fish species in western Lake Erie that directly preys upon zebra mussel - the freshwater drum.)

3.19.5. Recommendation

A local study of the effect of zebra mussels on water quality and the food chain was suggested in the Stage I RAP. However, those participating in the development of the Stage II RAP do not recommend such a study because zebra mussels are a lakewide problem and are already being studied on a lakewide basis.

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