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

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

1. Impaired Uses

a. Guidelines for Problem Definition

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

(1) Restrictions on Fish and Wildlife Consumption;
(2) Tainting of Fish and Wildlife Flavor;
(3) Degradation of Fish and Wildlife Populations;
(4) Fish Tumors or Other Deformities;
(5) Bird or Animal Deformities or Reproduction Problems;
(6) Degradation of Benthos;
(7) Restrictions on Dredging Activities;
(8) Eutrophication or Undesirable Algae;
(9) Restrictions on Drinking Water Consumption, or Taste and Odor Problems;
(10) Beach Closings;
(11) Degradation of Aesthetics;
(12) Added Costs to Agriculture or Industry;
(13) Degradation of Phytoplankton and Zooplankton Populations;
(14) Loss of Fish and Wildlife Habitat.

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

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

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

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

FIGURE 4-1

GUIDELINES FOR RECOMMENDING THE LISTING AND DELISTING OF

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

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

Figure 4-1

GREAT LAKES AREAS OF CONCERN

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

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

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

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

c. Impaired Uses Identified by RAP Process

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

d. Impaired Uses In the AOC

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

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

Status: Impaired.

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

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

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

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

Carp in Irondequoit Bay: EAT NONE.

WILDLIFE CONSUMPTION RESTRICTIONS THROUGHOUT NEW YORK STATE:

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

Snapping turtles: Discard fat, liver and eggs.

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

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

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

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

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

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

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

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

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

Figure 4-2
Map of Sampling Locations

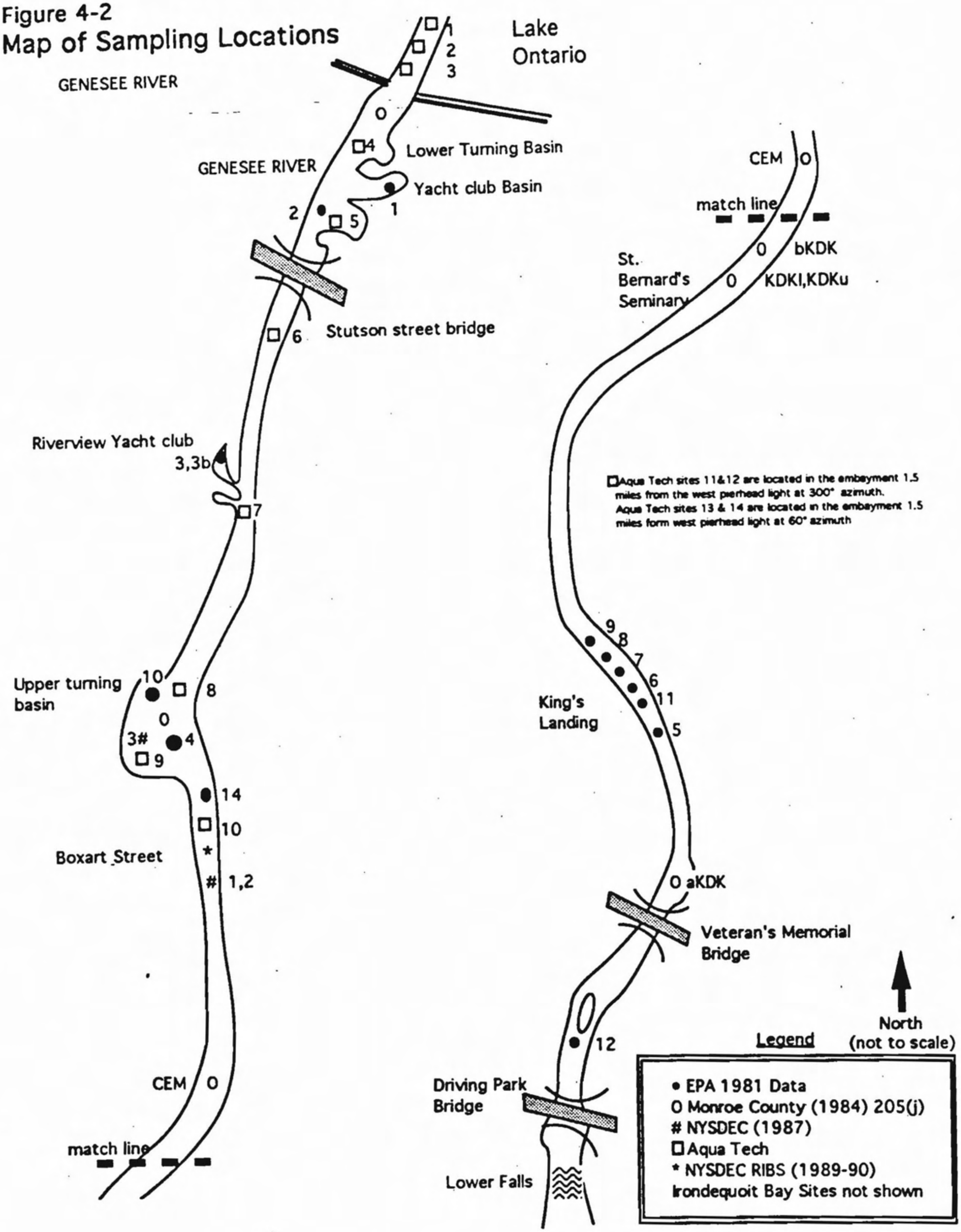

TABLE 4-3 TOXIC SUBSTANCES IN FISH IN THE WATERSHED OF THE ROCHESTER EMBAYMENT

Location	Year	Species	No. Fish Analyzed	No. of Analyses	Average Length (mm)	Length Range (mm)	Average Weight (g)	Weight Range (g)	Average PCB (ppm)	PCB Range (ppm)
Irondequoit Bay										
	1981	Carp	14	1	603	509-690	3088	2067-4808	5.16*	-
		Black crappie	17	1	225	200-285	191	118-435	0.74	-
	1984	Carp	8	3	576	532-660	2581	2130-3560	3.61*	3.26-4.43*
Genesee River										
- Belvedere	1982	Smallmouth bass	3	2	289	250-326	318	204-431	0.16	0.15-0.17
		White sucker	5	1	347	328-378	413	363-499	0.05	-
- Canadea	1982	Smallmouth bass	3	2	358	313-439	658	295-1270	0.10	0.07-0.15
- Fillmore	1982	Smallmouth bass	4	2	336	317-386	499	363-771	0.08	0.08-0.10
		White sucker	5	1	343	329-352	390	363-408	0.03	-
- W. Henrietta	1982	Northern pike	1	1	638	-	1300	-	0.23	-
		Walleye	3	2	547	454-712	1910	860-3940	0.69	0.18-1.71
		Carp	3	1	575	548-603	2687	2260-3260	2.09*	-
- Lower Falls	1982	Smallmouth bass	7	2	196	164-272	123	60-300	0.36	0.25-0.50
		Walleye	3	1	513	502-523	1513	1340-1700	1.43	-
Canaseraga Creek										
- Dansville	1982	Brown trout	3	1	275	259-290	240	200-260	0.21	-
		Northern pike	1	1	490	-	940	-	0.15	-
		Redhorse spp.	7	1	337	319-358	411	360-480	0.18	-
Silver Lake	1983	Largemouth bass	8	2	443	384-499	1698	1020-2540	0.14	0.14-0.15
		Yellow perch	7	1	201	195-210	109	100-120	0.06	-
Oatka Creek										
- Union St. Bridge										
	1983	Brown trout	18	3	246	213-312	156	120-320	0.11	0.10-0.14
Conesus Lake										
- McPherson Pt.										
	1983	Largemouth bass	8	1	264	235-299	282	170-460	0.02	-
		Smallmouth bass	3	1	327	320-340	533	460-590	0.14	-
		Yellow perch	36	2	206	190-242	132	100-200	0.05	0.05-0.05
Honeoye Lake										
- Richmond	1983	Smallmouth bass	15	3	399	357-440	985	700-1300	0.09	0.07-0.10
- Burns Point	1983	Yellow perch	22	2	255	240-290	-	-	0.06	0.02-0.07
Hemlock Lake	1984	Lake trout	14	14	644	515-734	2886	1400-4560	0.49	0.30-0.76
		Yellow perch	15	4	221	177-354	118	66-362	0.04	0.02-0.14
Canadice Lake	1984	Lk. trout <381 mm	4	4	375	365-380	402	363-410	1.22	1.01-1.59
		Lk. trout >381 mm	25	25	575	381-738	2371	416-4640	7.65*	0.78-20.54*
		Smallmouth bass	6	3	344	318-380	622	470-910	1.41	0.79-2.65*
		Yellow perch	9	3	283	230-358	339	150-680	1.12	0.32-2.67*

*** Exceeds FDA guidelines for fish consumption**

TABLE 4-3 (cont.)

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

HCB = hexachlorobenzene

TABLE 4-3 (cont.)

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

* Exceeds FDA guidelines for fish consumption.

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

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

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

Status: Impaired for mink.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Table 4-4 Sediment Bioassays

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

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

Table 4-5 Bulk Sediment Analyses: Metals and Cyanide

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

See Chapter 5 for further information on sources of phosphorus.

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

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

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

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

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

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

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

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

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

Table 4-6.

Summary of Ontario Beach Closure Statistics: 1976-1991

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

FIGURE 4-3

Genesee River Membrane Filter Fecal Coliform Daily Log Mean

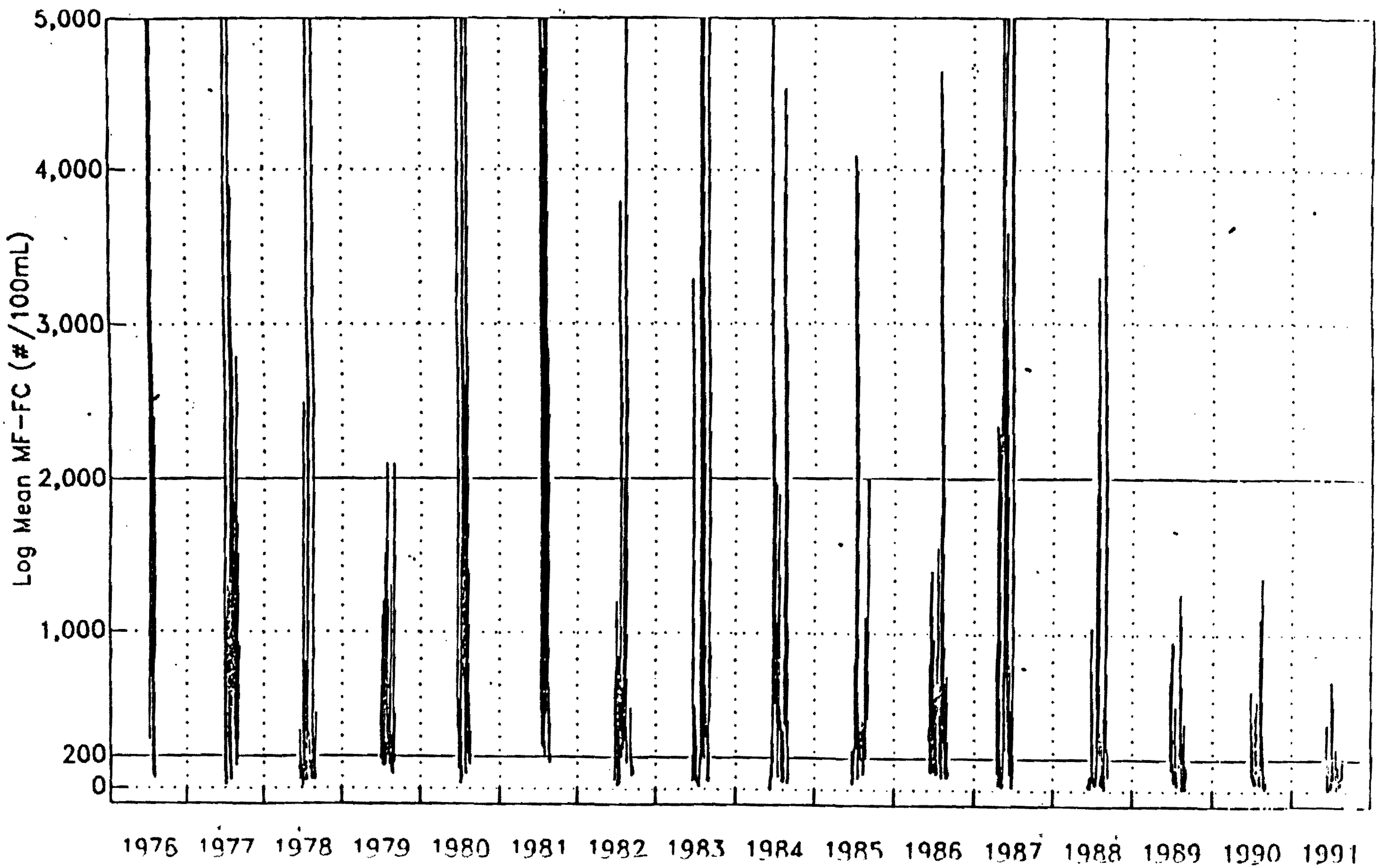

TABLE 4-7 Genesee River: Membrane Filter Fecal Coliform: 1976 - 1991

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

***No samples in August 1983**

PRELIMINARY DRAFT

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

Summer Log Mean: 1972 - 1991

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

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

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

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

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

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

Status: Impaired.

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

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

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

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

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

Status: Impaired due to zebra mussels.

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

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

Status: Impaired.

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

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

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

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

e. Uses with Impaired Status not known for the AOC

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

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

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

Status: Unknown

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

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

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

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

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

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

(n=number of samples)

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

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

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

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

Status: Unknown

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

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

Anglers have not complained about tumors or deformities.

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

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

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

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

TABLE 4-11

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

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

1: NYSDEC, 1989, Buffalo River RAP.

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

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

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f. Impairments in the Rochester Embayment with Unknown Causes

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

(3) Degradation of Fish and Wildlife Populations

(6) Degradation of Benthos.

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

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

(1) Lake Ontario Central Basin Impairments

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

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

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

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

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

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

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

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

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

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

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

2. Lake Ontario West Basin Impairments

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

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

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

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

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

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

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

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

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

3. **Genesee Basin Impairments:**

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

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

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

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

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

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

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

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

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

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

2. Status of Toxic Contaminants

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

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

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

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

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

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

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

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

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

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

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

Pollutants from outside the area of concern.

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

TABLE 4-12 TOXIC POLLUTANTS IN WATER OF EMBAYMENT

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

NOTES:

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

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

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

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

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

NOTES:

* Exceeds criterion.

ND = not detected. NT = not tested.

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

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