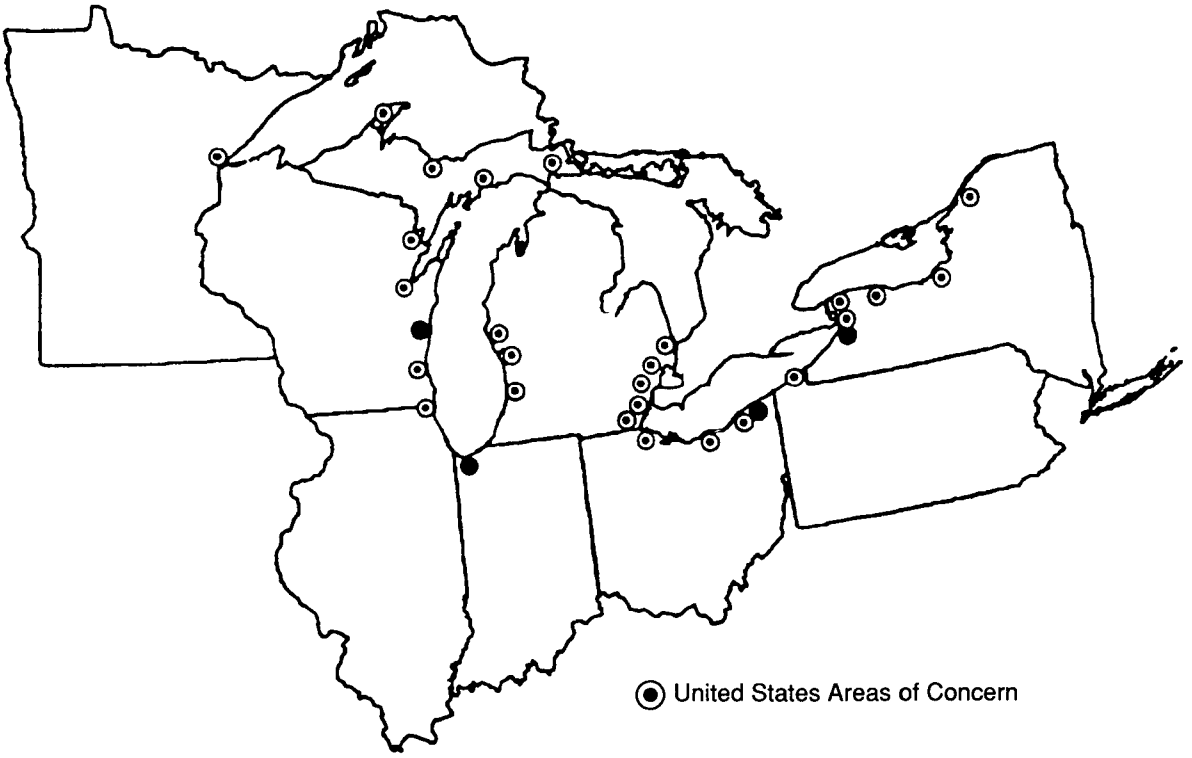
United States
Environmental Protection
Agency

Great Lakes
National Program Office
77 West Jackson Boulevard
Chicago, Illinois 60604

EPA 905-R94-002
January 1994

EPA

A Summary of Contaminated Sediment Activities Within The United States Great Lakes Areas of Concern



A SUMMARY OF CONTAMINATED SEDIMENT ACTIVITIES WITHIN THE UNITED STATES GREAT LAKES AREAS OF CONCERN

by
Callie Bolattino, Intern
National Network for
Environmental Management Studies Program

Indiana University
Bloomington, Indiana

Project Officer:
Marc Tuchman
U. S. Environmental Protection Agency
Great Lakes National Program Office

August, 1993

DISCLAIMER

This report was furnished to the U.S. Environmental Protection Agency by the student identified on the cover page, under a National Network for Environmental Management Studies (NNEMS) fellowship.

The contents are essentially as received from the author. The opinions, findings, and conclusions expressed are those of the author and not necessarily of the U.S. Environmental Protection Agency. Mention, if any, of company, process, or product names is not to be considered an endorsement by the U.S. Environmental Protection Agency.

Table of Contents

List of Acronyms 3
Acknowledgments 4
Introduction 5

Descriptions of Sites

Illinois
Waukegan Harbor 9

Indiana
Grand Calumet River/Indiana Harbor Canal 12

Michigan
Clinton River 16
Deer Lake/Carp River/Carp Creek 17
Detroit River 19
Kalamazoo River 21
Manistique River 23
Muskegon Lake 24
River Raisin 26
Rouge River 28
Saginaw River/Bay 30
Torch Lake 33
White Lake 34

Minnesota
St. Louis River/Bay 36

New York
Buffalo River 39
Eighteenmile Creek 41
Niagara River 42
Oswego River 44
Rochester Embayment 46
St. Lawrence River (Massena) 47

Ohio
Ashtabula River 50
Black River 53
Cuyahoga River 54
Maumee River 56

Pennsylvania
Presque Isle Bay 59

Wisconsin
Fox River/Lower Green Bay 61
Menominee River 63
Milwaukee Estuary 65
Sheboygan River/Harbor 68

Summary 71
References 72
Appendix A
Appendix B

List of Acronyms

AOC	Area of Concern
ARCS	Assessment and Remediation of Contaminated Sediments
BMP	Best Management Practice
BHC	Hexachlorocyclohexane
CDF	Confined Disposal Facility
CSO	Combined Sewer Overflow
CTF	Confined Treatment Facility
GLNPO	Great Lakes National Program Office
GLWQA	Great Lakes Water Quality Agreement
GLWQB	Great Lakes Water Quality Board
IDEM	Indiana Department of Environmental Management
IEPA	Illinois Environmental Protection Agency
IJC	International Joint Commission
IPP	In-Place Pollutants
MDNR	Michigan Department of Natural Resources
MPCA	Minnesota Pollution Control Agency
NPDES	National Pollutant Discharge Elimination System
NPL	National Priority List
NYSDEC	New York State Department of Environmental Conservation
OEPA	Ohio Environmental Protection Agency
OME	Ontario Ministry of the Environment
OU	Operable Unit
PADER	Pennsylvania Department of Environmental Resources
PAH	Polynuclear Aromatic Hydrocarbon
PCB	Polychlorinated Biphenyl
PRP	Potentially Responsible Party
RAP	Remedial Action Plan
RCRA	Resource Conservation and Recovery Act
RI/FS	Remedial Investigation/Feasibility Study
ROD	Record of Decision
SAIC	Science Applications International Corporation
SCS	Soil Conservation Service
SEMCOG	Southeast Michigan Council of Governments
TKN	Total Kjeldahl Nitrogen
TSCA	Toxic Substances Control Act
USACE	US Army Corps of Engineers
USEPA	US Environmental Protection Agency
USFDA	US Food and Drug Administration
USFWS	US Fish and Wildlife Service
VOC	Volatile Organic Compound
WDNR	Wisconsin Department of Natural Resources
WWTP	Wastewater Treatment Plant

Acknowledgments

In preparing this report it was important to amass all of the Remedial Action Plans (RAPs), scientific studies and assorted documentation that were available for each of the US AOCs. In doing so, many state and federal employees involved in the RAP process had to locate and send reports, take time to answer questions and provide requests regarding these sites. All of these efforts were greatly appreciated.

A special thanks must go to the Remedial Programs Staff in the Great Lakes National Program Office (GLNPO) for the interest that was shown in this project and the sincere effort that was put forth to make the "government experience" a positive one.

Introduction

Formed by glacial activity approximately 12,000 years ago, the Great Lakes comprise a unique ecosystem that, as a result of industrialization and human intervention, has been degraded over time. Canada and the United States have long depended upon the Great Lakes for a drinking water supply sufficient to support 24 million people, and for the resources and mobility to enhance technological production and transportation (Hartig and Thomas, 1988). The Great Lakes provide the natural resources needed to give Canada and the US an economic boost in the competitive, industrialized world. Considering the magnitude of human intervention that has occurred within the Great Lakes, it is not surprising that there is the need for an increasing effort to remediate the natural ecosystem damage that has resulted from human demands.

In 1909 with the signing of the Boundary Waters Treaty, Canada and the US agreed to collectively manage and protect shared Great Lakes water. This treaty established the International Joint Commission (IJC), comprised of three presidential appointees and three appointees of Canada's prime minister, to oversee the quantity of water used by the two countries and to examine the quality of water in the Great Lakes. Over the years the IJC worked to identify sources of pollutants and to provide remedial recommendations to the states, provinces and federal governments for addressing the contamination within the Great Lakes. However, the advisory efforts of the IJC proved to be no match for the continual demands of a growing society as the environmental problems of the Great Lakes expanded.

The first Great Lakes Water Quality Agreement (GLWQA) was signed in 1972 and with it the duties of the IJC were revised and expanded. This agreement was signed by both Canada and the US and represented a joint commitment to restore and maintain the Great Lakes ecosystem. The IJC relied on the Great Lakes Water Quality Board (GLWQB), their principal advisor, in order to meet this challenge. To begin the process, areas that had severely impaired water quality and were in need of remediation strategies, were identified by the GLWQB and were listed by the IJC as "problem areas" (Hartig and Thomas, 1988).

The expansion of the GLWQA in 1978, along with the amendments in 1987, established the currently used guidelines for restoring the quality of the Great Lakes. This was accomplished by detailing a general process through which the "problem areas", now termed Areas of Concern (AOCs), should be addressed. The AOCs were identified as locations where GLWQA objectives had been exceeded and such exceedance had caused, or was likely to cause, impairment of beneficial use or the area's ability to support aquatic life (United States and Canada, 1987). Impairment of beneficial use has been defined as a change in the chemical, physical or biological integrity of the Great Lakes System sufficient to cause any of the following:

restrictions on fish and wildlife consumption,
tainting of fish and wildlife flavor,
degradation of fish and wildlife populations,
fish tumors or other deformities,
bird or animal deformities or reproductive problems,
degradation of benthos,
restrictions on dredging activities,
eutrophication or undesirable algae,
restrictions on drinking water consumption, or taste and odor problems,
beach closings,

degradation of aesthetics,
added costs to agriculture or industry,
degradation of phytoplankton and zooplankton populations,
loss of fish and wildlife habitat,
(United States and Canada, 1987).

The defined AOCs included rivers, connecting channels, harbors and embayments, with the responsibility of remediating these areas falling upon the state and provincial governments within the US and Canada. The WQB officially determines the AOCs, but the specific boundaries of the AOCs are set by the states and/or provincial governments. Originally there were 42 AOCs designated by the WQB; 12 were the responsibility of Canada, 25 of the US and 5 were the joint responsibility of both countries. Since then, one more site has been added to the US list, for a present total of 26. All considered, there are 43 AOCs that are in the process of being remediated (Figure 1).

More assistance was needed in order to define the methods by which the remediation of these AOCs should proceed to fulfill the obligation to the GLWQA. In 1985, in order to provide more uniform guidance to the states, the WQB introduced the idea of a Remedial Action Plan (RAP) and developed a scenario flow chart to help the states with the decision-making process. This problem solving flow chart was comprised of the following six categories (Hartig and Thomas, 1988):

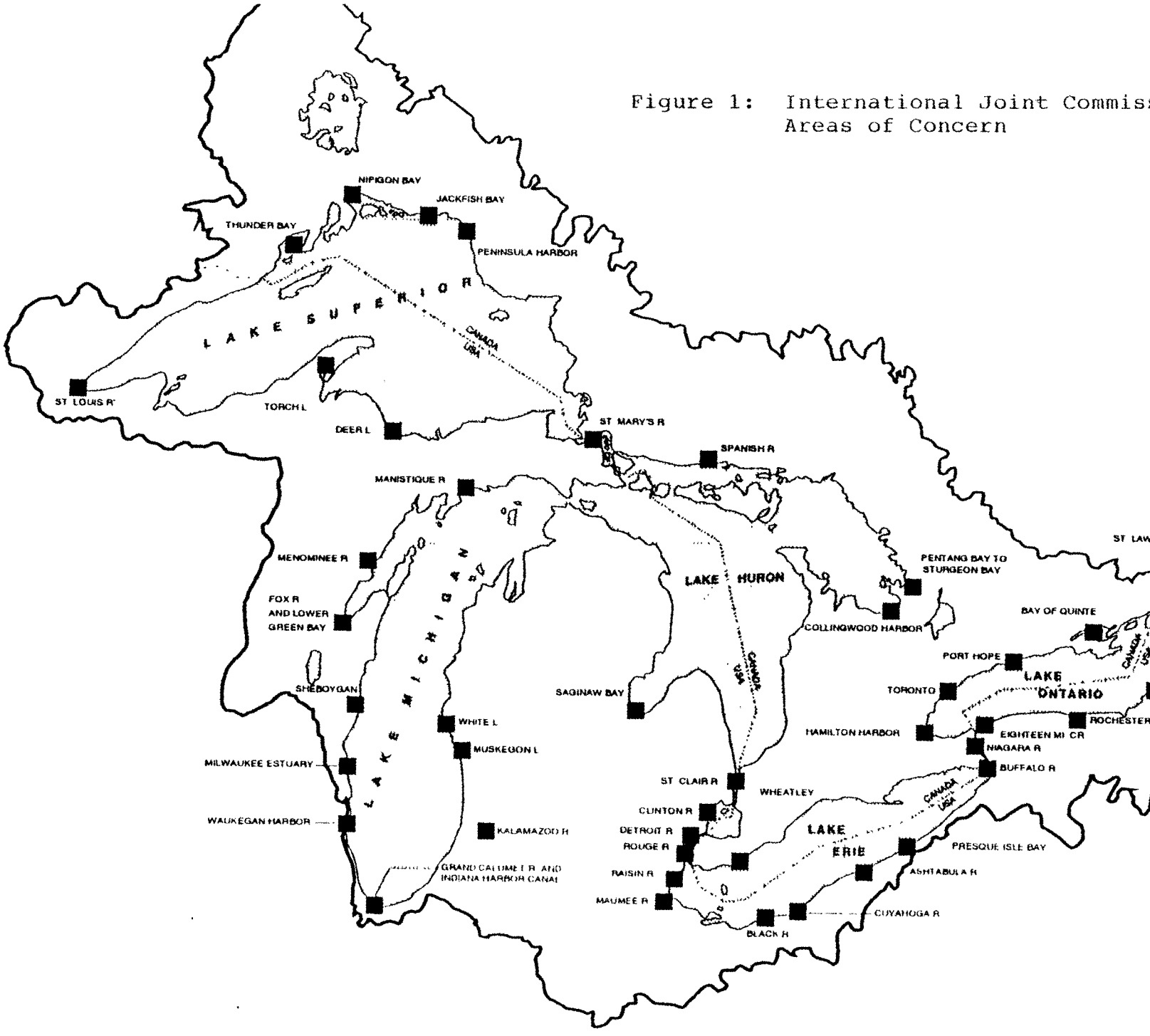
1. Causative factors are unknown and there is no investigative program underway to identify causes.
2. Causative factors are unknown and an investigative program is underway to identify causes.
3. Causative factors known, but remedial action plan not developed.
4. Causative factors known and remedial action plan developed, but remedial measures not fully implemented.
5. Causative factors known, remedial action plan developed, and all remedial measures identified in plan have been fully implemented.
6. Confirmation that uses have been restored and deletion as an Area of Concern.

These categories more clearly outlined for the states the steps through which an AOC had to move in order to be classified as completely remediated.

Central to this flow chart was the development of a RAP that would address specific use impairments and help restore and protect the environment by using an ecosystem approach. The WQB provided some basic guidance for the creation of a RAP and recommended that the remedial plans include these points (United States and Canada, 1987):

1. A definition and detailed description of the environmental problem in the AOC, including a definition of the beneficial uses that are impaired, the degree of impairment and the geographic extent of such impairment.
2. A definition of the causes of the use impairment, including a description of all known sources of pollutants involved and an evaluation of other possible sources.
3. An evaluation of remedial measures in place.
4. An evaluation of alternative additional measures to restore beneficial uses.
5. A selection of additional remedial measures to restore beneficial uses and a schedule for their implementation.
6. An identification of the persons or agencies responsible for implementation of remedial measures.

Figure 1: International Joint Commis
Areas of Concern



7. A process for evaluating remedial measure implementation and effectiveness.
8. A description of surveillance and monitoring processes to track the effectiveness of remedial measures and the eventual confirmation of the restoration of uses.

These recommendations were part of the 1987 amendments to the GLWQA, along with the division of the RAP process into three stages, Stage I, II and III, requiring submittal to the IJC at the end of each phase. The Stage I RAP must include the fore mentioned points 1 and 2. This initial phase of the RAP process is designed to provide a characterization of the AOCs' ambient environment and a description of its problems. A Stage II RAP should include points 3 through 7 and will constitute the development, implementation and evaluation of remedial actions. Lastly, the Stage III RAP must contain point 8 and is intended to be an evaluation of the improvement measures that have been identified in Stage II as well as RAP implementation. All three stages of RAP development require a cooperative effort between federal, state and local government employees, business representatives, non-governmental organizations and the local citizens. The level of participation and commitment within the AOC, in most cases, should parallel the degree of remedial action that can be achieved.

One of the major problems facing the AOCs today is toxic substance contamination of the sediments. Years of industrial and municipal discharges, combined sewer overflows and urban and agricultural non-point source runoff have contributed to the creation of vast and highly polluted sediments that pose serious human and ecological health concerns. The bioaccumulation of sediment pollutants in fish is one way for humans to become affected by the in place contaminants. The toxics increase in concentration at every level of the food chain, from the benthos, to the fish and finally, to humans. Of the 43 AOCs, 42 have problems with sediments contaminated by toxic substances and 38 have health advisories issued for human consumption of fish.

In an attempt to focus efforts on the issue of contaminated sediments, in the 1987 amendments to the Clean Water Act, Congress authorized the US Environmental Protection Agency's (EPA) Great Lakes National Program Office (GLNPO) to coordinate and conduct a 5-year study and demonstration project relating to the appropriate treatment of toxic pollutants in bottom sediments. Five areas were specified by Congress as requiring priority consideration in conducting demonstration projects: Ashtabula River, Ohio; Buffalo River, New York; Grand Calumet River, Indiana; Saginaw Bay, Michigan; and Sheboygan Harbor, Wisconsin. To fulfill the requirements of this Congressional mandate, GLNPO initiated the Assessment and Remediation of Contaminated Sediments (ARCS) Program. ARCS is an integrated program for the development and testing of remedial action alternatives for contaminated sediments. Information from the ARCS program activities will be used to assist in the decision-making of sediment remedial activities, and provide guidance for the development of RAPs for the 43 AOCs (USEPA GLNPO, 1992). It is intended that most of the outputs from the ARCS Program will be available by the end of the calendar year.

Presently, in the US, 8 states are involved in the RAP process: Indiana, Illinois, Minnesota and Pennsylvania each have 1 AOC, Ohio has 4, Wisconsin has 5, New York has 6 and Michigan has 14. Of these AOCs, 2 are the joint responsibility of two states, while the remediation of the 5 connecting channels is shared by both the US and Canada. All of the US AOCs have impaired beneficial uses attributable to contaminated sediments.

This report will address the challenges of sediment remediation within the 29 US AOCs,

and are presented based upon the state having the lead in the remedial process. For each site the following information is included (if available):

site location
contaminants polluting sediments
volume of contaminants or contaminated sediments
fish consumption advisories
enforcement history relating to Superfund sites
dredging history not related to Superfund actions
technical tools in use or needed
state requests for information and resources

Additionally, Appendix A contains a summary of the impaired beneficial uses in all US AOCs and Appendix B is a list of the state and federal RAP coordinators who contributed information and/or requests for this report. It is worthwhile to mention that the state requests contained in this report are in no way indicative of the priorities the states have set in their remedial efforts but are merely suggestions, or "wish list ideas", relating only to the issue of contaminated sediments.

Another point to clarify involves the issue of sediment criteria and the ongoing question of how the states are to determine what is and what is not considered "contaminated". For the purposes of this report, the only guidelines referred to are the 1977 guidelines for the pollutional classification of Great Lakes Harbor sediments that were developed by USEPA Region V. These guidelines were developed due to an obvious need to make immediate decisions regarding the disposal of dredged material and have not been adequately related to the impact of the sediments on the Great Lakes. These are considered interim guidelines and will be used only until more scientifically sound guidelines are developed (USEPA Region V, 1977). They are used in this report to give a general indication of the characterization of the sediments in the AOCs by using the categories of "nonpolluted", "moderately polluted" and "highly polluted". However, it should be kept in mind that absolute confidence is not placed in these guidelines and major remedial decisions are usually not based upon findings using these guidelines. It is also important to note that most of the concentrations presented in this report are maximum values from limited sampling efforts and do not represent average concentrations within the Areas of Concern. Additionally, changing technologies and lower detection limits place constraints on the comparisons that can be drawn between recent data and 1970's data.

The most current information was compiled in an effort to provide an overview of the sediment remediation issues that the AOCs are confronting, and to provide federal, state and local RAP decision-makers with a summary of past, present and future sediment activities to assist in accelerating and strengthening the process toward future remediation. It is not intended for this report to be a comparison of the efforts that are being put forth by any of the states, but should instead be viewed only as a means of sharing information that may benefit all involved parties. As a final note, though this report focuses mostly on Superfund clean-up activities, it should be kept in mind that Superfund is just one tool available for remediation. The importance of state enforcement, RCRA actions, non-enforcement and cooperative agreements should not be underestimated. In some cases, the effectiveness and timeliness of cooperative clean-up activities may be the most efficient way to remediate contaminated sediments within Areas of Concern.

DESCRIPTIONS OF SITES

Illinois

Waukegan Harbor

Location of Site

Illinois' only AOC, Waukegan Harbor, is located on the western shore of Lake Michigan, approximately 37 miles north of Chicago and 10 miles south of the Illinois-Wisconsin border. The harbor is roughly 37 acres in size and has an average depth of about 20 feet. the decision concerning the official boundaries of the AOC has resulted in an ongoing disagreement between the citizens advisory group and the state. The citizens advisory group wanted to expand the AOC so that it would be bounded by the Dead River on the north, the bluff line which parallels Sheridan Road on the west, the southern boundary of the former US Steel property on the south and the Lake Michigan nearshore on the east. However, this has not been agreed to by the State of Illinois and the official AOC presently includes only the harbor. The area that is under dispute is referred to as the "Waukegan Expanded Study Area" (ESA) and is addressed in the Stage I RAP along with the official AOC (Figure 2) .

Contaminants Polluting Sediments

Waukegan Harbor was originally designated as an AOC due to high levels of Polychlorinated Biphenyls (PCBs) in the harbor sediments. Today, pollutants of concern in the sediments also include Arsenic, Barium, Cadmium, Chromium, Copper, Cyanide, Iron, Lead, Manganese, Nickel, Phosphorous, Kjeldahl Nitrogen and Volatile Solids. Additionally, Polynuclear Aromatic Hydrocarbons (PAHs) and Phenols are present at a former General Motors Coke Plant and at the Waukegan tar pit.

The level of contamination was determined through chemical analysis of sediment samples collected in 1987 and 1990 at seven stations within the Waukegan Harbor and ESA. A summary of the findings is as follows (Hey and Associates, Inc., 1992):

1. The upper harbor had the highest number of parameters signifying "heavy pollution" with 11, followed by central harbor with 8, Slip 1 with 5, new harbor with 3 and the harbor channel with 1. Heavily polluted levels of Arsenic, Cadmium, Chromium, Copper, Cyanide, Iron, Kjeldahl Nitrogen, Lead, Nickel, Phosphorous, Volatile Solids and Zinc were found, while levels of Barium, Manganese and PCBs were determined to be moderately polluted (USEPA Region V, 1977).
2. The highest levels of PCBs were obtained from Slip 3 (Figure 3). The maximum concentrations of PCBs found were: 17,251 ppm (1985, 420 ppm (1987), 10,000 and 12,220 ppm (1990).

Volume of Contaminants or Contaminated Sediments

Roughly 700,000 pounds of PCBs were estimated to be in the soils on the Outboard Marine Corporation (OMC) property. Within the Waukegan Harbor sediments however, 300,000 pounds of PCBs were estimated to be present. Recent OMC dredging has resulted in the removal of a substantial amount of the contamination from this site. Within Waukegan Harbor and Slip 3 approximately 32,000 and 6,300 cubic yards of PCB contaminated sediments were respectively dredged. Additionally, about 3,800 cubic yards of PCB contaminated soils and sediment were dredged from the Crescent Ditch, around 2,900 cubic yards from the Oval Lagoon and approximately 5,000 cubic yards from the North Ditch. The remaining volume of contaminants is not currently known but will be determined during the follow up sampling and will be addressed by the Stage II RAP.

Figure 2: Regional Location of the Waukegan Expanded Study Area

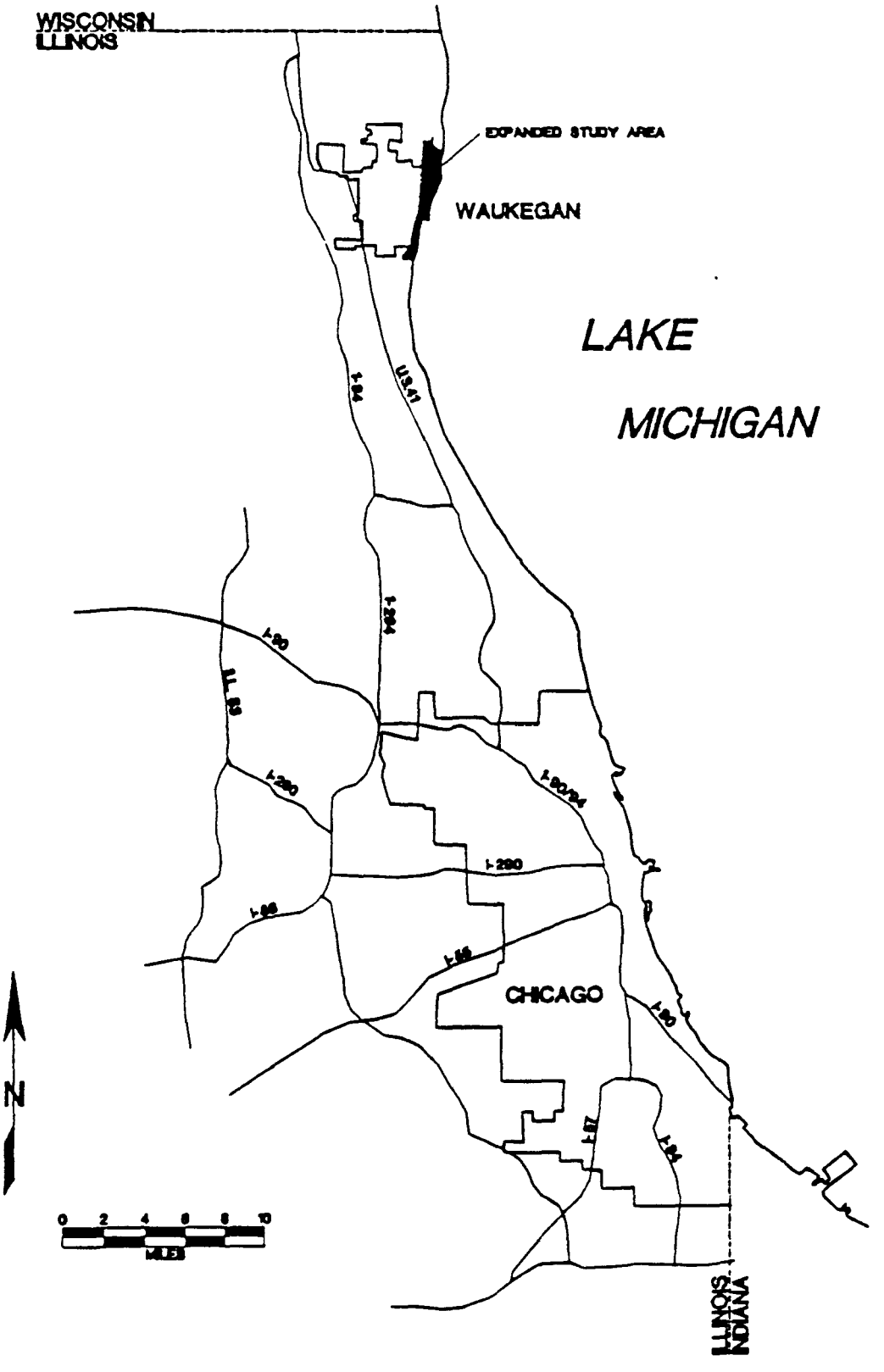
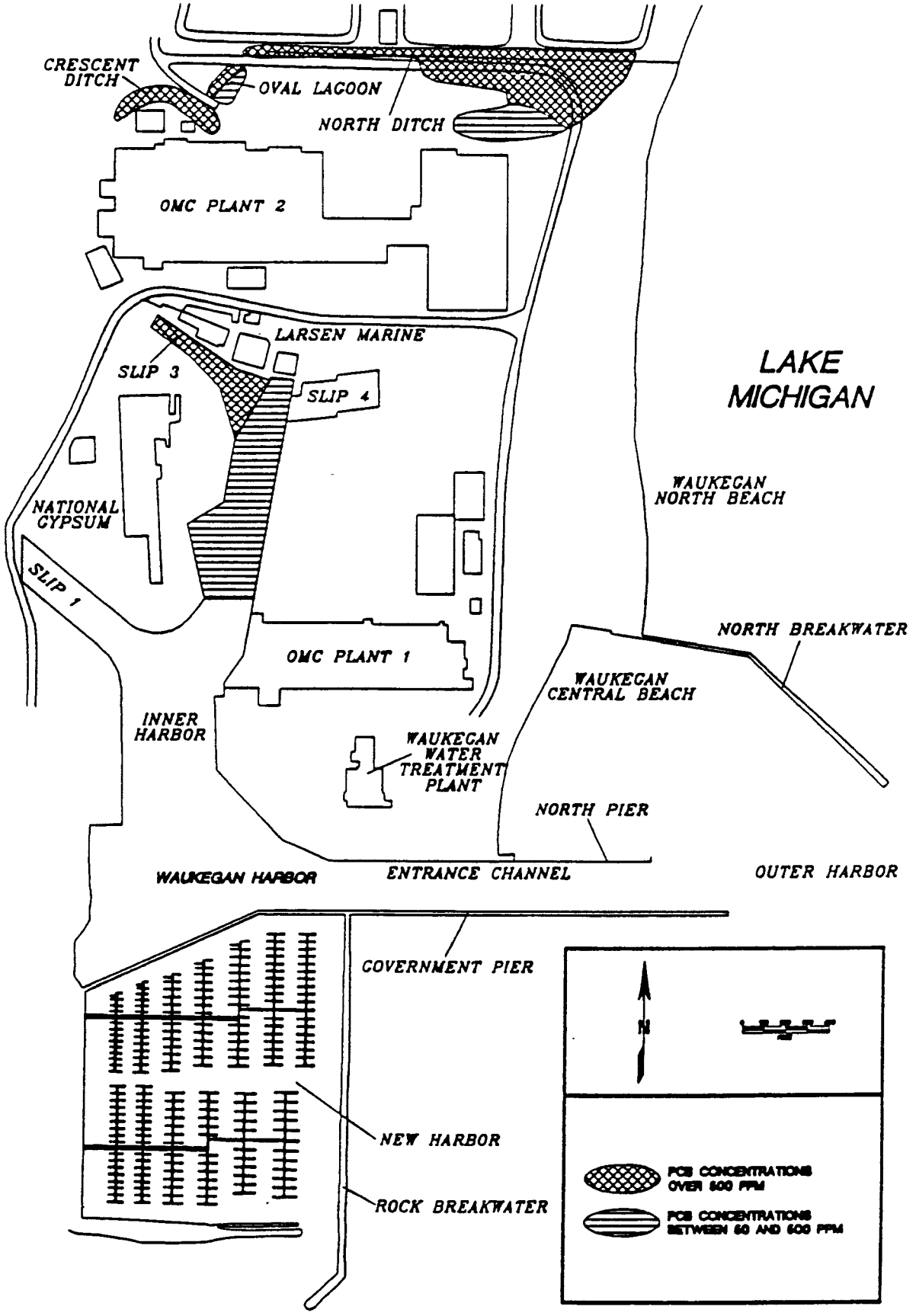


Figure 3: Extent of PCB contamination In and Around Waukegan Harbor (also locations of Slip 1 and Slip 3).



Fish Consumption Advisories

In 1981, the USEPA recommended that fish caught in Waukegan Harbor not be eaten. The basis for this recommendation was obtained from two types of studies completed by EPA to determine the extent of PCB contamination in fish. In the first study, 16 random samples of fish were collected and their PCB content was measured. All but 1 of the samples exceeded the 2 ppm US Food and Drug Administration (USFDA) guideline. The average concentration of all samples was 18 ppm. For the second study, uncontaminated fish were exposed for 30 days to water from Slip 3 in the harbor and were then placed in open lake water for an additional 84 days. The 30-day exposure to harbor water resulted in 20 ppm PCB levels in bluegills and 12 ppm levels in yellow perch. Even after the 84-day exposure to cleaner open lake water these levels did not drop below 8 ppm (Hey and Associates, Inc., 1992). Presently, there are fish consumption advisories for all fish species and the Lake County Health Department has posted a warning for the harbor area that the consumption of fish taken from the "north" portion of Waukegan Harbor may be dangerous to human health (Hey and Associates, Inc., 1992).

Enforcement History Relating to Superfund Sites

For approximately 11 years (1961-1972), Outboard Marine Corporation (OMC) purchased a PCB containing hydraulic fluid used in die-casting work. Some of the PCBs escaped through floor drains and were ultimately discharged to Waukegan Harbor. The harbor area discharge was located in the western edge of Slip 3, and in 1975 and 1976 high concentrations of PCBs were found in the sediments in this area. An initial investigation of the Waukegan Harbor sediments was made by Superfund in 1977, and was followed by more thorough investigations, a Feasibility Study (FS) and a Record of Decision (ROD). Following some remedial action, litigation, negotiations and a consent decree, construction on the remedy at the site began on November 15, 1990. The clean-up plans involved the dredging of parts of the harbor, the building of containment cells for less contaminated soils and sediments, the extraction of PCBs from the soil and finally, the thermal treatment of the sediments with PCB concentrations greater than 500 ppm. As of August, 1993, the construction of the new slip and the dredging of the sediments was completed.

Dredging History Not Related to Superfund Actions

Both the inner and the outer areas of Waukegan Harbor are affected by sediment accumulation that is estimated to be between 1 and 10 feet thick. In order to keep the harbor accessible for navigational purposes the US Army Corps of Engineers (USACE) has dredged the outer areas of Waukegan Harbor as recently as 1991 (Hey and Associates, Inc., 1992). The dredged materials removed from these areas were clean sandy sediments, suitable for open lake disposal or for use as nourishment materials for beaches. However, dredging of the inner portions of Waukegan harbor, west of North Pier, was discontinued after 1972. The sediment classification of "polluted" has prevented further dredging in the inner harbor areas. This is an issue that will be addressed through the Stage II RAP process.

Technical Tools in Use or Needed

Since the OMC remedial work has been completed, there is a need to do follow up monitoring and assess the present status of the sediments. It is important to answer the question, "How clean is the harbor now?" This will involve a recharacterization of the sediment situation after which the data will be used to plan the next step toward complete remediation of Waukegan Harbor.

State Requests

Since the dredging has been completed at the OMC site, the Waukegan Harbor AOC is now in need of financial help to fund the follow up monitoring. Specifically, fish monitoring will be very important in order to determine whether or not the advisory can be lifted. Additionally, water and sediment sampling and monitoring will be equally important in order to help with the next remedial decision.

Indiana

Grand Calumet River/Indiana Harbor Canal

Location of Site

The Grand Calumet River is located at the southern end of Lake Michigan in northwest Indiana and flows for 13 miles through the heavily industrialized cities of Gary, East Chicago and Hammond into Lake Michigan. The AOC, 15 miles south of downtown Chicago, includes the east branch of the river, a small segment of the west branch and the Indiana Harbor Canal. The defined boundaries of the Grand Calumet AOC are Interstate 80/94 on the south, the state line on the west, the Lake/Porter county line on the east and Indiana's boundary on Lake Michigan into the water (Figure 4). The land use around the Indiana Harbor is heavily industrialized primarily as a large steel production and processing center. Northwest Indiana produces more steel than any other region in the US and maintains the largest US petroleum refinery. It is also worthwhile to note that this AOC has different and much larger problems than all other AOCs because the political and public backing have historically not been supportive of issues concerning northwest Indiana.

Contaminants Polluting Sediments

Due to the vast amount of industrial activity centered around the Grand Calumet River, the condition of the AOC has been degraded so severely that it is considered by many to be the most seriously polluted of all 43 AOCs. Throughout the years, a very high environmental price has been paid by this area in order to provide the nation with machinery, automobiles and farming equipment. Presently, 90% of the Grand Calumet River's flow is discharged from industrial sources and sewage treatment plants.

A substantial amount of bottom sediments in the river and harbor are heavily contaminated with PCBs, PAHs, heavy metals and conventional pollutants. Specifically, the highest concentrations of certain contaminants found in the Grand Calumet River/Indiana Harbor Canal (GCR/IHC) sediments are as follows (Simmers, J.W. et al., 1991):

Iron: 326,000 ppm	Napthalene: 2,033.333 +/- 57.735 ppm
Lead: 1,430 ppm	Benzo(a)pyrene: 105.667 +/- 16.921 ppm
Zinc: 4,630 ppm	Fluoranthene: 160.000 +/- 10.000 ppm
Total PCBs: 102.3 ppm	

Most recently, the Toxicity/Chemistry work group within the ARCS program determined that out of the 3 priority sites tested (Buffalo River, Saginaw River and Grand Calumet River), the Grand Calumet River/Indiana Harbor Canal generally had the highest levels of sediment contamination for all parameters. Additionally, all toxicity tests indicated high toxicity with the benthic community strongly dominated by oligochaetes, a very pollutant tolerant species.

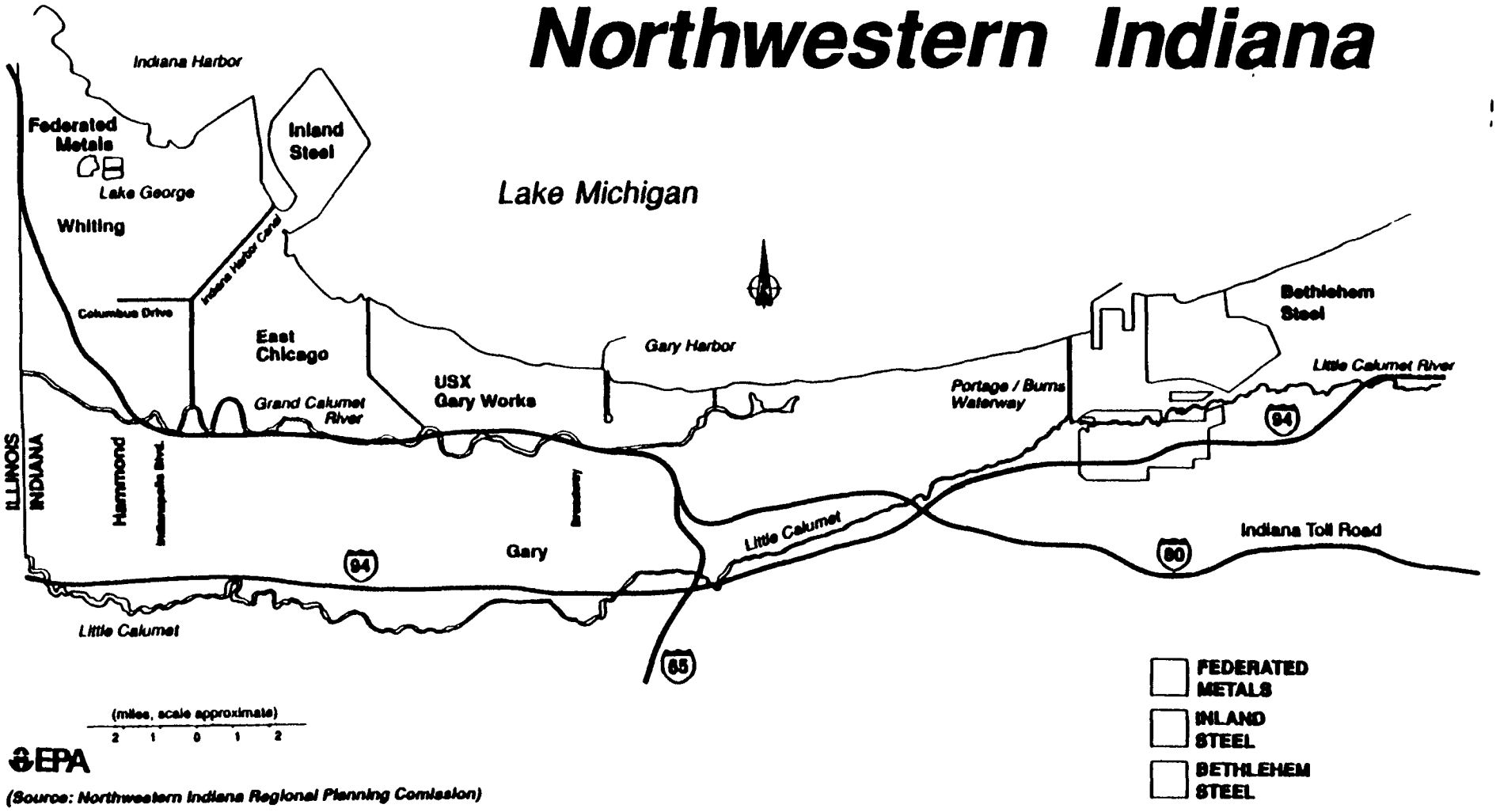
Volume of Contaminants or Contaminated Sediments

The USACE has estimated that there is between 4.5 and 5.0 million cubic yards of potentially contaminated sediment within the Grand Calumet River/Indiana Harbor Canal AOC.

Fish Consumption Advisories

In 1985, there was a "no consumption" fishing advisory issued for the GCR/IHC AOC. It was recommended that no species be eaten from these waters. Today, the advisory remains in effect.

Figure 4: Grand Calumet River/Indiana Harbor Canal Area of Concern



(Source: Northwestern Indiana Regional Planning Comission)

Enforcement History Relating to Superfund Sites

Currently, there is no remediation of contaminated sediments occurring in conjunction with any of the Superfund sites in the Grand Calumet River/Indiana Harbor Canal AOC. However, major enforcement actions with 4 sites in the AOC will have a significant impact upon the contaminated sediment situation and are worthy of mention.

In order to address the issues involved in ecosystem remediation of the GCR/IHC, the USEPA initiated lawsuits against several industrial and municipal sources of contamination to the AOC. The goals were to enforce existing environmental laws, and to make the responsible parties remediate c amage that had been done to the GCR/IHC ecosystem. Some of the settlements required responsible parties to dredge and dispose of contaminated sediments located within the AOC. The results of 4 of the lawsuits will directly influence the remediation of contaminated sediments. The responsible parties include US Steel Gary Works (USX), LTV Steel, Gary Sanitary District and Inland Steel Corporation. It should be kept in mind that only the portions of the settlements pertaining to contaminated sediments are discussed below, however, the entire settlements required much more remedial activity than is reported here.

The enforcement action against US Steel Gary Works (USX) was resolved in October, 1988 and was a result of violations of the Clean Water Act. The settlement stated that USX had to spend $17.5 million investigating approximately 13 miles of sediment in the GCR and remediating the sediments in a 5-mile stretch near USX's property. To date, USX has completed the sediment characterization study for the 13 mile stretch. The study showed that sediments contain heavy metals associated with the steel industry, such as Cadmium, Chromium, Iron, Lead and Zinc. The sediment is also contaminated with oil and grease, PCBs, PAHs, benzene, Cyanide and sulfates. The study concluded that there are about 475,000 cubic yards of contaminated sediment in the 5-mile stretch of the GCR from the river's headwaters to the Gary Sanitary District outfall. USX must clean up these sediments. Additionally, results of certain sludge tests on the contaminated sediments showed concentrations of lead as high as 800,000 ppm in certain areas.

Actions against LTV Steel were pursued for their violations of the Clean Water Act also. The results of this settlement, in May of 1992, were that LTV must do a three phase project to remove oil and clean-up sediments in the water intake channel. USEPA estimates that a minimum of 30,000 cubic yards of sediment will be remediated at a cost of $3 million. Currently, LTV's sediment remediation plan is under review by USEPA Region V.

The enforcement action taken against Gary Sanitary District was a result of repeated violations of the Clean Water Act. A settlement was reached in October 1992, in which the Sanitary District agreed to provide $1.7 million to clean-up sediments in the GCR. This project will supplement and enlarge the sediment project being carried out by USX.

Violations of the Clean Air Act, Clean Water Act, Safe Drinking Water Act and the Resource Conservation and Recovery Act, led to enforcement action against the Inland Steel Corporation. The settlement in March 1993, required Inland to spend $19 million to address contaminated sediments in a 3-mile stretch of the Indiana Harbor and Ship Canal next to Inland's property. At least $17.5 million must be spent on clean-up. EPA currently estimates that between 400,000 and 700,000 cubic yards may be cleaned up. To date, no remedial activity has commenced.

Dredging History Not Related to Superfund Actions

Due to environmental concerns and the ACE's inability to find an acceptable location for the dredged sediment, the harbor has not been dredged in many years. The USACE has determined that over 1.2 million cubic yards need to be dredged from the Federal Navigation Channel of IHC. This effort is critical because it will abate the annual movement of 150,000 cubic yards of contaminated material from the harbor to Lake Michigan. Currently, this dredging is being held up since there are problems with disposal of dredge spoil. In the past, volume and contamination of sediment in the Harbor and Canal stopped the USACE efforts to locate and construct a suitable confined disposal site for dredged materials. The ACE is presently developing a Environmental Impact Statement (EIS) for dredging of the Federal Navigation Channel, and is analyzing the Energy Cooperative, Inc. site as a possible location for a CDF.

In addition to the USACE activities, the Hammond Sanitary District tentatively agreed to dredge 428,000 cubic yards from the west branch of the Grand Calumet River. However, the State of Indiana denied Hammond's request for dredge spoil disposal on land.

Technical Tools In Use and Needed

As one of the 5 ARCS priority sites, a baseline human health risk assessment was performed for the GCR/IHC. The results are summarized as follows (Crane, J.L. (1), 1992):

1. The only dermal exposure risk estimate that approached a level of concern was the carcinogenic risk resulting from dermal exposure to IHC sediment porewater under the reasonable maximum exposure. These risk estimates were only calculated for children and teenagers in the 7 to 17 year old age group. It was assumed that contaminants in the sediment porewater would come in contact with the skin when someone stepped into the sediments barefoot or dipped their hands into the sediments.
2. The only noncarcinogenic risk estimate that reached a level of concern was for the consumption of whole carp collected from the IHC under a reasonable maximum exposure scenario.
3. The carcinogenic risk resulting from the consumption of fish was at or above levels of concern for all fish species and sites except for pumpkinseed collected from the GCR. Additionally, the carcinogenic risk from consuming whole carp from either the GCR, IHC or Indiana Harbor was almost identical.

Additionally, Grand Calumet River sediments have been recently used in a demonstration project performed jointly under the ARCS Program and the Superfund Innovative Technology Evaluation (SITE) Program. The demonstration test used 2 composited sediments (A and B) collected from the GCR, and tested the technical and economic aspects of the Resources Conservation Company (RCC) pilot-scale Basic Extractive Sludge Treatment (B.E.S.T.) solvent extraction system. The following conclusions are a few of the project findings, and are based on the demonstration test results collected by the SITE program and supported by other available data, including demonstration test data collected by RCC (SAIC 4, 1993):

1. Contaminant concentration reductions of 96% for PAHs and greater than 99% of PCBs were achieved for sediment A. Contaminant concentration reductions of greater than 99% for PAHs and 99% for PCBs were achieved for sediment B.
2. Removal efficiencies in excess of 98% were realized by both sediments for oil and grease.

State Requests

Presently, the most important issue mentioned by the State for the GCR/IHC AOC is to get the results from the ACE EIS. If these results do not become available, the State will then have to duplicate the work at a large cost before any remedial action can take place. After the EIS is released, it will be much easier for responsible parties to move ahead with contaminated sediment remediation. The EIS was scheduled to be completed by the late summer of 1993.

Michigan

Clinton River

Location of Site

Located in southeastern Michigan, just north of Detroit, is the Clinton River. The river flows 80 miles from its headwaters to Lake St. Clair near Mt. Clemens. Before entering Lake St. Clair, the river flows through a natural channel and a manmade spillway. The Clinton River AOC includes the spillway and the main branch of the river, downstream of Red Run (Figure 5). The AOC covers approximately 19 miles; 17 miles of the river and 2 miles of the spillway. Land use in the AOC is entirely urban with the main industries being automotive related. However, on the north branch of the river, the land use is agricultural.

Contaminants Polluting Sediments

Sediments within the Clinton River AOC are contaminated with PCBs, heavy metals, oil and grease. The heavy metals of concern include Arsenic, Cadmium, Chromium, Copper, Lead, Nickel and Zinc. PCBs have been detected at levels up to 11.4 ppm in the sediments downstream of Mt. Clemens (MDNR 1, 1988).

Very little characterization of the sediments within the AOC has been performed. Most attention has been focused on the federal navigation channel, so the information concerning the navigation channel is current, but data related to either side of the channel is lacking. Characterization of sediments outside the dredged channel is definitely needed.

Volume of Contaminants or Contaminated Sediments

No estimates have yet been calculated for the volume of contaminated sediments within the Clinton River AOC.

Fish Consumption Advisories

Within the Clinton River AOC there is a fish consumption advisory for carp due to the presence of PCBs in the sediments. A caged fish study was conducted for one month in 1989 to evaluate fish uptake levels of PCB at both the mouth of the Clinton River and the Clinton spillway. After 27 days, channel catfish from both locations accumulated low levels of PCBs. Another caged fish study was completed in 1992 and results should be available by September 1993. These studies may be used to confirm the necessity of the consumption advisory and to obtain a better indication of the magnitude of the PCB problem.

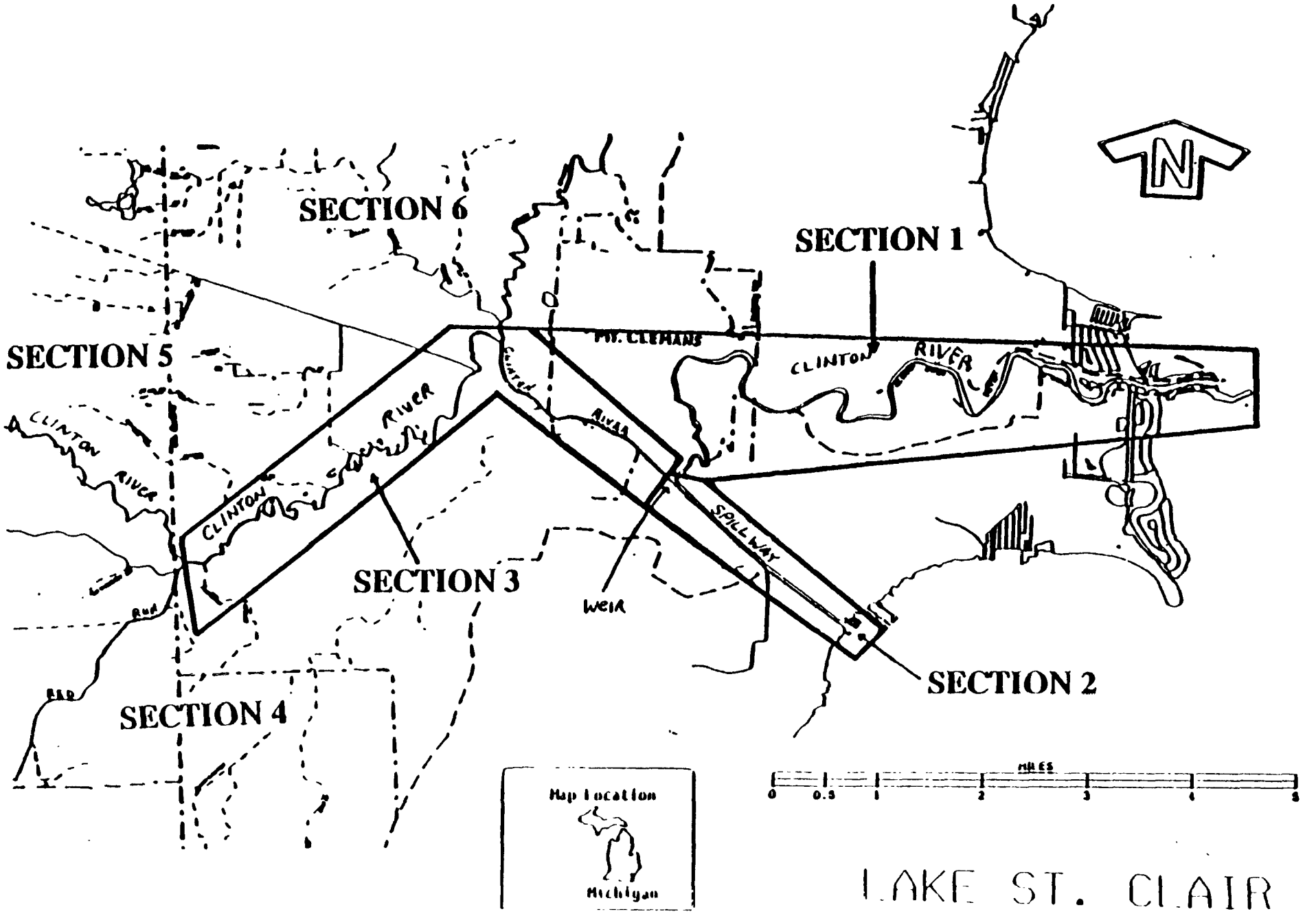
Enforcement History Relating to Superfund Sites

There are 5 Superfund landfills that have been identified in the Clinton River watershed, 4 of which are located within the AOC. The 4 sites are: Liquid Disposal Inc., G&H Landfill, J&L Landfill and South Macomb Disposal #9. All four of these sites have completed the RI/FS phase and are at various stages of clean-up and agreements with PRPs. It has been determined that none of these sites are impacting the river and therefore, no remediation of the sediments within the AOC is occurring in conjunction with any Superfund actions. Currently, there are no plans to remediate any river sediments.

Dredging History Not Related to Superfund Actions

Dredging within this AOC has recently been performed by the USACE and the Macomb County Public Works Commission (MCPWC). Due to the ineffective spillway weir, sediment

Figure 5: Clinton River Area of Concern, including the spillway weir, and River Sections 1, 2 and 3. Portions of the Source Area of Concern, River Sections 4, 5 and 6 are also shown.



deposits have occurred across the natural river channel at the confluence with the spillway, diverting much of the river flow down the spillway channel. In an attempt to correct this problem, the MCPWC completed the removal of sediment deposits in November of 1990. The dredged sediments were disposed of in a CDF. There is also a proposed project to modify the spillway weir that may involve the removal of more sediments. This needs to be done in order to insure that the appropriate river flows are maintained.

In addition to the MCPWC dredging, from October 23, 1991, to November 18, 1992, the USACE removed approximately 99,000 cubic yards from the navigation channel. This dredge spoil was placed in the new CDF that was completed in 1989. This new CDF is located 150 feet from the river and is 37 acres in size.

Technical Tools in Use or Needed

Most of the efforts concerning the sediments within the Clinton River AOC have been from dredging activities. A modification of the spillway weir is proposed. Other than work involving the spillway, little has yet been done to assess where this AOC is in the remediation process. Completion of the Stage II RAP (with updates for the Stage I RAP) is scheduled for 1995. Work groups have been decided upon and one of the groups is focused on contaminated sediments. Characterization of the sediments in the AOC on the outside of the navigation channel is needed.

State Requests

The Clinton River RAP Committee needs time to get the work groups moving so that decisions can be made and the sediment situation addressed. They are going to need help with funding the sediment characterization work of the AOC on both sides of the navigation channel and farther up the river. Once some data is obtained and assessed by the contaminated sediment work group, remedial decisions can be considered and remedial actions implemented.

Deer Lake/Carp River/Carp Creek

Location of Site

Deer Lake is located in the Upper Peninsula of Michigan, northwest of the city of Ishpeming, near the shore of Lake Superior. The Carp River connects Deer Lake to Lake Superior. The AOC includes all 907 acres of Deer Lake, 20 miles of the Carp River and Carp Creek, a tributary stream that flows into Deer Lake. Land use around this AOC is 96% forested with a few industrial areas from past iron ore and gold mining activities.

Contaminants Polluting Sediments

Sediments in the AOC are highly contaminated with heavy metals including Chromium, Copper, Lead, Zinc and especially Mercury. It was estimated by MDNR that 30 pounds of Mercury per year were discharged into the sewer system every year for approximately 52 years. The highest concentrations of Mercury (10 to 15 ppm) were found off the Carp Creek Inlet (MDNR 2, 1987). All sources of Mercury, except for atmospheric loadings, were eliminated in 1981.

Volume of Contaminants or Contaminated Sediments

No estimates are available for the volume of contaminated sediment within the Deer Lake AOC.

Fish Consumption Advisories

Fish consumption and health advisories were issued for the AOC in 1981 and 1982. The advisories were based upon the discovery that fish in Deer Lake were contaminated with Mercury in excess of the USFDA action level of 1.0 ppm wet weight and the State of Michigan Consumption Advisory level of .5 ppm (MDNR 2, 1987). The advisories remain in effect for all species.

Enforcement History Relating to Superfund Sites

There are no federal Superfund sites within this AOC. However, in order to understand the challenges of remediation for the Deer Lake AOC, it is important to look at the history of contamination.

The major sources of pollution are believed to have been discharges of Mercury from the old Ishpeming Wastewater Treatment Plant (WWTP) and Combined Sewer Overflows (CSOs). The Cleveland Cliffs Iron Company (CCI) laboratories was responsible for the Mercury discharges that the Ishpeming WWTP received. The CCI Company maintained two Mercury laboratories in the city of Ishpeming which used Mercuric Chloride in ore assays and research. After being used, the spent reagents were poured down the drains that were connected to the sewer system. Between the two labs this activity occurred over a period of 52 years (MDNR 2, 1987).

A consent judgment was signed between CCI and MDNR in 1984 that held CCI financially responsible for the restoration and monitoring of Deer Lake. The remediation of Deer Lake involved the following actions: drawing down the lake to the lowest possible level, stabilizing the water levels near the top of the dam so as not to stir the sediments, leaving the mercury contaminated sediments in place to be covered during the process of natural sedimentation, killing all mercury contaminated fish and restocking, and lastly, monitoring fish, sediment and water for 10 years. These remedial actions were completed in 1986 and the monitoring is in progress until 1996 at which time CCI has to do extensive sampling of the Mercury levels in the fish and benthos to determine if a healthy ecosystem has been restored.

Dredging History not Related to Superfund Actions

No dredging has ever occurred within this AOC.

Technical Tools in Use or Needed

Currently there is annual monitoring of Mercury levels in fish that will continue through 1996. In 1996, CCI will have to perform more extensive sampling of the fish, sediment and benthos to determine if the Mercury levels have decreased to a point where it is no longer available to the aquatic wildlife or water column. It would be helpful to perform a study of bottom dwelling biota to obtain an updated look at the health and diversity of the benthic region. There is interest in monitoring eagles and other wildlife for Mercury, but this has received no funding and will probably not be done.

State Requests

There are no requests for additional help at the present time because the remedial strategy is to wait on further remedial decisions until after the results of the extensive 1996 sampling is available. At that time there may be an extensive "wish list" to help complete the restoration of the Deer Lake AOC.

Detroit River

Location of Site

The Detroit River, 32 miles in length, connects Lake St. Clair and Lake Erie and serves as part of the international boundary between Canada and the US. This river is the lowest link of the Upper Great Lakes connecting channels, conveying water from Lakes Michigan, Superior and Huron to Lake Erie. The physical boundary of the Detroit River AOC is the Detroit River, from Windmill Point to the Detroit Light (Figure 8) Fifteen tributaries discharge into the AOC, with the largest being the Rouge River, an AOC in itself. A major use of the Detroit River is as an industrial and drinking water supply. The river supplies approximately 25 industries with process or cooling water. Additionally, there are 7 municipal drinking water intakes serving around 4 million people in nearly 100 communities within the AOC watershed (MDNR and OME, 1990). Shoreline use in Michigan is 61% industrial, versus 33% for the Ontario shoreline, while 31% of the Ontario shoreline is residential and 22% recreational, compared to 16% residential and 6% recreational for Michigan.

The Detroit River RAP is being developed jointly by the Ontario Ministry of the Environment (OME) and MDNR, with Michigan bearing the major responsibility.

Contaminants Polluting Sediments

It is believed that the Detroit River sediments have likely been accumulating contaminants since the AOC became industrialized (MDNR and OME, 1990). Today, sediments in the nearshore areas are heavily polluted with metals, PCBs, Cyanide and other organics. Heavy metals of concern include Arsenic, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Mercury, Nickel and Zinc. The following ranges of contaminants were developed from 9 studies and were presented in the Detroit River RAP:

Arsenic: .86 to 36 ppm	Cadmium: .1 to 41 ppm
Chromium: 4 to 680 ppm	Copper: .5 to 280 ppm
Cyanide: less than detect to 15.7 ppm	Iron: 2600 to 180,000 ppm
Lead: non-detect to 810 ppm	Mercury: less than detect to 55.8 ppm
Nickel: 3 to 300 ppm	Zinc: 6 to 53,000 ppm
PCBs: below detect to 40 ppm	oil and grease: 20 to 47,226 ppm

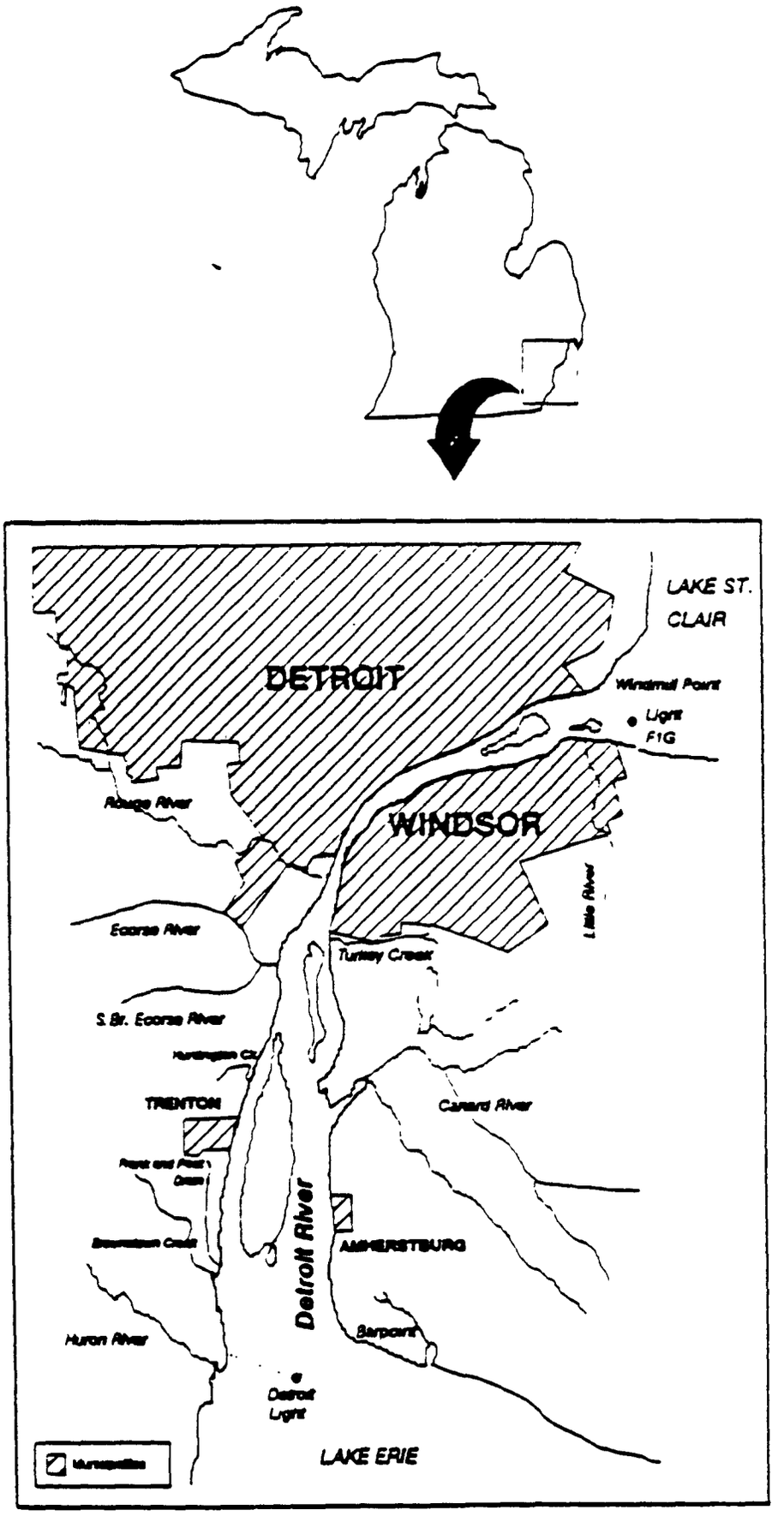
Most of the sediments sampled along the entire MI shoreline were classified as "heavily" or "moderately polluted" based upon 1977 USEPA guidelines (USEPA Region V, 1977).

As for a characterization of the sediment situation, there are "hot spots" of PCBs and "hot spots" of metals, downriver from the steel industry discharge areas. Additionally, the Michigan shoreline from the Rouge River southward through the Trenton Channel appears to have the greatest overall contaminant levels. Generally, contaminant concentrations are substantially higher along the Michigan shoreline where there is widespread, significant contamination, as compared to the mid-river and Ontario shoreline sectors.

Volume of Contaminants or Contaminated Sediments

No estimates are currently available as to the volume of contaminated sediments within the Detroit River AOC. Some approximations may soon be available in conjunction with specific projects.

Figure 8: The Detroit River Area of Concern



Fish Consumption Advisories

The Detroit River currently has a restricted consumption advisory for freshwater drum above 14" due to Mercury levels, and a no consumption advisory for carp due to PCBs. The Canadian government has also issued a restricted consumption advisory for walleye over 18" due to high levels of Mercury.

Enforcement History Relating to Superfund Sites

No Superfund sites within the AOC are believed to be contaminating the sediments at any significant levels.

Dredging History Not Related to Superfund Actions

Maintenance dredging by the USACE is constant within the Detroit River harbor areas. All dredge spoil is currently disposed of at the Pointe Mouillee CDF. In addition to the ACE dredging, there has been recent marina dredging near Elizabeth Park. This dredging was conducted by Wayne County in 1993 and the dredge spoil was disposed of at an upland site. There are now plans to monitor and study this site to determine the rate of re-sedimentation and re-establishment of the benthic community. This will hopefully provide an indication of the recovery or recontamination potential of the river in its present state.

Technical Tools in Use or Needed

Currently there are many different sediment related activities being implemented in the Detroit River AOC. The purpose of these activities is to build the data base so it supports the Detroit River as an area for the application of technology developed under the ARCS program. In order to develop this data base, efforts are first being focused on the Trenton Channel, instead of the Detroit River as a whole, because this channel is highly polluted and has all the characteristics of the Detroit River within a much smaller area. The Trenton Channel is located in the lower river between Grosse Isle and the MI mainland and is approximately 8 miles in length. It is hoped that through extensive sampling and other baseline work that a very detailed mass balance model for Trenton Channel can be run for various scenarios. These scenarios should then indicate the possibility of obtaining any benefits from different remedial options . The information and procedures used on the Trenton Channel could then be applied to the entire Detroit River (Benzie, 1993).

To make this process more manageable, these efforts within the Detroit River AOC have been divided into short-term and long-term goals. The short-term goals involve the identification and remediation of the "hot spots" and the collection of baseline information for the Trenton Channel, while the long-term goals include the performance of mass balances on the Trenton Channel and the Detroit River. Data needs for the mass balance models will include: mapping of soft sediments, re-suspension measurements, bathymetric changes and contaminant analyses (Benzie, 1993).

Other work in relation to the sediment situation within the Detroit River AOC involves the CSO Toxics Demonstration Project that is to develop a single empirical model which can be used to predict the contribution of toxicants from the CSOs. This will be important information for the Detroit River mass balance model. Additionally, the contaminated sediment data that was presented in the Stage I RAP is being updated using Geographic Information Systems (GIS). This is intended to give a more accurate depiction of the contaminated sediment situation in the Detroit River.

State Requests

An important goal within this AOC is to compile enough information and baseline studies to reach a level for consideration as an ARCS demonstration site. In order to get to that point, assistance with funding parts of the Trenton Channel mass balance modeling effort is needed. It would also help the State if the resources were available to do a much larger study on CSOs. This would involve better monitoring and modeling that would assist in pinpointing which loads need to be controlled first. Lastly, a more accurate estimate of the effects of storm water runoff on the contaminated sediments would also help in moving this AOC forward in the remediation process.

Kalamazoo River

Location of Site

The Kalamazoo River is located in the southwestern portion of the Lower Peninsula of Michigan. The river flows in a westerly direction and discharges into Lake Michigan near the city of Saugatuck. The original designation of the AOC included only the lower 28 miles of the river, but currently, the AOC includes the lower 80 miles of the river. The area upstream of the AOC is heavily industrialized and includes several large paper companies. The principal sources of pollution in this AOC are these large paper companies. The source area for the PCB contamination has been identified as the Kalamazoo River from Calkins Dam to the city of Kalamazoo and Portage Creek, a tributary to the Kalamazoo River in Kalamazoo (Figure 9).

Contaminants Polluting Sediments

PCBs are the identified pollutants of concern in the Kalamazoo River AOC sediments. Highlighted in the Kalamazoo Stage I RAP (Draft) were 8 "hot spots" that were believed to contain much of the pollution within the river: the Bryant Mill Pond area of Portage Creek in Kalamazoo, the Plainwell impoundment, the Ostego impoundment, the Trowbridge impoundment, Lake Allegan, the city of Allegan impoundment, a paper industry sludge disposal area and the Ostego city dam impoundment (MDNR 3, 1987). The following points concerning the sediment situation were presented in the RAP (MDNR 3, 1987):

1. In the Kalamazoo River upstream of Calkins Dam to Kalamazoo, sediment PCB concentrations were generally in the 10 to 30 ppm range in depositional areas. However, at Portage Creek (Bryant Mill Pond) in Kalamazoo, sediment PCB concentrations were generally in the 100 to 300 ppm range.
2. The highest concentrations of PCBs in the sediments were found in the Bryant Mill Ponds and the Portage Creek area. An estimated 50% of the Bryant Mill Ponds data exceeded the EPA action level of 50 ppm, while 38% of sediment data from Portage Creek exceeded 50 ppm.

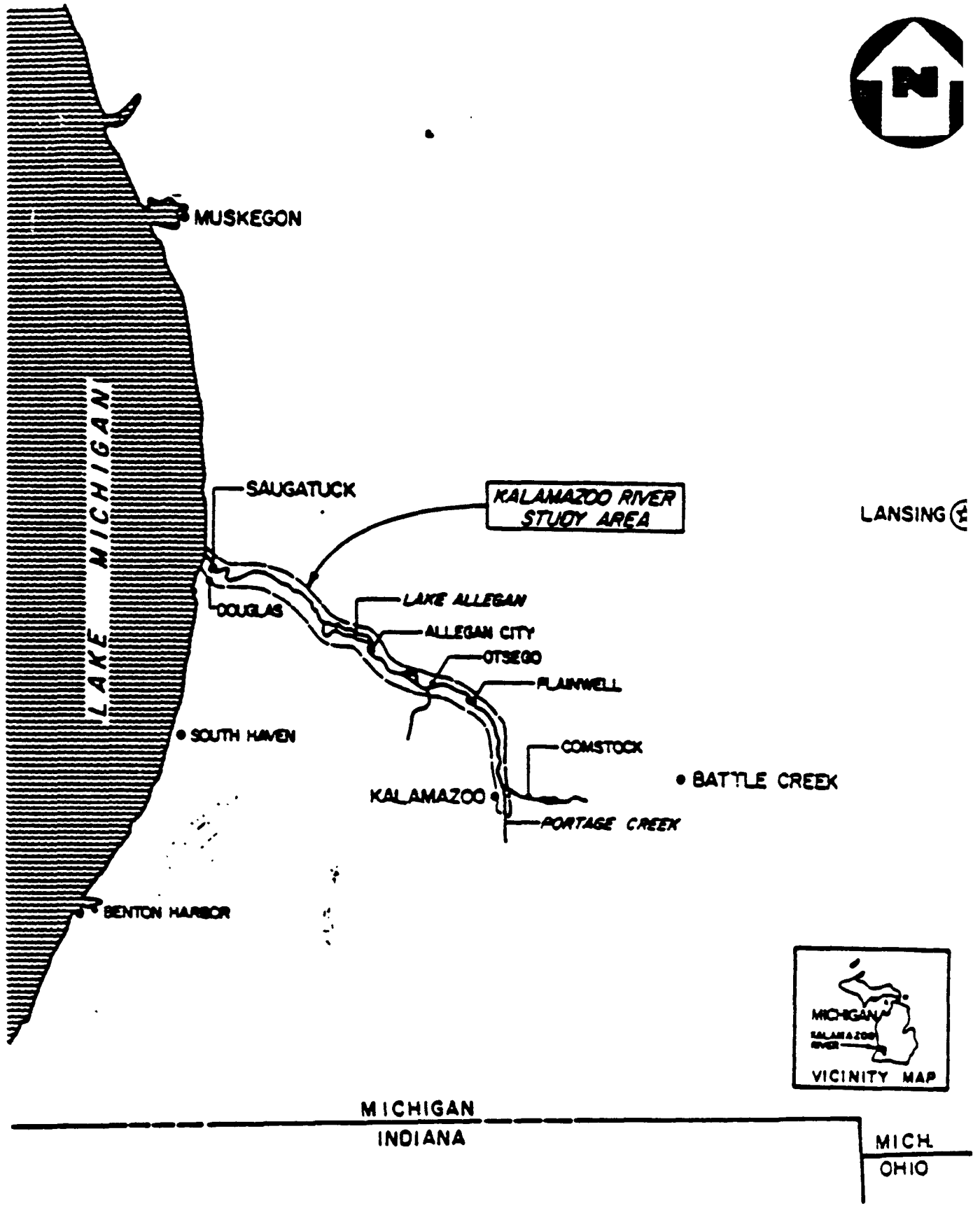
Volume of Contaminants or Contaminated Sediments

It has been estimated that there are 230,000 pounds of PCBs in the depositional areas of Lake Allegan, Plainwell, Trowbridge and Ostego impoundments and Bryant Mill Pond. MDNR has also approximated that the lower portion of Bryant Pond contains 22,000 to 36,000 pounds of PCBs. No final estimates of the total cubic yards of contaminated sediment within the Kalamazoo River AOC are currently available.

Fish Consumption Advisories

As a result of PCB contamination, a fish consumption advisory, issued in 1977, is in effect

Figure 9: General Location Map for the Kalamazoo River PCB Study
Scale: 1" = 15.2 miles



in the Kalamazoo River AOC for all species except walleye. Data from 1986 showed that generally, the most contaminated species was carp, having an average total PCB concentration of 3.46 ppm (MDNR 3, 1987).

Enforcement History Relating to Superfund Sites

The Kalamazoo River Superfund site encompasses roughly 80 miles of PCB contaminated waterways, including banks, several impoundments and landfills. This site attained Superfund status on August 31, 1990. The State has identified 3 PRPs to date: Allied Paper Incorporated/HM Holdings, Incorporated, Simpson (Plainwell) Paper Company and Georgia Pacific Corporation. These PRPs own property that contains high concentrations of PCBs in the soils and/or sediments which are believed to be contributing to the continuing contamination of the Kalamazoo River.

The Superfund approach is not specifically focused on the 8 "hot spots" referred to in the RAP, but instead involves an investigation of the entire river to (approximately) Lake Allegan. Within the Superfund site there are 4 source areas, referred to as operable units (OUs), that are landfills and are considered continuing sources of contamination to the river. The 4 OUs are: King Highway Landfill, A-site Landfill, Willow Boulevard Landfill and the Bryant Mill Pond. These OUs are being addressed very quickly and are currently in the remedial investigation phase. Each of the 4 OUs has its own work plan and is on a faster track than the rest of the river. In total, there are 5 work plans being implemented, one each for the 4 OUs and one for the entire river. Remediation of the entire site will first focus on completing the RI/FS which is estimated to take another 2 and 1/2 years.

Dredging History Not Related to Superfund Actions

No dredging of contaminated sediments has ever occurred within the Kalamazoo River AOC.

Technical Tools in Use and Needed

Currently the activities within this AOC are centered on characterizing contamination, and are specifically focused on mapping contamination. Later in the summer of 1993, a pilot study of two methods to determine depositional areas and volume estimates is planned. The two methods to be studied are Kriging (a geostatistical method) and dividing up the area into transects and horizons (what is usually done at sediment sites). After the study is completed, the best method or a combination of the two methods will be applied to the whole river. Additionally, a biota sampling project has been started which will try to integrate into a model the biological pathways and degree of biomagnification that is present within the AOC. The model output will be used to develop an ecological risk assessment for the Kalamazoo River.

Within the Kalamazoo River AOC, the RAP process has just been re-initiated. Since Superfund is taking the lead with the PCB issues, the RAP committee will address NPS pollution to the river and will concentrate on the other beneficial use impairments not caused by contaminated sediments.

State Requests

In general, it was suggested that it would be very helpful in remedial decision-making for this AOC if new sediment criteria were established. Additionally, it was stated that it would be helpful if an ARCS project was taken one step further and a full-scale demonstration completed in lieu of doing different pilot studies.

Specifically, for the Kalamazoo River AOC, funding is needed for programs to control NPS agriculture sedimentation within the tributaries, and for the acquisition and restoration of wildlife habitat. Restoration of habitats would only come after some criteria have been developed to ensure there will be a healthy ecosystem.

Manistique River

Location of Site

The Manistique River flows into northern Lake Michigan from Michigan's Upper Peninsula. The AOC is the lower 1.7 miles of the river and extends from below Manistique Papers, Inc. to the Manistique Harbor and portions of nearshore Lake Michigan (Figure 10). The AOC is located completely within the city of Manistique and most of the county is open, underdeveloped land accounting for 98% of all land uses.

Contaminants Polluting Sediments

In 4 studies conducted by EPA and MDNR, it was found that the sediments near the Manistique Paper Company were extremely polluted with very high levels of PCBs and contained moderately polluted levels of Chromium, Copper and Lead (SAIC 1, 1987). In a 1985 EPA study, PCB concentrations ranging from 4.3 to 66 ppm were found along the northern portion of an old de-inking lagoon located on Manistique Paper Company property. In addition, extensive sampling by the USACE in 1991 found PCB levels as high as 338 ppm in the federal navigation channel, just outside of the Manistique River AOC. It was also found that the high PCB levels were associated with the deposits of pulping material as opposed to the sandy sediments. In July 1993 sampling by PRPs, PCB levels in the harbor navigation channel were detected as high as 720 ppm.

Volume of Contaminants or Contaminated Sediments

The volume of contaminated sediments within the Manistique River navigation channel is currently estimated to be approximately 35,000 to 50,000 cubic yards.

Fish Consumption Advisories

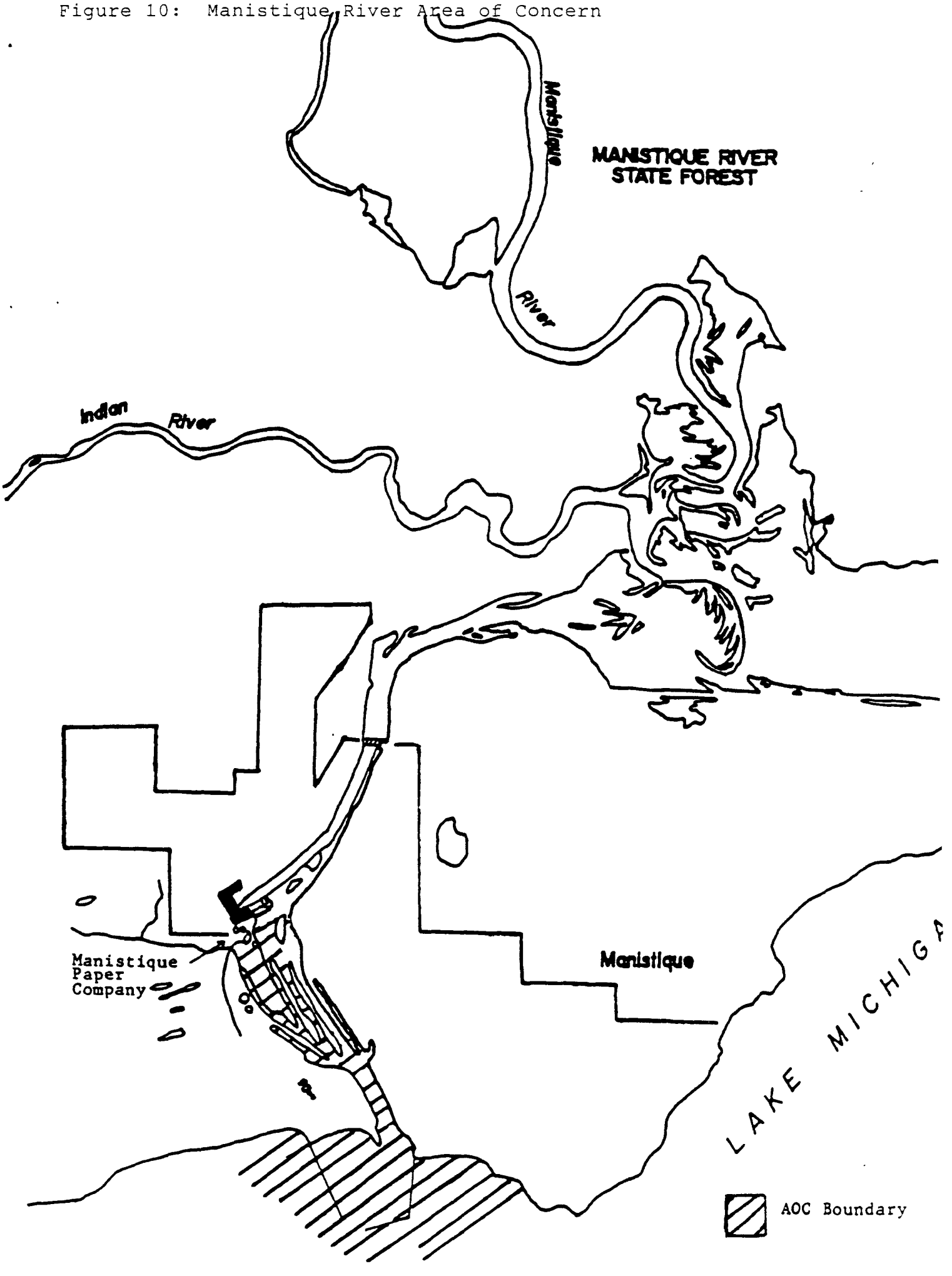
Within the AOC there is a fish consumption advisory listed only for carp. Concentrations were found in excess of both the USFDA action level and the Michigan Consumption Advisory level.

Enforcement History Relating to Superfund Sites

Sources of pollution within the Manistique River AOC are Manistique Papers, Inc., Edison Sault Electric and Warshawsky Brothers Iron and Metal. The Emergency Removal Branch is presently investigating whether or not a contaminated sediment site within the AOC should be placed on the NPL and/or emergency dredging performed.

Manistique Papers uses recycled paper as a raw material. In the 1960's, the company used a lagoon located near the river to settle de-inking wastes. High concentrations of PCBs have been found around the area of the lagoon during past sampling surveys. There have been erosion problems with the contaminated soils on the lagoon banks. Properties owned by Edison Sault Electric and Warshawsky Brothers are also believed to be sources of PCB contamination to this site.

Figure 10: Manistique River Area of Concern



Action was initially started on this site because the ACE did extensive sampling in 1990 and found high levels of PCBs. This in turn triggered DNR sampling in 1991 and 1992. After becoming aware of this data, the Emergency Removal Branch of Superfund became involved and named 3 PRPs to perform PCB sampling. This work was completed in June, 1993, and the results were made available to the agencies and the PRP's. Based upon these studies a determination will be made as to the need for emergency dredging and other remedial action.

Dredging History Not Related to Superfund Actions

In the 1960's the USACE dredged Manistique Harbor to maintain appropriate water depths for navigation. At that time the sediments were open water disposed. The Manistique Paper Company also dredged and backfilled the de-inking lagoon in the late 1970's and these sediments were disposed of in the facility owned landfill.

Technical Tools in Use or Needed

At this time the Emergency Branch of EPA Superfund is dealing with the PCB "hot spots" in this AOC by analyzing sampling data and assessing the need for emergency dredging. A sediment study was also just completed by the USACE that provided contaminated sediment volume estimates. The combined efforts of Superfund, PRPs and USACE should provide a better characterization of the contamination throughout the AOC and provide the basis for decisions concerning the next remedial actions.

State Requests

The Emergency Branch of Superfund is dealing with only the PCB "hot spots" and the State would like to consider a more extensive removal. Since this site is only 90 acres in size it is believed that the overall clean-up costs would be reduced if all the sediments in need of dredging were removed in one effort. This way the site could be permanently remediated. It was also suggested that Manistique would be a good site on which to perform removal and disposal demonstration techniques. It is believed that this is an ideal site on which to test new technologies because it is small, with a well-defined and serious problem.

Muskegon Lake

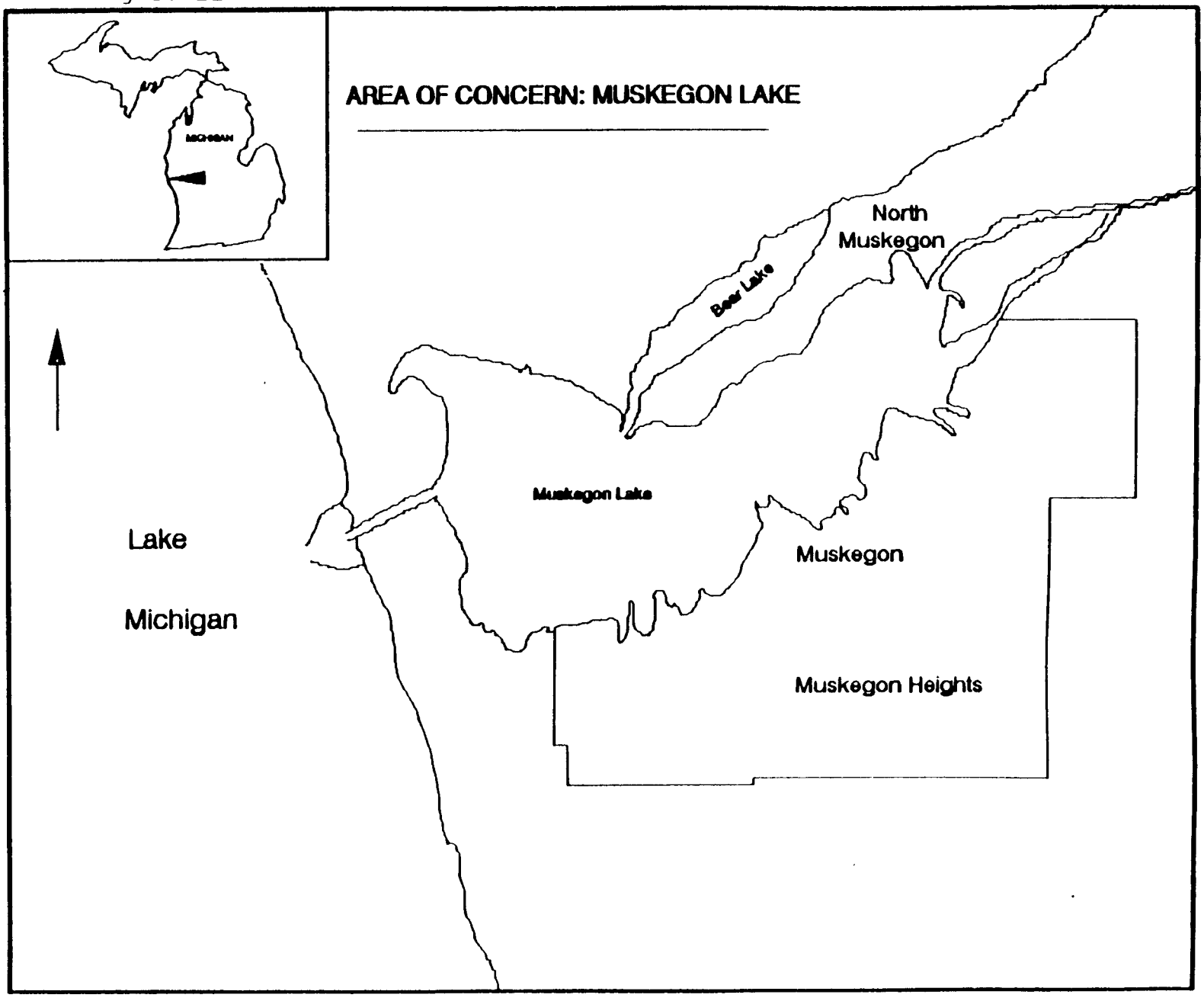
Location of Site

Muskegon Lake, 4,150 acres in size, is located on the eastern shore of Lake Michigan near the city of Muskegon. This lake is a drowned river mouth that has been separated from Lake Michigan by large sand dunes. The Muskegon Lake AOC includes the entire lake (Figure 11). Tributaries to this AOC include Bear Lake, Greens Creek, Ryerson Creek, Ruddiman Creek, and, most importantly, the Muskegon River which flows through the lake and into Lake Michigan. The immediate area is primarily residential and industrial, with petrochemical companies, foundries, a pulp and paper mill and other industries located on the lake or within its immediate watershed.

Contaminants Polluting Sediments

Muskegon Lake was originally designated as an AOC because, prior to 1973, the lake received direct discharges of industrial "treated" process wastewater, municipal WWTP effluent, CSOs and urban runoff. Additionally, the development of petroleum, chemical and heavy industries in the area resulted in the contamination of groundwater. Because of these past

Figure 11


AREA OF CONCERN: MUSKEGON LAKE
North Muskegon
Muskegon Lake
Muskegon
Muskegon Heights
Lake
Michigan

activities, the sediments of Muskegon Lake are contaminated with heavy metals such as Arsenic, Chromium, Copper, Lead, Mercury, Nickel and Zinc. The heavy metal concentrations are fairly evenly distributed throughout the entire lake, with a few in localized areas near the mouths of Ruddiman and Ryerson Creeks containing more elevated concentrations. Other areas with elevated contaminant concentrations are also located in deeper zones of the AOC.

Previous sediment sampling was done in 1972 and 1986 by MDNR, in 1981 by GLNPO and in 1982 by the USACE. The following list provides a quick glance at the results of these studies (MDNR 5, 1987):

1. Of 13 locations sampled, using guidelines for the pollution classification of Great Lakes harbor sediments (USEPA Region V, 1977 and MDNR, 1986), all the sediment samples collected were classified as heavily polluted for heavy metals and oil/grease combinations (1972 and 1986).
2. The analysis of 6 sites in Muskegon Lake found that 2 sites were heavily polluted for heavy metals and TKN concentrations (1981).

Overall, the most contaminated sediments appear to be at either former industrial point source discharge sites, storm sewer outfalls or in the deep lake basins. The most recent sediment sampling was done in 1990 and determined that there was a general decreasing trend in concentrations in sediments of the deeper basins. No detectable levels of PCBs were found.

Volume of Contaminants or Contaminated Sediments

No estimates for the volume of contaminated sediments in the Muskegon Lake AOC are presently available.

Fish Consumption Advisories

Although there is no specific advisory for Muskegon Lake, there is a statewide advisory for restricted consumption of piscivorous (fish eating) fish due to elevated levels of Mercury which includes this AOC. This advisory was initially issued in 1989 by the Michigan Department of Public Health. A 1986 survey of Muskegon Lake fish indicated that walleye and large mouth bass in Muskegon Lake contained Mercury concentrations greater than .5 ppm.

Enforcement History Related to Superfund Sites

This AOC has 1 Superfund site that is located within the AOC's watershed. The now defunct Cordova (Ott/Story) Chemical Company plant was used to manufacture various synthetic organic intermediates, including pharmaceutical and agricultural products. Solvents, such as benzene, toluene, methanol, dimethylaniline, tetrahydrofuran and carbon tetrachloride were used in manufacturing processes (MDNR 4, 1987). Currently, this site has contaminated groundwater which vents to Little Bear Creek, a tributary to Bear Creek, and then flows into Bear Lake. The contaminated plume is estimated to be approximately 1.5 billion gallons containing around 5 million pounds of volatile organic compounds (VOCs). The Remedial Investigation/Feasibility Study (RI/FS) was completed in 1990, but no remediation of the sediments has yet occurred.

Dredging History Not Related to Superfund Actions

Approximately every 2 years the USACE dredges the 6,500 foot navigation channel which connects Muskegon Lake and Lake Michigan. In 1984, the ACE dredged 50,500 cubic yards from the harbor, in 1988, 53,774 cubic yards and in 1991, 85,100 cubic yards were removed. There has also been considerable shoreline dredging for marinas along the south shore of Muskegon Lake.

Technical Tools in Use and Needed

Currently the remedial strategy is for natural sedimentation. In 1994-95, the Muskegon Lake AOC RAP will be updated and at that time an extensive, updated characterization of the sediments will be needed in order to address the issues of the remaining sediment problem.

State Requests

According to the State, Muskegon Lake is in good shape and is one of the finest fisheries in the area. The major discharges were removed in the 70's and since then the lake has greatly improved with the exception of the localized areas of elevated contamination. One of the areas of elevated contamination is located near the 11th street storm sewer where there appears to be increasing levels of Mercury. If this area could be monitored, it may help in determining whether or not the sediments should be removed. It would also be beneficial to have more studies done to further characterize organic contamination in the groundwater.

River Raisin

Location of Site

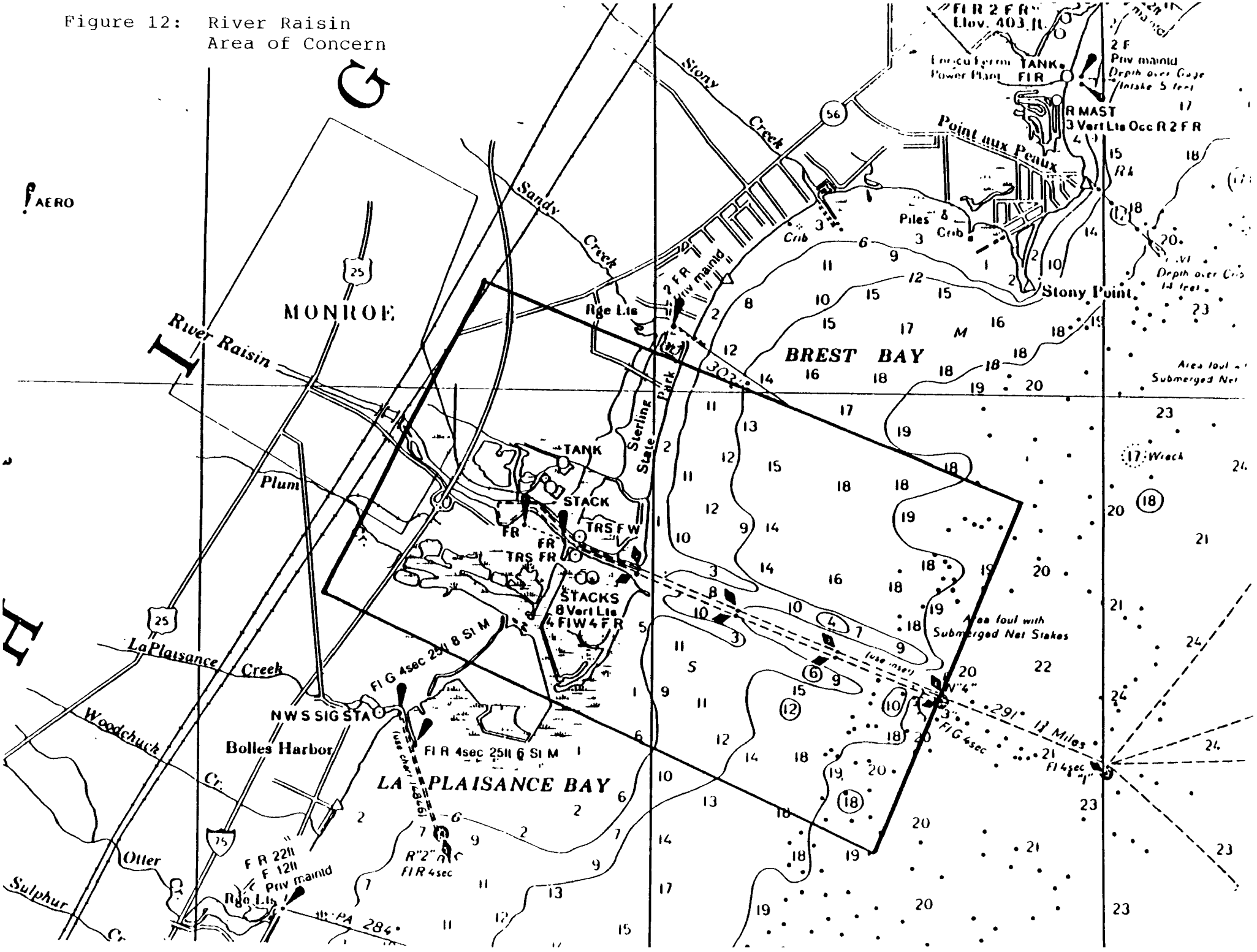
The River Raisin flows southeast through the southeast corner of Michigan's Lower Peninsula, discharging into Lake Erie at Monroe Harbor. The boundaries of the AOC have been defined as the lower 2.6 miles of the River Raisin, downstream from Dam No. 6 at Winchester Bridge in the city of Monroe, extending one-half mile into Lake Erie, and including Plum Creek which discharges to Lake Erie through a canal (Figure 12). Once forested within mature hardwoods, the area within this AOC is now mostly cleared and the land use is mostly urban, suburban and industrial. Industries within the AOC include automotive, steel and paper manufacturers. Additionally, there are several landfills that border the river.

Contaminants Polluting Sediments

Data collected from the River Raisin AOC has indicated that the sediments are heavily polluted with PCBs, Chromium, Copper, Zinc, Volatile Solids, oil and grease. The following points summarize some of what is known about the contamination of the sediments within this AOC.

1. In 1976, sediment samples collected by MDNR downstream of the Ford Motor Company facility in Monroe, Michigan, showed the highest levels of Chromium, Copper and Zinc in the AOC, and were above the limit for "heavily polluted" conditions based upon USEPA guidelines (USEPA Region V, 1977).
2. A July 1989, MDNR survey found PCB concentrations ranging from .6 ppm to 24 ppm with the highest concentration collected from a location along the northern side of the river across from Detroit Edison's intake canal.
3. An April 23, 1991, sampling by Michigan State University discovered PCB ranges from .1 ppm, at a depth of 15 to 20 cm, to 42,167 ppm at a depth of 5 to 10 cm in the vicinity of Ford Motor Company's former 48" outfall.
4. On November 25, 1991, MDNR's Surface Water Quality Division collected sediment samples from the River Raisin near the Ford Motor Company's former 48" outfall and found PCB levels ranging from 55 ppm to 4,600 ppm.
5. An October 15, 1992, an USEPA survey found PCB levels ranging from .04 ppm to 20,000 ppm near Ford's former 48" outfall.

Figure 12: River Raisin
Area of Concern



Volume of Contaminants or Contaminated Sediments

Estimates for the volume of contaminants polluting the River Raisin have only been completed for the "hot spot" by the Ford Motor plant outfall. It is approximated that 33,000 cubic yards of contaminated sediment will be removed during the PCB "hot spot" clean-up project.

Fish Consumption Advisories

Since 1987, the River Raisin has had a fish consumption advisory in place for carp and white bass over 11". This advisory specifically places the area below Dam No. 6 at the Winchester Bridge in the "no consumption" category due to the levels of PCBs found in the aforementioned fish. Caged fish studies conducted by MDNR in 1988 confirmed that PCB uptake rates in the test fish were rapid and that PCB tissue concentrations were significant at the end of the 28-day test.

Enforcement History Related to Superfund Sites

There are officially no Superfund sites within this AOC. However, sediment data was collected in 1992 by the Emergency Response Branch of Superfund to determine the extent of the PCB contamination of the "hot spot" adjacent to the Ford Motor Company facility in Monroe, Michigan. These investigations pinpointed the contamination adjacent to a Ford outfall, now closed, but also determined that there were several other sources that contributed to the contamination of the AOC. In regards to the Ford site, remedial action has been proposed to include dredging the PCB "hotspot", dewatering the sediments, treating all PCB contaminated wastewater and transporting and disposing of the dredged spoil at a Federally approved disposal facility. The Emergency Response Branch will be overseeing work being performed by the PRP.

Dredging History Not Related to Superfund Actions

If possible, the USACE dredges the River Raisin navigation channel and turning basin annually. However, if it cannot be dredged annually, the USACE never waits longer than 2 years. In the past, dredge spoils were disposed of at a power plant landfill and the Port of Monroe landfill, but are now placed in the Sterling Park Confined Disposal Facility (CDF).

Technical Tools in Use and Needed

The most recent sampling work has been done by the Emergency Response Branch of Superfund in relation to determining the extent of PCB contamination attributable to the Ford facility in Monroe. In addition to this work, the USEPA and the US Fish and Wildlife Service (USFWS) will be performing a caged catfish/caged zebra mussel study before, during and after the dredging. This study will include 3 different sets of animals and will help determine the uptake of PCBs at all different phases of dredging.

State Requests

The River Raisin RAP committee will need help completing the characterization of the sediments if it cannot compel PRPs to conduct this work. This work would focus on detailing the horizontal and vertical contamination of "hot spots" in addition to concentrating on the heavy metal problems. This would be necessary since most of the recent work has been with PCBs. Along with direct sediment work, it would greatly help the resolution of the River Raisin AOC if there were more funds for Best Management Practices (BMPs) and erosion control. Each year the river needs to be dredged due to heavy sedimentation from agricultural practices within several counties. A portion of this soil runoff settles in the river, mixes with the contamination and

increases the burden of cleaning up the sediments.

Rouge River

Location of Site

Located in southeastern Michigan, the Rouge River flows through Detroit's northern and western suburbs, emptying into the Detroit River at Zug Island in Detroit. The Rouge River consists of four main branches that total 125 miles. These branches are fed by many tributary streams and more than 400 lakes and ponds. The entire river basin is included in the Rouge River AOC.

The Rouge River watershed is the longest and most densely populated and industrialized area in southeastern Michigan. Over 1.5 million people inhabit the basin's three counties and more than 50% of the land use in the basin is residential, commercial or industrial. Because this AOC is so large, for planning and remedial action purposes, the basin was divided into 11 subbasins (Figure 13).

Contaminants Polluting Sediments

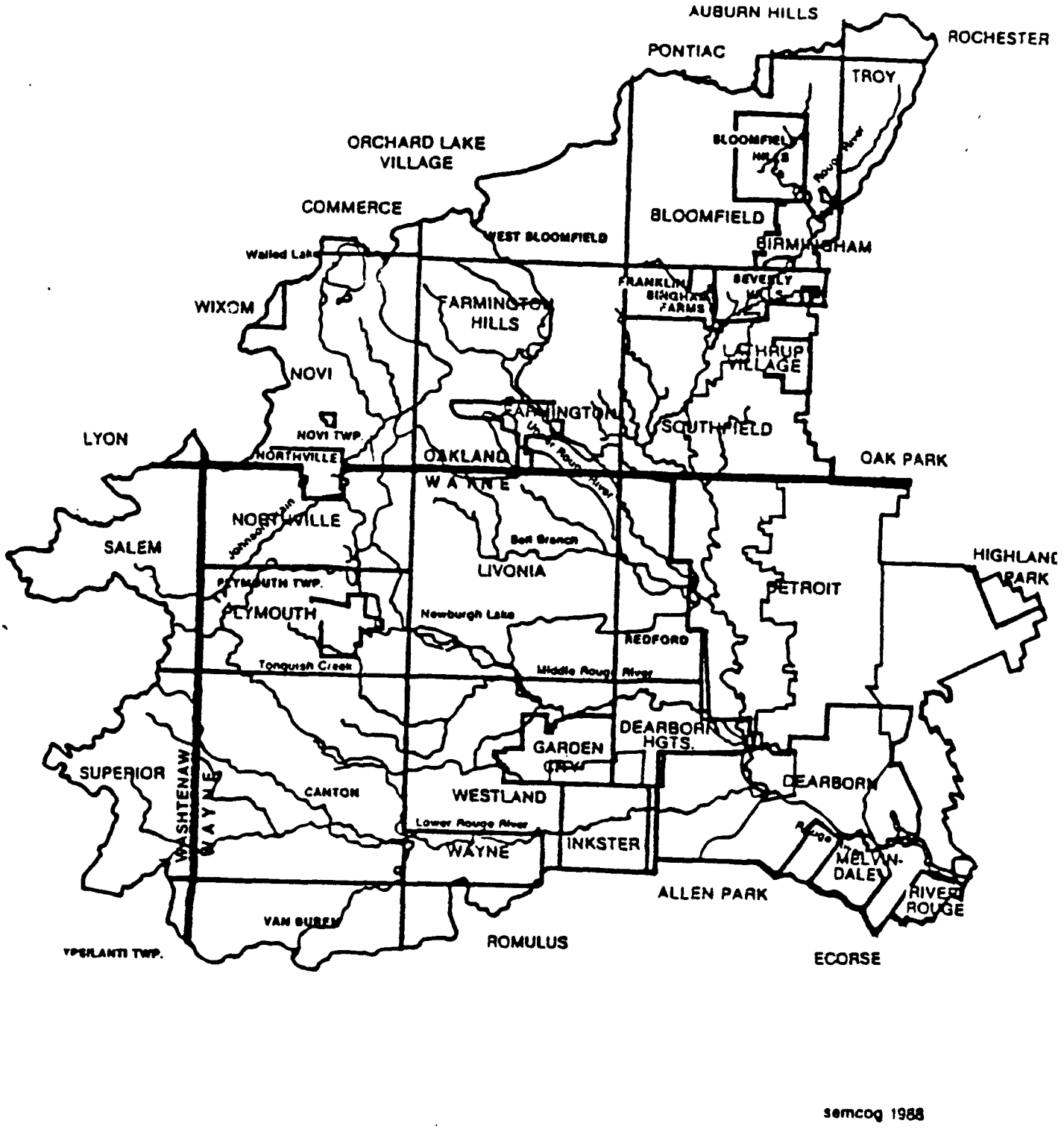
The sediments of the Rouge River are contaminated with Cadmium, Lead, Mercury, Cyanide, PCBs, PAHs, oil and grease. One of the reasons for the serious contamination of the sediments within this AOC is the excessive amount of CSO discharge. There are 168 CSOs that annually discharge an estimated 7.8 billion gallons of combined sanitary sewage and stormwater (MDNR and SEMCOG , 1990).

Sediments in the Rouge River have been found to be of major or minor concern in 10 of the 11 subbasins. Identified as having a minor concern with contaminated sediments are Main Subbasin 1 and 2, Upper Subbasin 1, Middle Subbasins 1, 2 and 3 and Lower Subbasin 1. Identified as having a major concern are Main Subbasins 3 and 4 and Lower Subbasin 2. The major designation signified that 50% or more of the MDNR 1986-87 sites in the subbasin were heavily polluted for at least one parameter according to USEPA guidelines (USEPA Region V, 1977), and that the biota in the subbasin indicated use impairment. The minor designation signified less than 50% (MDNR and SEMCOG, 1990). Overall, the levels of contamination in the sediment increase from the headwater to downstream reaches.

A sediment survey of the Rouge River was completed by MDNR in 1989 and concluded the following (MDNR 6, 1992):

1. PCBs in the sediments were detected primarily in the Newburgh-Nankin Lake stretch of the Middle Branch of the Rouge River. PCB levels in 19 Newburgh Lake fish averaged 8.9 ppm.
2. Sediment Mercury levels were high at two stations, both on the Middle Branch; all others were close to average levels.
3. Heavy metal sediment concentrations were lowest at the Rouge River headwaters and highest in Newburgh Lake.
4. In comparison to the 1986-87 sediment survey, areas with lower levels of metals in 1986-87 tended to decrease in concentration, while areas of greater concentration in 1986-87 tended to increase.
5. The temporal trend for metals and PCBs in the lake core samples was an increase from the bottom toward the middle and then a decrease toward the top. This indicated a

Figure 13: Subbasins of the River Rouge Area of Concern



decrease in recent sources of sediment contamination.

Currently, most of the sediment work within this Rouge River AOC is being done through the Rouge River National Wet Weather Demonstration Program conducted by the Wayne County Department of Public Service.

Volume of Contaminants or Contaminated Sediments

No estimates are presently available concerning the volume of contaminated sediments within the Rouge River AOC.

Fish Consumption Advisories

An extensive biological and fisheries survey of the Rouge River, completed in 1987, found that the river ranged from fair to poor quality. A result of this work was fish consumption advisories were placed on the Lower Branch, Middle Branch and the lower portion of the Main Branch of the river. The fishing advisories are specific for certain branches. From the Middle Branch downstream from Phoenix Lake and the Main Branch downstream to Ford Road there is restricted consumption for all species except bluegill and sunfish, while in the Lower Branch there are no restrictions except for carp and sucker.

Enforcement History Relating to Superfund Sites

The only federal Superfund site within this AOC is 3M. They have dealt with some remediation of the sediments, but that work is currently on hold while they concentrate on other remedial actions.

Dredging History Not Related to Superfund Actions

In the Main-4 Subbasin, dredging of the lower 3 mile segment of the Rouge River navigational channel is done annually by the USACE. This portion includes the turning basin at Ford Motor Company boat slip downstream to the mouth of Short-Cut Canal. All dredge spoils are placed in a CDF. The old river channel around Zug Island is dredged approximately every 5 years. Other than the Main-4 Subbasin, no other dredging has occurred. Any private dredging has been discouraged because the pollutant level of the sediments is largely unknown.

Technical Tools in Use and Needed

The Rouge River National Wet Weather Demonstration Program is currently the largest remediation effort in progress within this AOC. The primary goals of this program are to quantify the pollutant sources contributing to the Rouge River, prioritize the cleanup effort identified in the RAP and demonstration program and initiate a watershed wide remediation effort. The focus of this program is combined sewer overflows, and will be to develop and implement a watershed wide approach for improving water quality problems caused by wet weather events from CSOs.

Within this program a sediment remediation pilot study is proposed for Newburgh Lake. The purpose of this is to determine the process for obtaining required permits and approvals for a sediment remediation project. The Newburgh Lake sediments display a wide range of contaminant concentrations most likely generated by a variety of sources. This is also a widely used recreational facility and its selection as a pilot study area is highly visible and important from a public participation point of view. This project will address those sediments for which there is no clearly identified PRP. As of yet there has been no dredging and the project remains

in the developmental stage.

State Requests

Within the Rouge River AOC the State would like to complete some sediment reevaluation. This is important because it is now known that the branches are contaminated, there are many PCB "hot spots" upstream and downstream of Newburgh Lake and one additional impoundment is contaminated. Specific requests focus on the need to have more work done on the Lower, Upper and Main branches of the Rouge in order to discern what is actually occurring within the sediments in these areas.

Saginaw River/Bay

Location of Site

Saginaw Bay, 1,143 square miles in size, cuts into Michigan's Lower Peninsula on the western shore of Lake Huron. The bay is 52 miles in length and varies in width from 13 to 26 miles. Approximately 75% of the river input comes from the Saginaw River with the remaining direct flow coming from 28 rivers, creeks or agricultural drains. The Area of Concern includes the entire Saginaw River and Saginaw Bay (Figure 14). Over one-half of the land use in the Saginaw River/Bay region is agricultural, with the primary urban and industrial centers being Flint, Saginaw, Bay City and Midland.

Contaminants Polluting Sediments

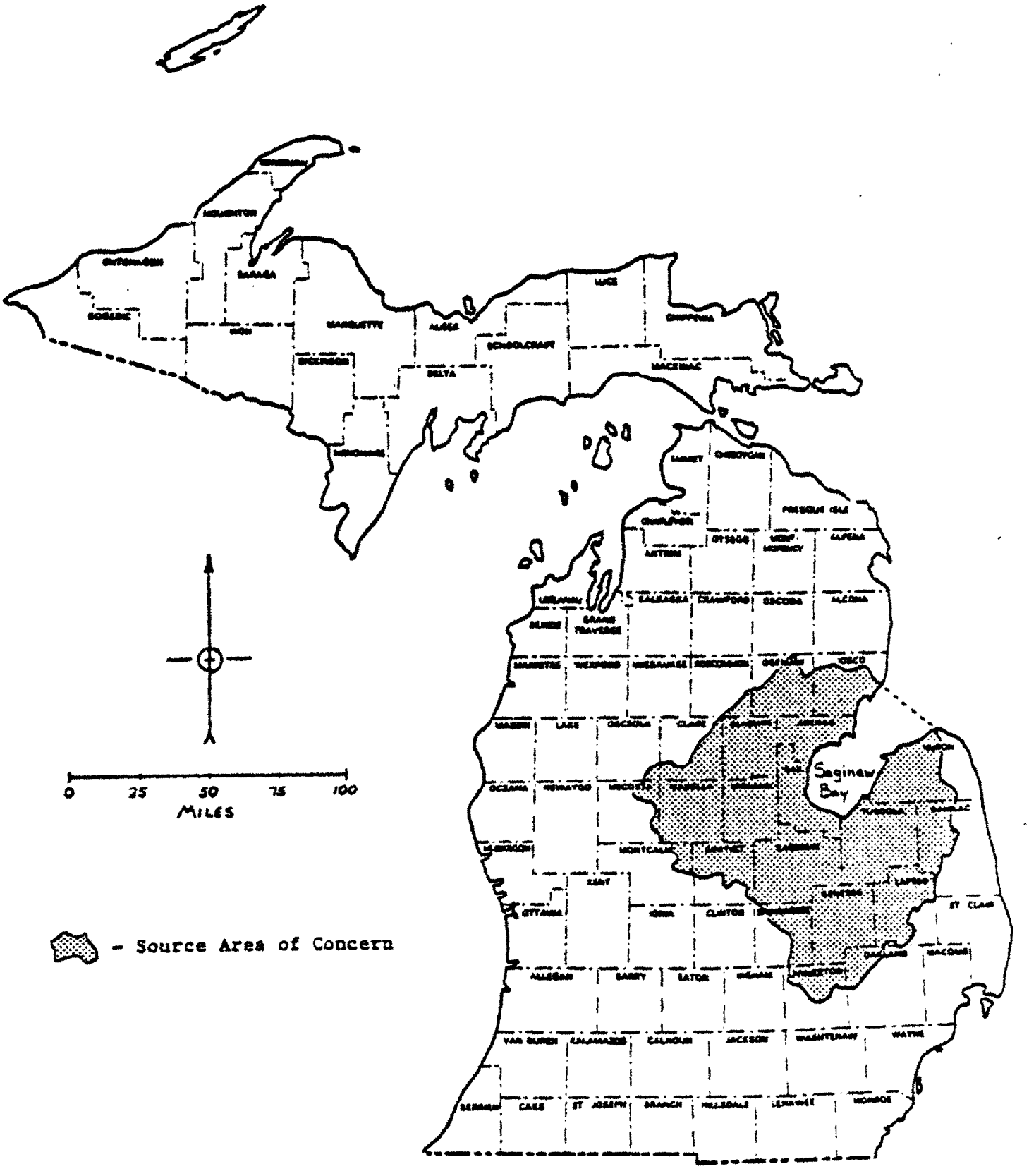
Within the Saginaw River and Bay there is a major problem with PCBs and heavy metal contamination. Chromium and Lead are the two most abundant metals in Saginaw Bay followed by Copper, Nickel and Zinc (MDNR 7, 1988). The USACE has recently reported that the river is also contaminated by dioxin and furan.

The Saginaw River/Bay AOC is characterized by sediment "hot spots" located below the WWTPs, the General Motors sites and the CSO discharge points; however, there is also other uniform contamination throughout the river and bay. Specifically, high levels of PCBs are present near the outfalls of the two GM industrial facilities that discharged contaminated wastes to the river: the GM Central Foundry in Saginaw and the GM-CPC Plant in Bay City. In addition to discharging directly into the river, these establishments also sent contaminated wastewater to their WWTPs (MDNR 7, 1988). Sediment contamination in the river is most significant immediately downstream of Saginaw and Bay City, while the most contaminated bay sediments are north of the Saginaw River mouth.

It is worthwhile to mention that the flood of 1986 may have redistributed some of the sediment in the river. However, an MDNR 1988 sediment survey indicated that most of the contaminated sediments appeared to be relatively undisturbed. Keeping this in mind, the following results of sediment sampling by the EPA and ACE (1983) should be viewed as estimates of the levels of contamination (MDNR 7, 1988):

1. Using 1977 EPA criteria, sediments in the inner bay that had respective average Arsenic and Barium concentrations of 16 ppm and 422 ppm were categorized as "heavily polluted." Sediments with average concentrations of Chromium of 63 ppm, Copper of 25 ppm, Lead of 45 ppm, Nickel of 32 ppm and Zinc of 96 ppm were classified as "moderately polluted" (USEPA Region V, 1977).
2. ACE 1983 data demonstrated that the highest levels in the river were found below the

Figure 14: Saginaw River/Bay Area of Concern



GM site. The values of contaminants found were: PCB, 27 ppm; Chromium, 180 ppm; Copper, 150 ppm; Iron, 34,000 ppm; Lead, 96 ppm; Nickel, 87 ppm; and Zinc, 560 ppm. All of these levels fell within the "heavily polluted" EPA classification (USEPA Region V, 1977).

Volume of Contaminants or Contaminated Sediments

No estimate of the total amount of contaminated sediment in the Saginaw River/Bay system has been calculated. However, it was approximated that 3.7 metric tons of PCB remain in the active sediment in inner Saginaw Bay, but this value is fairly dated (Brandon, D.L. et al., 1991).

Fish Consumption Advisories

The fish consumption advisories currently in effect for several species in the Saginaw River/Bay AOC are restricted to bottom feeding fish and fish with relatively high levels of body fat. People are advised not to eat any carp or catfish from either the Saginaw River or Saginaw Bay because PCB concentrations in some fish tissue samples exceed the Michigan Department of Public Health criteria for levels of public health concern. Additionally, for Saginaw Bay, it is suggested that people restrict their consumption of lake trout, rainbow trout and brown trout to no more than one meal per week. There are no advisories for walleye or yellow perch, principal sport fish, in Saginaw Bay (MDNR 7, 1988), but it is suggested that people not consume large quantities of any fish from the Saginaw River.

Enforcement History Relating to Superfund Sites

There are 13 Superfund sites within the Saginaw Bay watershed. Of these 13 sites, only 2, Velsicol and the Shiawassee River, have contributed to the contamination of the Saginaw system sediments. These two sites are responsible for some of the PCB contamination, but currently there is no activity relating to the remediation of the sediments at either of these sites.

Dredging History Not Related to Superfund Actions

Since 1982 the Saginaw River has been dredged annually, except for 1983 when the Bay was dredged. Overall, in this 10 year period, 2,575,588 cubic yards of sediment have been dredged from the river by the USACE. In 1983, the Bay was dredged and 745,277 cubic yards were removed. All of the sediment removed from the Saginaw River and Bay was contaminated and the dredge spoil was disposed of in a CDF.

Technical Tools in Use and Needed

Saginaw River/Bay is one of the 5 ARCS priority sites. Presently, a baseline human health risk assessment has been completed and a sediment dynamics model is being developed from biological, chemical, toxicological and benthic community structure data that was collected in 1990. The results of the ARCS human health risk assessment were as follows (Crane, J.L. (2), 1992):

1. Non-carcinogenic risks, as represented by Hazard Index (HI), were less than .5 for all exposure levels and pathways except for the subsistence consumption of walleye and carp.
2. The estimated upper-bound carcinogenic risk levels for all pathways and exposure scenarios were at or above concern levels.

As for the sediment dynamics model, the model will be run for 5 different scenarios in order to obtain an understanding of the different remedial options on the health of the Saginaw

River. The scenarios that will be tested are:

1. No action alternative
2. Dredge lower 5 miles
3. Determine adequacy of natural cap below WWTP
4. Dredge pocket below WWTP
5. Predict thickness of cap needed to ensure stability

Results are currently unavailable but should be ready sometime in the fall of 1993.

Right now the ARCS work is the major activity occurring in relation to the sediments within the Saginaw River/Bay AOC. No other sediment sampling is in progress and potential MDNR sediment activities are being delayed until the ARCS results can be studied. As for other technical tools related to the sediments, more caged fish studies will soon be conducted in order to obtain more information concerning the PCB uptake rate.

State Requests

Most requests would be reserved until after the ARCS data becomes available and some remedial decisions can be considered. The State was disappointed that the ARCS study was only focused on the mouth of the Saginaw River and that it did not include any stations in the Bay. Future needs and requests would highlight the contaminated sites in the upper river in the city of Saginaw and representative areas of the Bay if ARCS results show significant inputs from Saginaw River sediments. The decision to focus on these areas of the AOC would come by way of a determination of concern for the lower river and the existence of similarly contaminated areas in the upper river along with the extensive area of lower-level (concentration) contamination in Saginaw Bay.

Additionally, there is the need for funding to look at the effects of organics and heavy metals on the Saginaw River/Bay ecosystem including population effects and community function, contaminant cycling, and impacts of toxics due to sediment resuspension in the bay. It was further suggested that the development of new EPA sediment criteria for relevant parameters would be extremely helpful in the remedial decision-making process.

Torch Lake

Location of Site

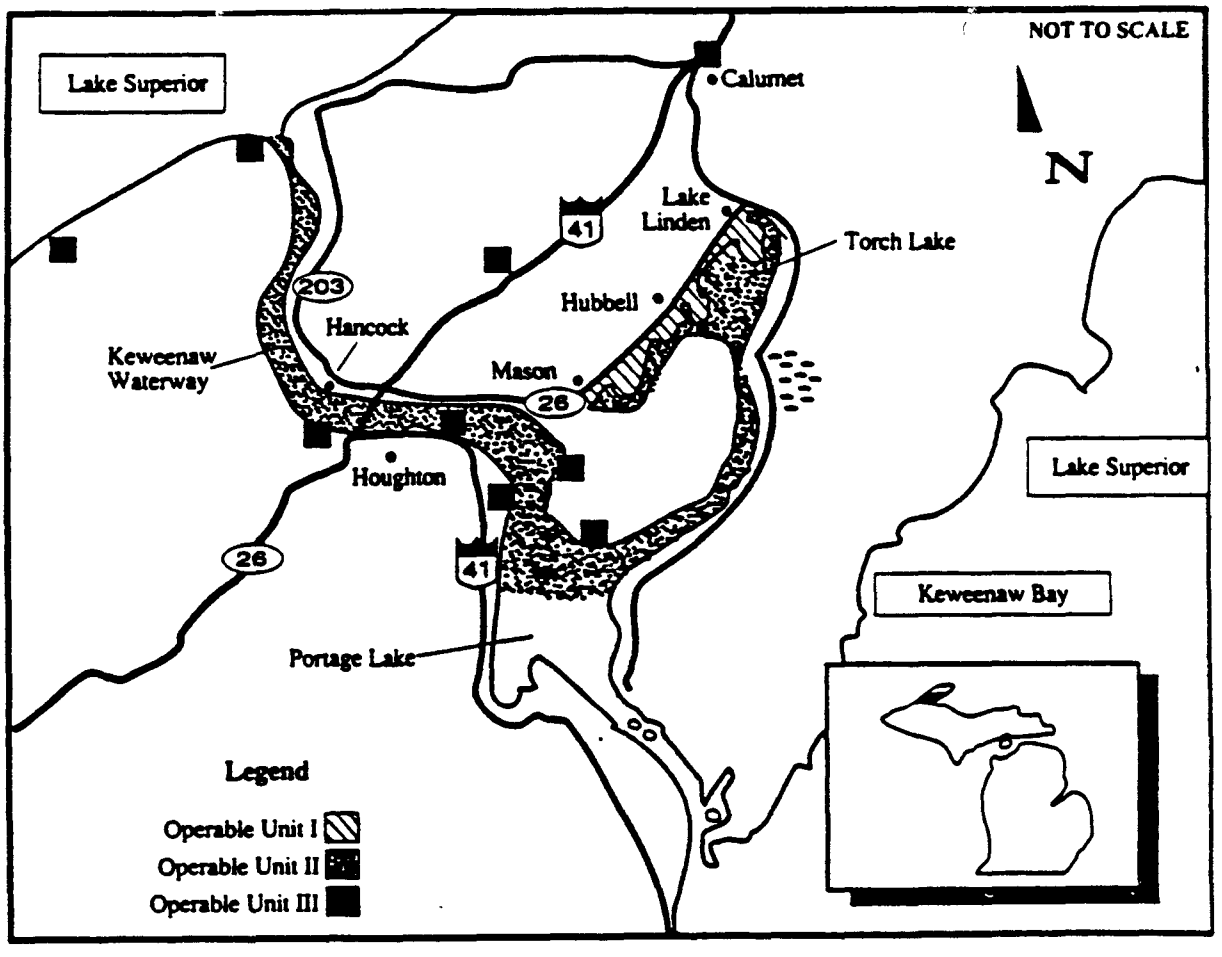
Torch Lake, a tributary to the Keweenaw Waterway and Lake Superior, is located in Michigan's Upper Peninsula. The AOC includes Torch Lake and its shoreline (Figure 15). Torch Lake is 2,718 acres in size and is approximately 14 miles by water from Lake Superior. The land around the AOC is primarily forested. Copper mining and processing were prevalent in the area until 1968.

Contaminants Polluting Sediments

For more than 100 years, tailings from copper mining and by-products from various mining processes were dumped into Torch Lake, thereby contaminating the lake's sediments with heavy metals and other contaminants. The sediments are now heavily polluted with Arsenic, Chromium, Copper, Lead, Nickel and Zinc. Additionally, PAHs have been detected in some samples.

Over 200 million tons of milling wastes were dumped into the lake, and, as a result,

Figure 15: Torch Lake Area of Concern and Superfund location.



much of the bottom and most of the western shore of Torch Lake now consists of "stampsands" (a local term for the copper tailings). The presence of these "stampsands" make it impossible for the lake to support a normal benthic community. Also, besides the "stampsand" piles, there is a 3 acre patch of sediment containing substantially higher levels of contamination than the rest of the lake. This is thought to be caused by the ongoing industrial activity on the lake shore which commenced after the copper milling activity ceased (MDNR 9, 1987).

Volume of Contaminants or Contaminated Sediments

Approximately 200 million tons of copper mine tailings were dumped into Torch Lake between 1868-1968. This filled around 20% of the original volume of the lake. No estimates are available as to the total amount of contaminated sediments within this AOC.

Fish Consumption Advisories

Torch Lake was included in a state fish consumption advisory in effect from 1983 to 1993 for sauger and walleye. This advisory was issued based upon the high frequency of liver tumors discovered in the late 70's, possibly attributable to the past use of organic chemicals. In March 1993, these fishing advisories were lifted. The decision to remove the advisories was based on 1988 MDNR fish tumor studies which showed tumor incidences not significantly different from other lakes. Currently, there are no AOC specific fish advisories.

Enforcement History Relating to Superfund Sites

Torch Lake was designated as a National Priority List (NPL) site in 1986, at which time a search for PRPs began. In 1988 the RI/FS phase was initiated and the site was divided into 3 Operable Units (OUs): OU 1 consisted of the surface tailings on the western shore of Torch Lake, OU 2 included Torch Lake and OU 3 was the Keweenaw Waterway. Units 1 and 3 consist of various "stampsand" piles located throughout the Keweenaw Peninsula and in the general vicinity of Torch Lake, while unit 2 consists of groundwater, surface water and sediments of the Torch Lake system. Only unit 2 is actually in the lake.

The RI results for unit 2 found that while Torch Lake bottom sediments were inhospitable to a normally expected benthic community, no subsequent damage to the food chain could clearly be discerned. It was also determined that the human health risk was deemed to be within the acceptable range, although drinking water wells, if installed in the "stampsand" piles in the future, would potentially subject residents to unacceptable risks (USEPA Region V, 1992). The subsequent decision for unit 2 involved accepting the no action alternative, while the decision for the remediation of units 1 and 3 focused on revegetation and natural sedimentation. Superfund is presently working to formalize the whole process with MDNR and will institute some long-term monitoring of the sediments (USEPA Region V, 1992).

Dredging History Not Related to Superfund Actions

No dredging has ever occurred within the Torch Lake AOC.

Technical Tools in Use and Needed

Initially, MDNR's plan was to allow natural sedimentation processes to cover the contaminated sediments, because the vast expanse and volume of the sediment contamination made remedies such as dredging infeasible. MDNR also encouraged shoreline stabilization and revegetation in order to reduce wind erosion and airborne transport of copper tailings that were deposited in the area . For example, sewage sludge from the Portage Lake sewer authority is being used to encourage vegetation on the shoreline. Currently, Superfund has

chosen a no action alternative for the 3 acre contamination site, and has chosen to revegetate and let natural sedimentation take care of the toxic sediments problem. Additionally, they will initiate a long-term monitoring of the sediments.

State Requests

As far as the remediation of the contaminated sediments is concerned, it would be very helpful to have an assessment of natural sedimentation rate and effect in order to answer the question, "is this an effective form of remediation?" This assessment would encompass chemical, physical and biological parameters.

White Lake

Location of Site

White Lake, a 2,570 acre drowned river mouth, is located on the east shore of Lake Michigan, close to the communities of Montague and Whitehall. The AOC includes White Lake and a .25 mile wide zone around the lake (Figure 16). Although developed, most of the land around the AOC is wooded or grassy. Sand dunes separate the AOC from Lake Michigan. The land is used primarily for recreation and agriculture, but the AOC also contains substantial residential and industrial areas.

Contaminants Polluting Sediments

Historical municipal and industrial discharges to White Lake resulted in elevated sediment concentrations of Arsenic, Cadmium, Chromium, Lead, Manganese, Mercury, Nickel, Zinc, PCBs, oil and grease (USEPA Region V, 1977).

The most elevated heavy metal is Chromium. Elevated levels of Chromium in the White Lake sediments resulted from past discharges by the Whitehall Leather Company. A maximum Chromium concentration of 4,300 ppm was collected in the vicinity of the now defunct outfall of Whitehall Leather Company. Prior to 1976, when the company discharged in White Lake, lake sediment Chromium concentrations in the vicinity of the discharge reportedly contained more than 23,000 ppm in 1980 (SAIC 2, 1987). Today, the Chromium contamination is evident lakewide, and remain elevated near the facility.

Volume of Contaminants or Contaminated Sediments

No estimates of the volume of contaminated sediments within the White Lake AOC are available.

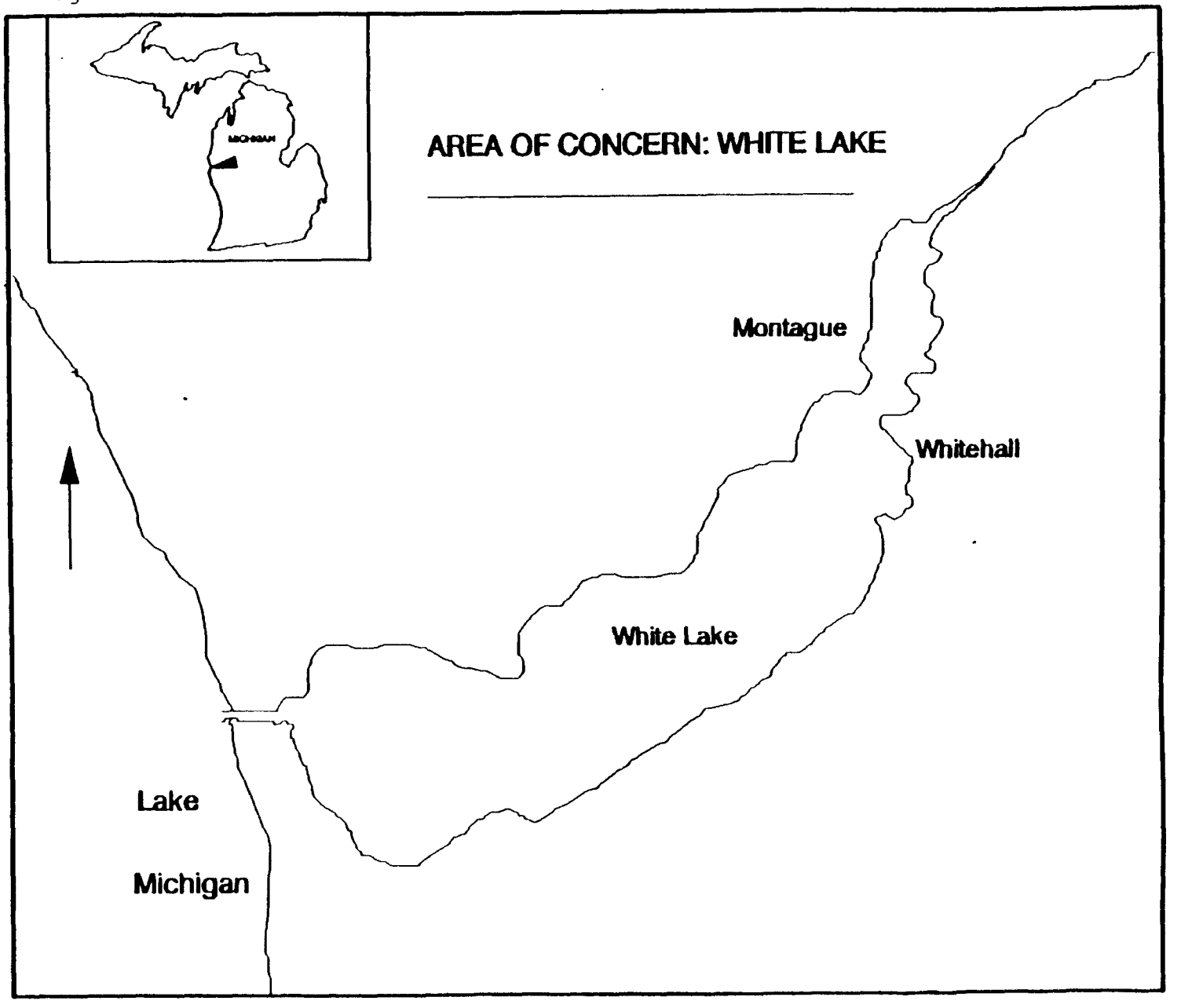
Fish Consumption Advisories

Within the White Lake AOC, a fish consumption advisory is presently in effect for carp. This advisory was originally issued because elevated levels of PCBs were found in fish tissue.

Enforcement History Related to Superfund Sites

There is only one Superfund site within this AOC that is believed to be responsible for past contamination of the sediments. Hooker Chemical and Plastics Company (HCPC) was placed on the NPL in 1982. Prior to this time, in 1979, a Consent Judgment was issued to have HCPC deal with the contamination of groundwater and soils that resulted from their improper waste disposal methods. Pursuant to the Consent Judgment, HCPC implemented a groundwater purge and treatment system and had to remove and dispose/confine solid wastes in clay

Figure 16


AREA OF CONCERN: WHITE LAKE
Montague
Whitehall
White Lake
Lake
Michigan

vaults on the company property. Data collected from March 1987 to January 1990 for the purge well system indicated that 100% of the plume is being captured. To date, Hooker has not been held responsible for the remediation of any contaminated sediments within the White Lake AOC.

Dredging History Not Related to Superfund Actions

The only dredging that has occurred in the White Lake AOC has been in conjunction with the recent large demand for marinas. Maintenance dredging of the navigational channel to Lake Michigan has historically been conducted by the USACE .

Technical Tools in Use and Needed

Effective programs for dealing with the industrial contamination are in progress and time is needed to pass so the effects of this remedial action can be studied. The benthic community is presently being assessed to determine contaminant trends and general health of the benthic communities.

State Requests

For the White Lake AOC, it was mentioned that the State would like to look at toxicity testing to see if biological impairment is occurring and to help determine if the toxic sediments should be removed from localized areas. It would also be desirable to implement some additional trend monitoring so that the sediment characteristics and conditions could be more closely evaluated over time. Additionally, the State would like to better characterize the "hot spots" to consider the possibility of removal. This would be especially important around Tannery Bay where the deposits of cow hides and Chromium concentrations are elevated.

Minnesota

St. Louis River/Bay

Location of Site

The St. Louis River flows southwest 171 miles, from its headwaters in Minnesota, into Lake Superior. The river's lower 23 miles form part of the boundary between Minnesota and Wisconsin. The lower reach is a freshwater estuary, from just below the Fond du Lac Dam to the outlet of Lake Superior. The St. Louis River System includes several major bays and tributaries. For purposes of the RAP, the St. Louis River AOC primarily focuses on the St. Louis River below Cloquet, including St. Louis Bay, Superior Bay, Allouez Bay and the lower Nemadji River (Figure 17). The 39 river miles of the St. Louis River, between the city of Cloquet and its entrance to Lake Superior, has historically been the region of most intense water uses, development and industrial activities.

The St. Louis River AOC is shared by Minnesota and Wisconsin and both are actively cooperating and are involved in the development of the RAP. However, in an attempt to simplify information collection for this report, only the lead state, Minnesota, was asked to supply data and opinions.

Contaminants Polluting Sediments

Sediments within the St. Louis River AOC are contaminated with Arsenic, Cadmium, Chromium, Copper, Lead, Mercury, Cyanide, dioxin, PCBs and PAHs. Certain areas have particularly elevated levels of sediment contaminants. At each of the following locations, elevated levels of a variety of PAHs and/or heavy metals have been detected in bottom sediments (MPCA and WDNR, 1992):

The embayment that received discharge from the Western Lake Superior Sanitary District and historically received discharge from previous treatment plants in Duluth, Minnesota.
The Interlake Superfund site vicinity in Duluth, Minnesota.
The US Steel Superfund site vicinity in Duluth, Minnesota.
Newton Creek and Hog Island Inlet of Superior Bay, Wisconsin.
Crawford Creek Wetland/Koppers Co. vicinity in Superior Bay, Wisconsin.

PAH concentrations as high as 2,690 ppm have been found in the St. Louis River AOC near the former Duluth Tar and Chemical Company site. Heavy metal concentrations of 68 ppm for Chromium, 45,000 ppm for Iron, and 38 ppm for Lead and Nickel and 290 ppm for Zinc were discovered during a January, 1989 USACE sampling. Overall, further chemical and biological characterization of the sediment within the St. Louis River AOC is needed.

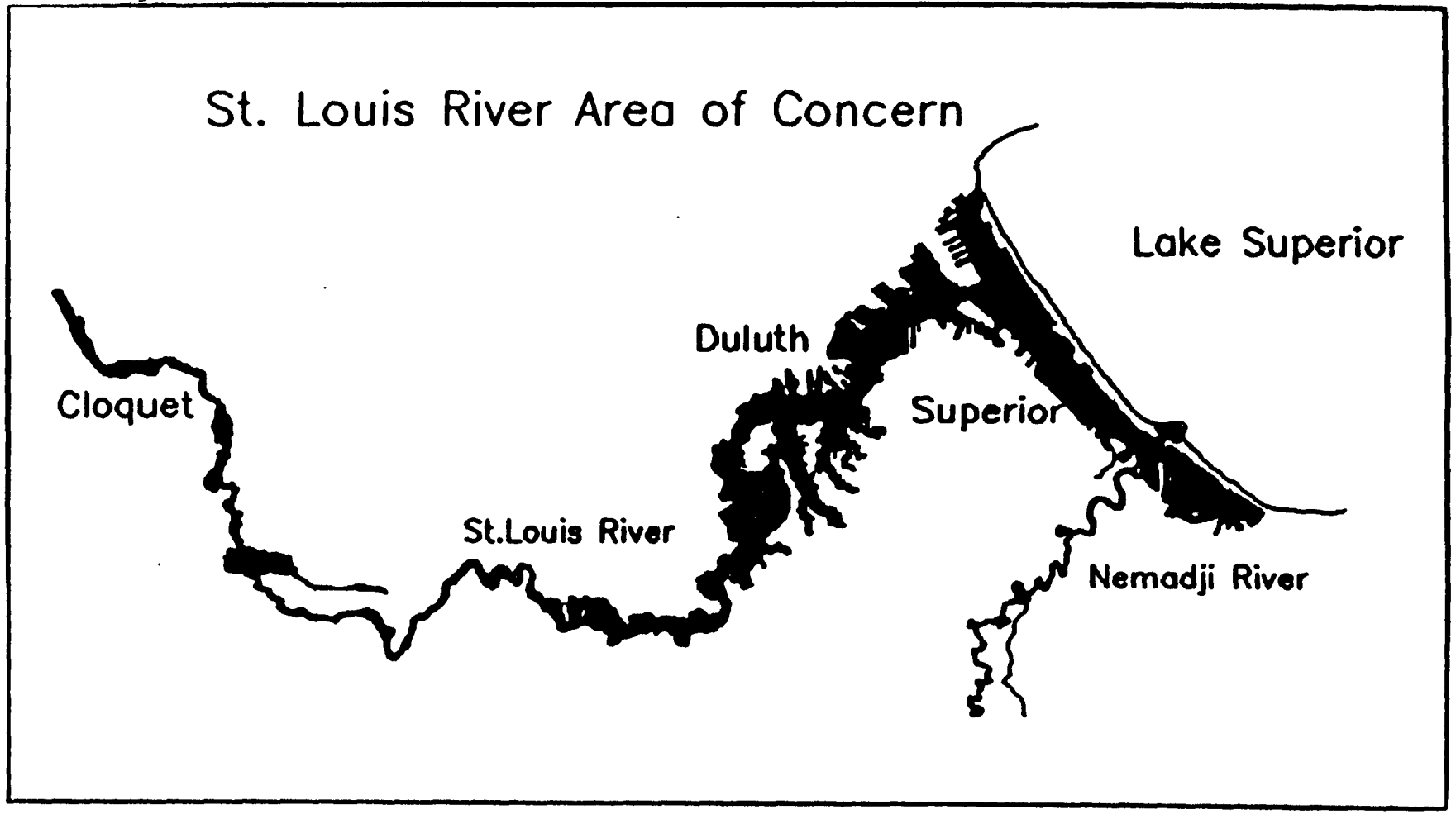
Volume of Contaminants or Contaminated Sediments

There are no estimates currently available as to the total volume of contaminated sediments within the St. Louis River AOC. However, it has been approximated that around 270,000 cubic yards of contaminated sediment exist in the St. Louis River near the mouth of the Wire Mill Settling Basin. Of this volume, 10,000 cubic yards of sediment are thought to be contaminated by PAHs (MPCA and WDNR, 1992).

Fish Consumption Advisories

In the St. Louis River AOC, contamination of fish tissue by toxic substances has resulted in

Figure 17


St. Louis River Area of Concern
Lake Superior
Duluth
Superior
Cloquet
St.Louis River
Nemadji River

the issuance of fish consumption advisories for some size classes of particular fish species by both Minnesota and Wisconsin. The advisories have been issued due to the presence of dioxin, Mercury and PCBs in fish tissue.

Enforcement History Relating to Superfund Sites

In 1983, the St. Louis River/Interlake/Duluth Tar Site was added to the NPL. This Superfund site is the former location of steel and iron plants, and separate tar and chemical companies which utilized by-products of the steel plant coking operations. US Steel-Duluth Works, Interlake Iron Corporation, Allied Signal Inc. and Domtar Inc. are all PRPs, responsible for the clean-up of this Superfund site. Although listed on the NPL as one site, several different investigations have been initiated in order to address the problems more efficiently.

For the Interlake/Allied Signal/Domtar site, the Remedial Investigation identified contaminated sediments at 3 principal areas, Stryker Embayment, the Hallett Boat Slip and the terminus of the 54th Avenue Peninsula. Each area has exhibited high concentrations of PAHs and other contaminants of concern. In 1992, the excavation of some soils and sediments from the terminus of the 54th Avenue Peninsula was performed. No other sediment remedial activity has occurred in conjunction with this operable unit.

The US Steel-Duluth Works site also has 3 principal areas of sediment contamination. These areas include a region defined as the estuary off the delta of the Un-named Creek, the sediments off-shore of the Wire Mill Settling Basin and the sediments within the Wire Mill Settling Basin itself. As of yet, no remediation has been attempted or ordered on these sediment areas. Removal costs for sediments off-shore of the Wire Mill Settling Basin, alone, are estimated to range from $13 to $52 million (MPCA and WDNR, 1992).

Dredging History Not Related to Superfund Actions

The management of dredged materials taken from the lower St. Louis River is of importance to the economic vitality of the Duluth-Superior Harbor. Dredging operations of the USACE annually remove approximately 150,000 cubic yards of sediment. Most materials are disposed of in the Erie Pier containment facility which is the Duluth-Superior's sole disposal site. This CDF is quickly approaching maximum capacity and new solutions to the long-term disposal and management of dredged materials are now being discussed.

Technical Tools In Use and Needed

All considered, more extensive chemical and biological characterization of the sites, where some sediment data are available, is needed. Characterization of sediment quality is also needed for large areas within the estuary, particularly in shallow biologically productive areas and in reservoirs behind the dams, where little or no data is available. Even the 5 areas, which have clearly elevated levels of contaminants, are in need of further characterization before remedial work can begin.

In order to address this lack of sediment data, a survey of sediment quality in the Duluth-Superior Harbor is scheduled to begin in September of 1993. This study is to be funded by USEPA GLNPO and is intended to better help characterize the sediment quality in 30 locations, including biologically productive backwaters. Additionally, USEPA Region V has funded a sediment study of the Thomson, Forbay and Fond du Lac areas that is intended to analyze for sources and levels of dioxin, Mercury and PCBs. It is hoped that PRPs can eventually be identified to provide money to cover remedial costs.

State Requests

It was mentioned by the State that it would be helpful for the eventual remediation of the St. Louis River AOC if technical assistance from the ARCS Program is readily available when this site reaches the remedial decision-making stage. It would also be helpful, in relation to the sediment situation, if more funding were available to assist in deciding which sampling sites to address more intensively. As far as remediation of the AOC as a whole, habitat protection programs and NPS pollution control programs would also be very helpful in restoring the St. Louis River Ecosystem.

New York

Buffalo River

Location of Site

The Buffalo River, in the southern part of the city of Buffalo, New York, empties into eastern Lake Erie. The river is approximately six miles in length with three major tributaries feeding into it: the Cayuga, Cazenovia and Buffalo Creeks. Additionally, the river flows from the east and enters Lake Erie near the head of the Niagara River. The AOC includes the entire Buffalo River (Figure 18). Land uses within this AOC are highly industrial and residential, while the land uses within the tributary watershed are agricultural and forested..

Historically, the Buffalo River served the industries along its banks as a convenient transportation corridor, a source of process and cooling water and a receptacle for wastewater. The AOC has been heavily industrialized, but steel production and oil refining were terminated in the early 1980's, thus alleviating some of the previous pollutional pressures placed on the Buffalo River.

Contaminants Polluting Sediments

Sediments within the Buffalo River AOC are heavily polluted with metals, Cyanide, PCBs, PAHs, pesticides, oil and grease (NYSDEC 1, 1989). Sediment sampling studies were done by GLNPO and the Buffalo District USACE in 1981, by NYSDEC in 1983 and by Erie County in 1985. The following points summarize the some of the findings of these 3 studies (NYSDEC 1, 1989):

1. PCBs were observed in 85 out of 86 bottom sediment samples analyzed in the 3 separate studies from 1981 to 1985.
2. In the 1981 EPA sampling, 16 out of 16 samples showed chlordane, while 15 out of 16 showed DDT. Other samples analyzed by the USACE and Erie County also showed DDT.
3. Metals and Cyanide were present in the sediment at levels that exceeded EPA criteria (USEPA Region V, 1977).
4. PAHs were also found in most contaminated samples. Extracts of Buffalo River sediments containing PAHs have been shown to induce tumors in laboratory fish.

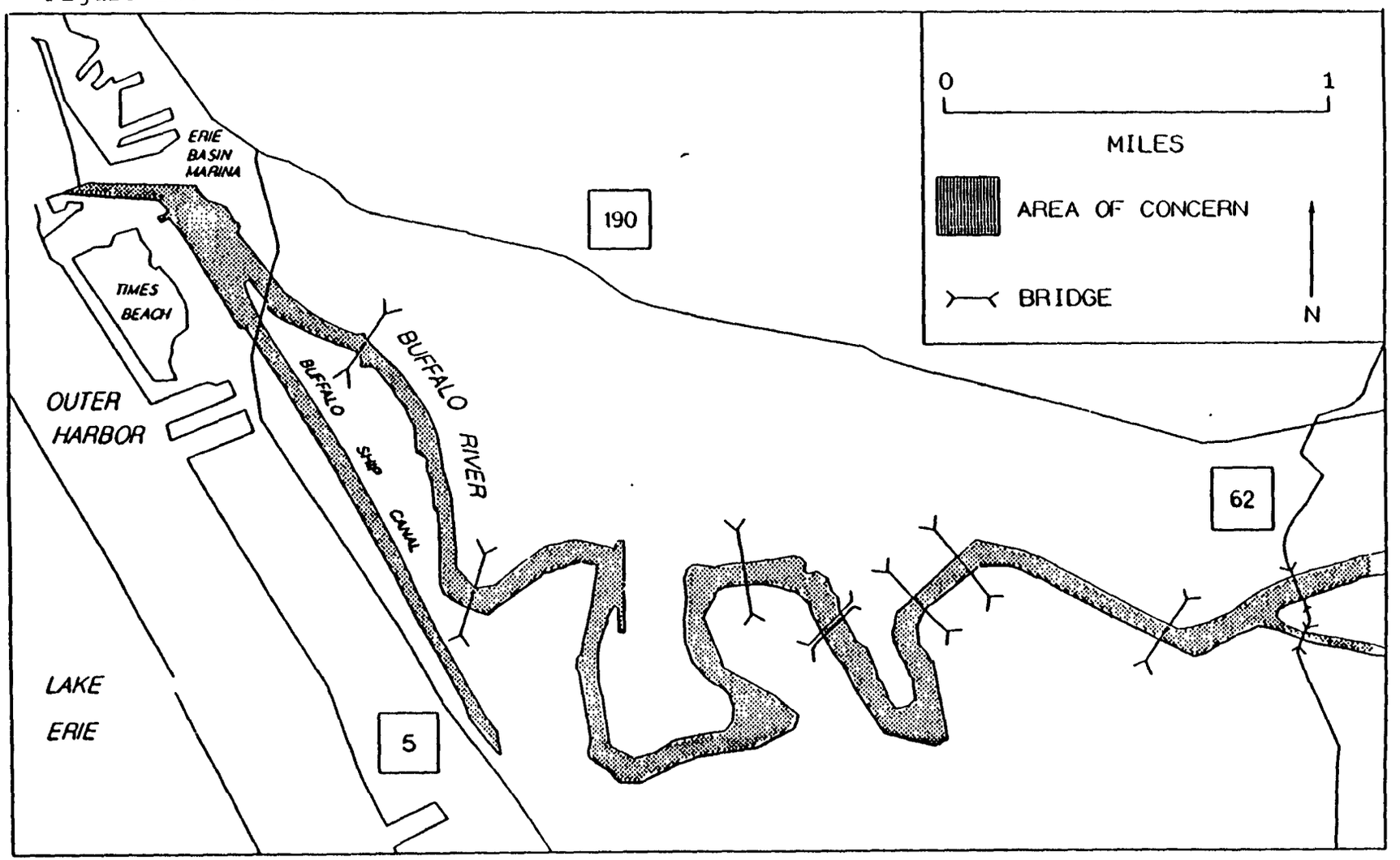
Volume of Contaminants or Contaminated Sediments

To date there have not been any volume estimates of the amount of contaminated sediment within the Buffalo River AOC. This is mostly due to the fact that the previously available equipment was only able to sample up to 4 feet in depth. Since the ARCS program has been working on this AOC, they can now sample 10 to 15 feet deep. No volume estimates were previously attempted because it was not possible to sample deep enough. From the ARCS results, the depth to which samples need to be taken in order to obtain an accurate volume estimate will be determined. After this information is available, a volume estimate of contaminated sediments can be completed.

Fish Consumption Advisories

Unacceptably high levels of PCBs and chlordane in carp have led to a state fish consumption advisory which affects the Buffalo River AOC. This "no consumption" advisory was issued by the New York State Department of Health in 1987 and was based upon fish sampling data collected by DEC.

Figure 18: Buffalo River Area of Concern



Enforcement History Relating to Superfund Sites

Currently, there are no Federal Superfund sites within the Buffalo River AOC that are responsible for the remediation of any contaminated sediments. Buffalo Color Corporation, while not on the Federal NPL, is planning the removal of some sediments. This will be performed within the Construction Phase of their remedial activity. As of yet however, no remedial work involving the sediments has been initiated.

Dredging History Not Related to Superfund Actions

The USACE dredges the Buffalo River to maintain it at a depth of 22 feet below low lake level for navigational purposes. The Buffalo River sediments are contaminated to a level that prohibits open lake dumping and therefore, dredged sediments must be placed in specifically confined sites. The most recent navigational dredging was completed in 1992. In addition, last year the ACE performed a dredging demonstration project in conjunction with the ARCS program. This work involved testing of the environmental effects of dredging and was completed through a Congressional appropriation. Several different dredging types were tested and the work was completed before the navigational dredging, in order to ensure that conditions were as settled as possible. Results should soon be available.

Technical Tools In Use and Needed

At the start of the RAP process it was determined that a sediment dynamics model for the Buffalo River AOC was needed (NYSDEC 2, 1990). This model would allow sediment scouring and deposition to be accurately predicted under a wide variety of flow conditions and alternative dredging scenarios. Currently, this model is being developed under the ARCS program and should be completed before 1994. The model could be run for 7 different scenarios in order to obtain an understanding of the various dredging impacts on the health of the Buffalo River. Some scenarios that could be analyzed for the Buffalo River are: the no action alternative, complete dredging of the lower 5 miles of the river, dredging of the entire river to 10 feet, discontinuation of dredging above Hamburg Cove, the Deadman's Creek demonstration project, site-specific "hot spot" dredging on Buffalo Color peninsula and site-specific dredging at Blue Tower turning basin. To date, it has not been decided whether or not every possible scenario will be run.

Also under ARCS, a pilot scale demonstration of remediation technologies thermal desorption unit on contaminated sediments from the Buffalo River was performed. In this study, a thermal desorption unit was evaluated for its effectiveness in remediating Buffalo River sediments contaminated with PAHs. The early results indicated that, with sediments remaining in the thermal desorption unit from 30 to 90 minutes and sediment temperatures reaching 300 to 480 degrees Fahrenheit, 43.2 to 97.9% of total PAHs were removed while 9.1 to 100% of total PCBs were removed. Although this thermal process had little effect on most metals, 16.7 to 100% of Mercury was removed from sediments during processing (ARCS, 1993).

In addition to the ARCS activities, the NYSDEC has had an automated sampling station set up to sample storm events and look at the effects of storms on scouring and releasing new contaminants. This was performed over a period of a few years and the results will be released soon.

Considering all the studies, the next step will be to decide if the sediments are contaminated to the point that they need to be removed or if they can be left in place and be made unavailable so as not to affect human health and aquatic life. The storm event results

should help in determining whether or not the severity of scouring would make in place remediation infeasible.

State Requests

Along with the studies performed under the ARCS program, the Buffalo River has benefitted from Congressional appropriations and therefore, has been very fortunate with the sources of funding. At this time, the State had no specific requests for remedial assistance. It was mentioned that time is needed obtain the results from completed studies and take a look at all the data before any remedial decisions can be made.

Eighteenmile Creek

Location of Site

Eighteenmile Creek is located in northwestern New York, just north of the city of Lockport. The creek flows north from Lockport into Lake Ontario near the hamlet of Olcott and empties into Lake Ontario 22 miles east of the Niagara River. The AOC includes Eighteenmile Creek, Olcott Harbor and the nearshore waters of Lake Ontario near Olcott. The Eighteenmile Creek AOC begins in a harbor area, flows upstream to a dam which is considered the physical breakpoint for the boundaries of the AOC. Most of the land use within the AOC is agricultural, however, there is currently a lot of development pressure around the harbor area.

The three AOCs located in the western part of NY were addressed in a sequential manner so that available personnel and finances were maximally utilized. Mainly due to citizen interest, the Buffalo River was designated to be addressed first, followed by the Niagara River and then Eighteenmile Creek. Currently, the RAP process for Eighteenmile Creek has not yet begun and most recently, a citizens advisory committee is being formed. It has been estimated that it will take approximately 18 months to 2 years to complete the Stage I RAP and activities should commence by the end of 1993.

Contaminants Polluting Sediments

Sediment characterization information for Eighteenmile Creek is currently extremely limited. What is known, however, is that the primary problem of contamination of the sediments within the Eighteenmile Creek AOC is due to heavy metals and a few PCB "hot spots". In a 1981 USACE study, heavy metal levels in the Olcott Harbor sediments were classified as heavily polluted with Arsenic, Chromium, Copper, Iron, Lead, Manganese, Nickel and Zinc (USEPA Region V, 1977). The ACE also noted that the sediment samples collected near the mouth of Eighteenmile Creek were generally more contaminated than those collected near Lake Ontario. Additionally, sediments from above Burt Dam contained 12 ppm PCBs when sampled in 1979 (SAIC 3, 1987).

Volume of Contaminants or Contaminated Sediments

No estimates of the volume of contaminated sediments within the Eighteenmile Creek AOC are currently available.

Fish Consumption Advisories

Presently, there is a Lake Ontario fish consumption advisory in effect for numerous species including coho and chinook salmon, rainbow, lake and brown trout, american eel and channel catfish. No Eighteenmile Creek AOC specific advisories are in effect at this time, but the

fishing advisory for Lake Ontario does extend into the lower portion of the creek. Eighteenmile Creek is one of the most popular fishing streams on Lake Ontario and most of the fishing is concentrated in the upper one-fourth of the stream and in Olcott Harbor.

Enforcement History Relating to Superfund Sites

There are no Federal Superfund sites within the Eighteenmile Creek AOC.

Dredging History Not Related to Superfund Actions

It is not believed that any dredging has occurred in the Eighteenmile Creek AOC since the maintenance dredging of Olcott Harbor by the USACE in 1987. Since that time, only minor dredging for recreational purposes has been done.

Technical Tools In Use and Needed

Information concerning the contamination of the sediments within this AOC is very limited and dated. Basically, this AOC is starting with no recent sampling data. Currently, there is a need to assess pollutant loadings and transport mechanisms so that the availability of pollutants and future contamination can be determined. There is also a need to determine the volume of sediments that are toxic and to perform risk assessments. These issues are to be addressed as part of the RAP process. Generally, work within the Eighteen AOC needs to follow the lead of some other AOCs and begin characterizing sediments more accurately, locating "hot spots" and discussing modes of remediation.

State Requests

Help with funding the initial sediment work is needed. The State would like this sediment sampling to be done in the form of cores, instead of surficial grabs, in order to begin to understand the characteristics and history of the sediments. Also needed is some time for the State and the RAP Committee to get the process moving. At that time, more specific requests and information will be available.

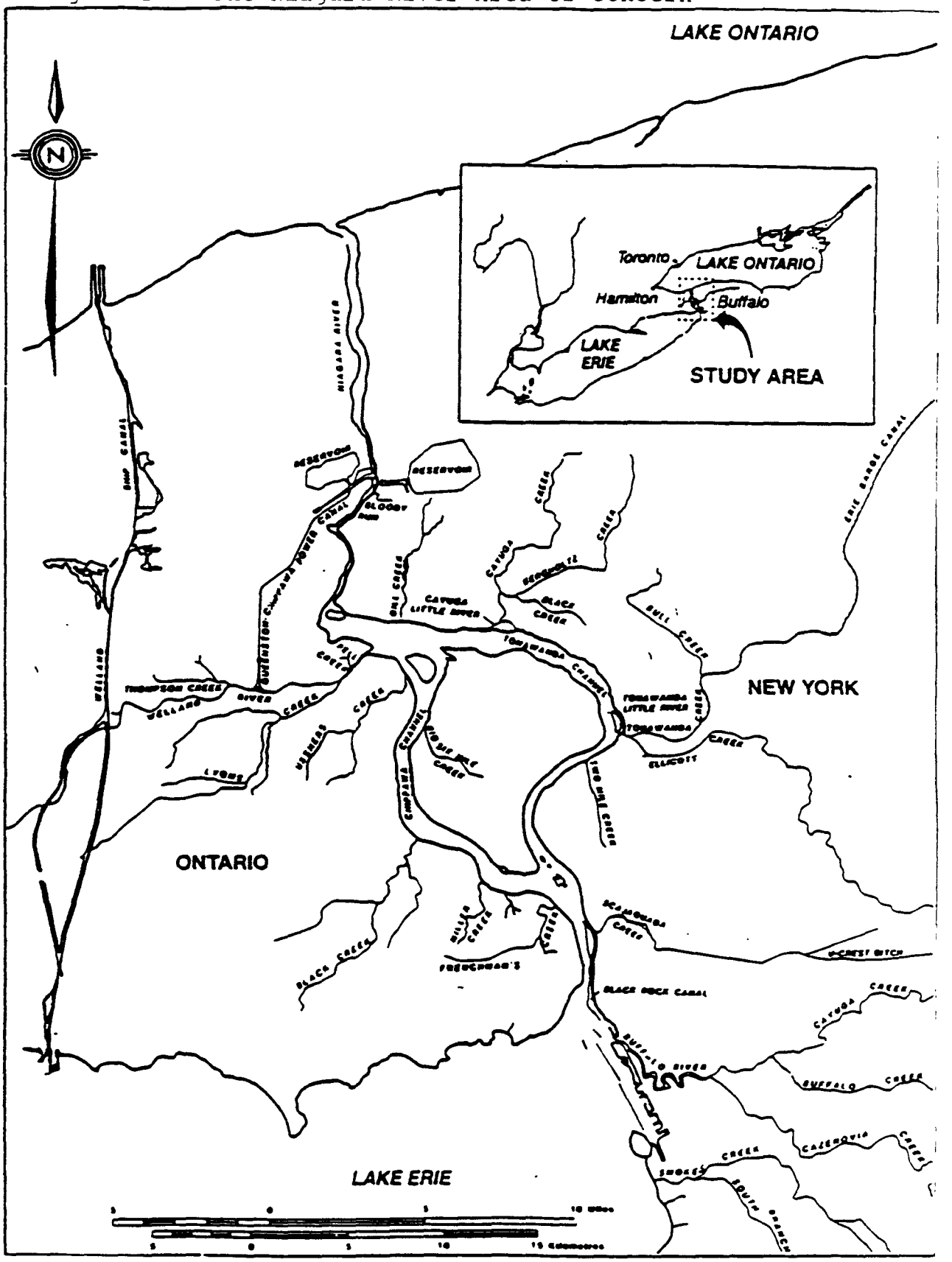
Niagara River

Location of Site

The Niagara River flows between the US and Canada from Lake Erie to Lake Ontario. The international border between Canada and the US divides the Niagara River and serves as a jurisdictional boundary. The Niagara River AOC includes all 37 miles of the river and is the dominant inflow into Lake Ontario (Figure 20). The AOC is located in Erie and Niagara counties in western New York State and extends from Smokes Creek near the southern end of the Buffalo Harbor to the mouth of the Niagara River at Lake Ontario. Tributaries of the Niagara River include Smokes Creek, Buffalo River, Scajaquada Creek, Two Mile Creek, Tonawanda Creek, Cayuga Creek and Gill Creek, in addition to several smaller waterways. The land within the AOC is used for residential and industrial purposes, yet also supports a major transportation corridor.

A unique feature of this AOC is that, because of the rapid flow of the water preventing the settling of any sediment, the Niagara River is scoured to bedrock and till. It is therefore impossible to obtain any sediment samples since there are no in-place sediments. The river simply acts as a pipeline carrying the sediment and water right into Lake Ontario. Because of

Figure 20: The Niagara River Area of Concern



this, there is no sediment bed in the whole Niagara River. Generally speaking, depositional areas do not exist in the river. However, there are several areas, three nearshore embayments and an upstream portion that is protected inside a breakwall, within the AOC that do have sediment related issues that are currently being addressed. Along with these specific areas, some tributaries to the Niagara River AOC also have sediment contamination problems.

Contaminants Polluting Sediments·

The contaminants that have been identified as polluting the sediments within the Niagara River AOC include heavy metals, PCBs, PAHs, Cyanide, mirex, chlordane, dioxin, dibenzofuran and hexachlorocyclohexane (BHC). In addition, the presence of hexachlorobenzene, DDT, DDE and dieldrin in the sediments are suspected causes of aquatic degradation (NYSDEC 3, 1993).

The areas within the Niagara River AOC that have sediment related issues include three nearshore embayments, Petit Flume, 102nd Street Embayment and Lower Gill Creek, and an upstream portion of the river, the harbor area by Buffalo River, that is protected inside a breakwall. The three nearshore embayments are each located adjacent to an inactive hazardous waste site, and as a result, have generated contaminated sediments. The first area is at the outlet of the Petit Flume in North Tonawanda, while the second and third, 102nd Street Embayment and Gill Creek, are both located in the Wheatfield Upper River segment. All three areas contain sediments contaminated with PCBs, PAHs, BHCs, dioxins, dibenzofurans and hexachlorobenzene (NYSDEC 3, 1993). The contaminated sediment issues in these three areas are being addressed by the respective PRPs. Within one of the areas, Gill Creek, sediment remediation has been completed. In addition to these AOC specific sites, the previously mentioned tributaries to the Niagara River have all been found to be contaminated with heavy metals (NYSDEC 3, 1993).

Volume of Contaminants or Contaminated Sediments

Recently, 76,000 cubic yards were removed as part of the Gill Creek clean-up. No estimates are available concerning the volume of remaining contaminated sediments within the Niagara River AOC.

Fish Consumption Advisories

The New York State Health Department has issued a 1992-93 fish and wildlife advisory to eat no more than one meal per month of carp from the upper Niagara River. In the lower Niagara River, the advisory is to eat no american eel, channel catfish, white perch, lake trout, chinook salmon, coho salmon over 21", rainbow trout over 25", brown trout over 20" and carp. In addition, along the lower Niagara River, it is advised that no more than one meal per month be eaten of smallmouth bass, white sucker, smaller coho salmon, rainbow trout and brown trout. These advisories were based on elevated levels of PCBs found in the specific species during 1981 and 1984 NYSDEC sampling and 1987 USEPA sampling. Elevated levels of chlordane and mirex were found in american eel in the lower Niagara River (NYSDEC 3, 1993).

Enforcement History Relating to Superfund Sites

There are currently 5 sites within the Niagara River Watershed that are on the Federal NPL. These Superfund sites are Love Canal, 102nd Street Landfill, Hyde Park Landfill, S-Area Landfill and the Niagara County Refuse Landfill. To date, no contaminated sediments within the Niagara River have been remediated in conjunction with any of these Superfund sites. There are plans however for the 102nd Street Landfill PRPs to address the remediation of

contaminated sediments in the later phases of the clean-up process. It is worthwhile to note that work has been done to remove contaminated sediments from tributaries related to Love Canal and Hyde Park.

Dredging History Not Related to Superfund Actions

No dredging is necessary in most of the Niagara River because it is scoured to bedrock and no sediments remain to be dredged. However, there was some dredging that did occur within the Lower Gill Creek, one of the three embayment areas within the Niagara River AOC. In 1981, the PRPs, Olin and DuPont, voluntarily undertook a remediation project to remove contaminated sediments in Gill Creek. Subsequent investigations of Gill Creek bottom sediments showed significant organic and Mercury contamination of the sediments in a 250 foot unremediated stream section (NYSDEC 3, 1993). This stream section was subsequently dredged in a 1992 project and the removal of contaminated sediments has since been completed. Additionally, the outer harbor area in the upper Niagara River is dredged by the USACE when needed.

Technical Tools In Use and Needed

As far as sediments are concerned, within the Niagara River AOC all work is being conducted by PRPs. The contaminated sediment remediation of the Petit Flume and the 102nd Street Embayment is still in the remedial design phases, however, after that phase is complete, remedial action will commence. The State is providing an oversight role in the embayment clean up.

State Requests

The only request that was mentioned for the Niagara River AOC involved the need for EPA sediment criteria. Presently, it is known that areas of contaminated sediment in the Buffalo Harbor that are contained in the Niagara River AOC exceed open lake disposal standards. Without accepted criteria however, the degree of contamination cannot be determined. The ability to classify the sediments will help with the remedial decision-making process.

Oswego River

Location of Site

The Oswego River, New York's largest tributary to the Great Lakes, is located in northcentral New York and empties into Lake Ontario near the city of Oswego. The AOC is located on the southeastern shore of Lake Ontario and is centered in the city of Oswego (Figure 21). The AOC is defined as: the area at the mouth of the Oswego River bounded by the breakwalls and an imaginary line connecting the breakwalls, the Oswego River as far south as the Varick dam and the shoreline area from the breakwall on the west to a point on shore where a line extended from the breakwall on the east would meet the shore (NYSDEC 4, 1990). Land use within the Oswego River AOC is primarily urban and residential. The Oswego River is a valuable natural resource for industry, commerce and recreation in central New York State.

It is worthwhile to mention that, even though it is not located in the Oswego River AOC, Onondaga Lake, a source of much contamination, flows directly into the Seneca River, a tributary of the Oswego River. Because of this, the serious pollution problems of Onondago Lake get carried directly into the Oswego River AOC.

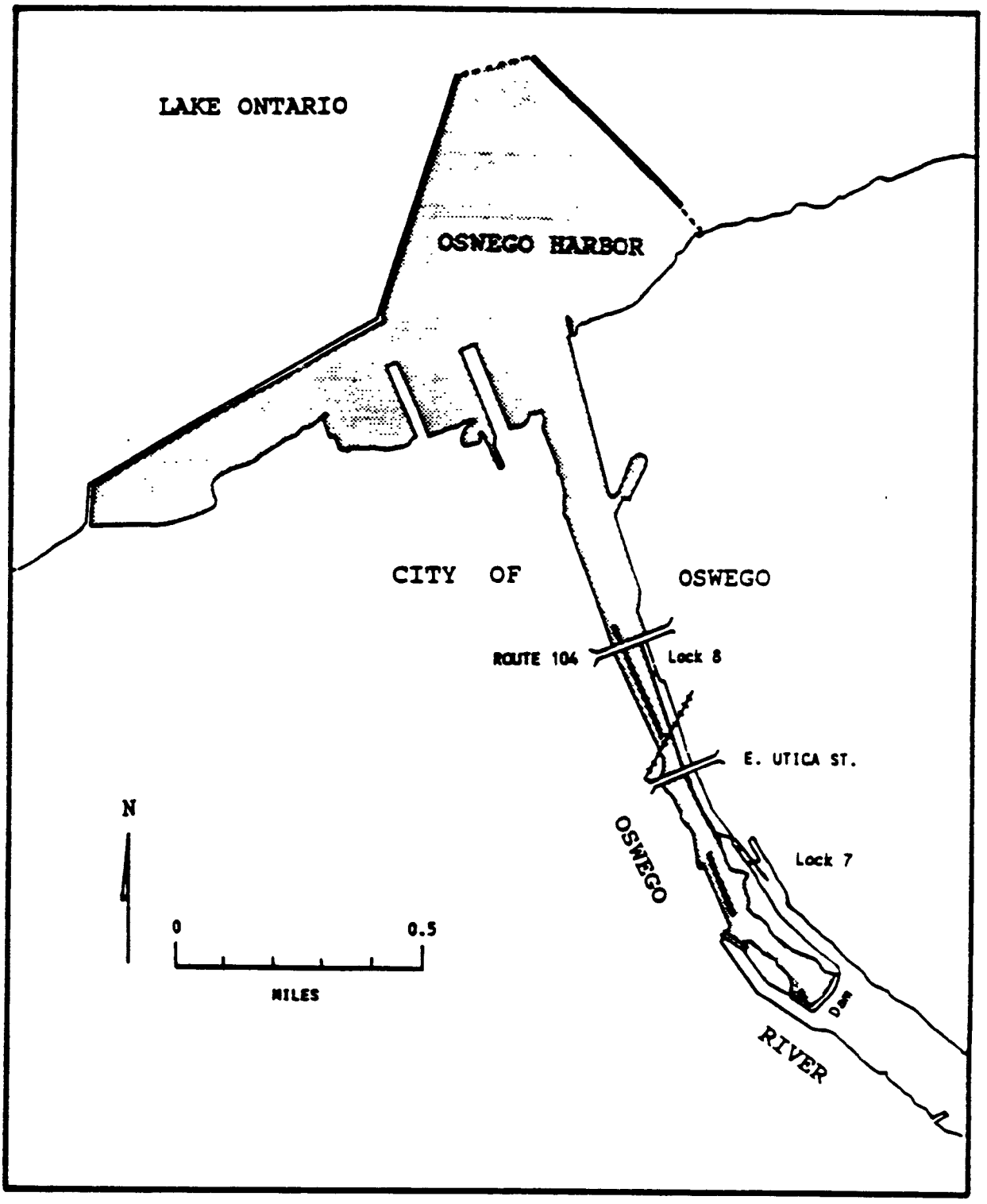


Figure 21: The Oswego River Area of Concern

Contaminants Polluting Sediments

For the Oswego River AOC, it is important to keep in mind that the contaminated sediments within the AOC are not viewed as major problems because the levels of contamination are marginal and fall within moderate to low levels. The exact extent of the sediment problem is not known, but it is expected that the level of contamination is not high. It is believed that the major contaminants polluting the sediments are mirex, PCBs and Mercury. It is also thought that the PCB contamination within the Oswego River originates from Onondaga Lake (NYSDEC 4, 1991).

Results from 1990 USACE Oswego Harbor sediment sampling for dioxin, mirex and PAHs obtained the following results:

dioxin: none detected with a detect level of 1.8 to 2.8 pg/g
mirex: none detected with a detect level of .12 to .32 ng/g
PAHs: ranged from none detected (at 10 ng/g) to 201 ng/g

Much more characterization of the sediments remains to be completed.

Volume of Contaminants or Contaminated Sediments

To date, there have been no estimates of the volume of contaminated sediments within the Oswego River AOC.

Fish Consumption Advisories

Currently, there is no AOC specific fishing advisory, however the AOC is affected by lakewide restrictions for Lake Ontario.

Enforcement History Relating to Superfund Actions

Only one Superfund site, Volney Landfill, is located within the Oswego River AOC. Volney Landfill is a likely source of PCBs. It was proposed for the NPL in 1984 and since has been capped. Additionally, a selected clean-up plan for this site was expected sometime in late 1992 or 1993. Presently, however, no activity related to sediment remediation is occurring in conjunction with activities at Volney Landfill.

Dredging History Not Related to Superfund Sites

There are no restrictions on the disposal of dredged material from Oswego Harbor. The next dredging by the USACE is planned for June through October of 1993. This will be maintenance dredging of the navigation channel and dredge spoil will be open lake disposed.

Technical Tools In Use and Needed

Currently there is insufficient data to draw conclusions on the status of bottom sediments within the Oswego River AOC. Investigations to determine the location and extent of the contaminated sediment problem are needed, as is computer modeling, risk assessment and remediation. Efforts are in progress to attempt to assess the sources of PCBs in the basin and to collect more information on the sediments in general to help determine if removal/remediation of the sediments is necessary. Prior to making decisions about removing the sediments, the present focus is on identifying sources of toxics and removing those sources that originate outside of the river. Critical components to the clean-up of this AOC are the Onondaga Lake clean-up, inactive hazardous waste site remediation and CSO abatement. In order to prevent recontamination, it will be prudent to remediate Onondaga Lake and other upstream sources before undertaking remedial actions on contaminated sediments in the Oswego River.

State Requests

Because the information is currently limited to data collected outside the navigation channel, the State could use assistance in obtaining a better assessment of the levels of contamination within the Oswego River AOC. The assistance for an expanded assessment would be helpful if it was in the form of surficial samples and/or dated cores.

Rochester Embayment

Location of Site

The Rochester Embayment is located on the southern shore of Lake Ontario near the city of Rochester, New York. A tributary of the Rochester Embayment, the Genesee River, flows in from the New York/Pennsylvania border. Several other smaller waterways also flow into the embayment. The AOC is defined as the nearshore of Lake Ontario within Monroe County from the town of Greece to the Nine Mile Point area of the town of Webster (Figure 22). The AOC also includes the lower Genesee River from the lower falls to the mouth. Land use within the Rochester Embayment AOC is primarily industrial and residential.

Contaminants Polluting Sediments

Sediments within the Rochester Embayment AOC are polluted with heavy metals, Cyanide and PAHs. The heavy metals of concern include Arsenic, Barium, Cadmium, Copper, Lead and Manganese. A 1990 sediment analysis showed most pollutants in the Rochester Embayment AOC to be in the "nonpolluted" or "moderately polluted" range (USEPA Region V, 1977). However, Arsenic, Barium, Manganese and Cyanide all fell within the "heavily polluted" range (Monroe County, 1993).

As far as PAHs are concerned, analyses in a 1981 EPA study in the lower Genesee River measured total PAH levels ranging from .66 to 5.91 ppm. Benzo(a)pyrene comprised approximately 1/4 of the total PAH levels (Monroe County, 1993). These findings have been disputed by more recent studies which found PAHs less frequently than the 1981 study. All considered, not much sediment characterization work has been done within this AOC and the extent of the contaminated sediment problem is still fairly unknown.

Volume of Contaminants or Contaminated Sediments

There have been no estimates as to the volume of contaminated sediments within the Rochester Embayment AOC.

Fish Consumption Advisories

Currently, there is no AOC specific advisory for the Rochester Embayment. However, the Lake Ontario advisory is applicable within this AOC. The Lake Ontario advisory recommends no consumption of american eel, channel catfish, lake trout, chinook salmon, coho salmon over 21", rainbow trout over 25" and brown trout over 20", and recommends "restricted consumption" of white sucker, white perch, smaller coho salmon, rainbow trout and brown trout. The contaminants responsible for these Lake Ontario advisories are mirex, PCBs and dioxin (Monroe County, 1993).

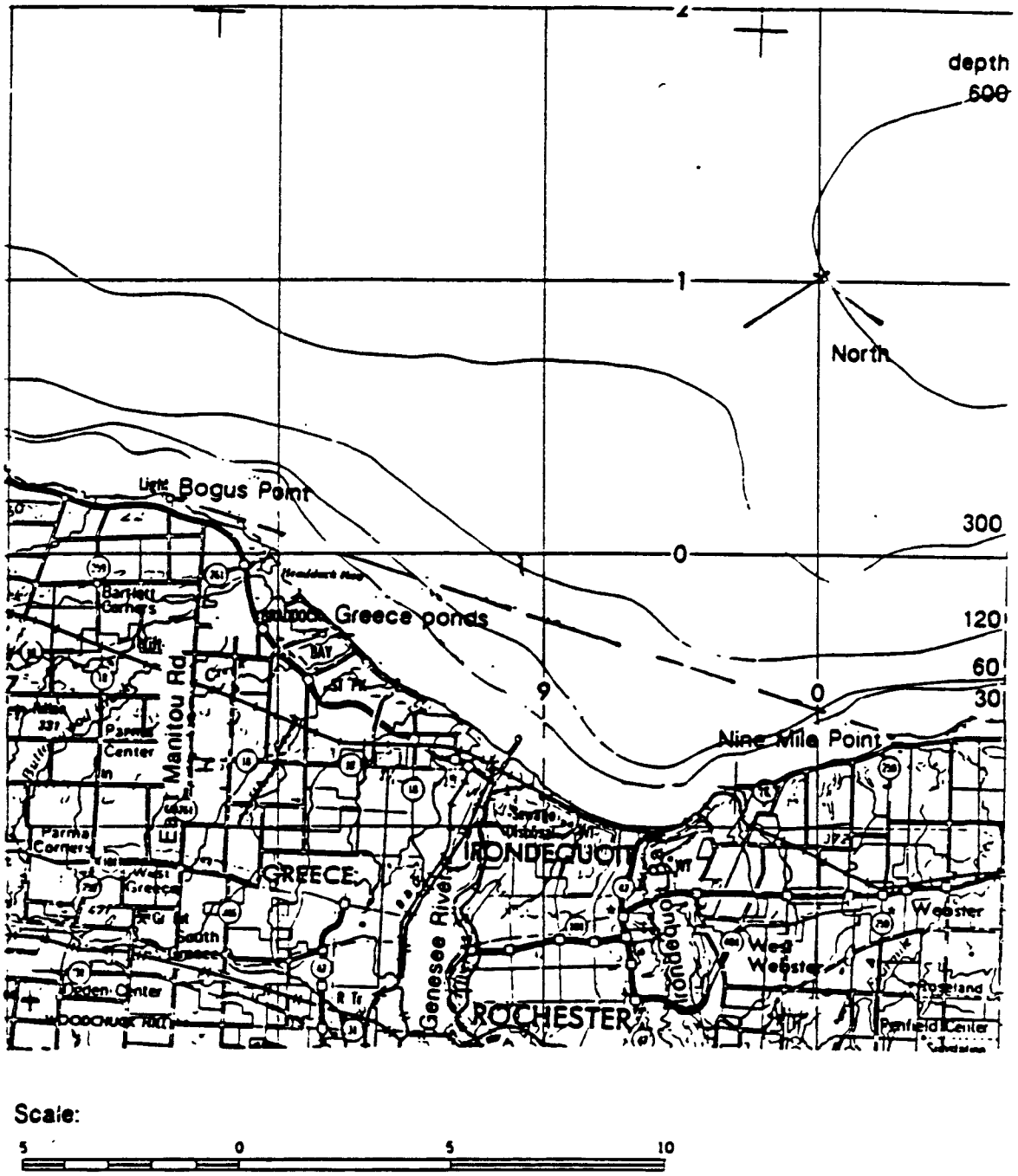


Figure 22: Rochester Embayment Map

Enforcement History Relating to Superfund Sites

There are approximately 83 inactive hazardous waste sites within the watershed of the AOC that are on the NY State Registry as Superfund sites. There is additionally a significant local effort to determine the location and contents of waste sites. However, no sites are currently on the Federal NPL list. Only one site, Trimmer Road landfill, is being submitted for NPL status . Therefore, no remediation of the sediments in Rochester Embayment is occurring under Superfund.

Dredging History Not Related to Superfund Actions

As of 1992, sediments from the Genesee River were deemed suitable for open lake disposal. The harbor part of the Genesee River is dredged annually by the USACE and all dredge spoil is open lake disposed.

Technical Tools In Use and Needed

There are no technical tools currently in use in this AOC in relation to the remediation of the contaminated sediments. This is because the work in this AOC focuses on efforts to reduce pollution in the watershed instead of removing contaminated sediments. The Rochester Embayment RAP committee does not believe that removing the sediment is a good idea. Consequently, most of the effort and funding within this AOC has been focused on a huge CSO abatement program and on NPS pollution control measures within Monroe County. A good deal of this work has been aided by information collected in the 1981 Monroe County Health Department sediment toxics survey of the Genesee River which focused on pollutant loadings to the Rochester Embayment.

State Requests

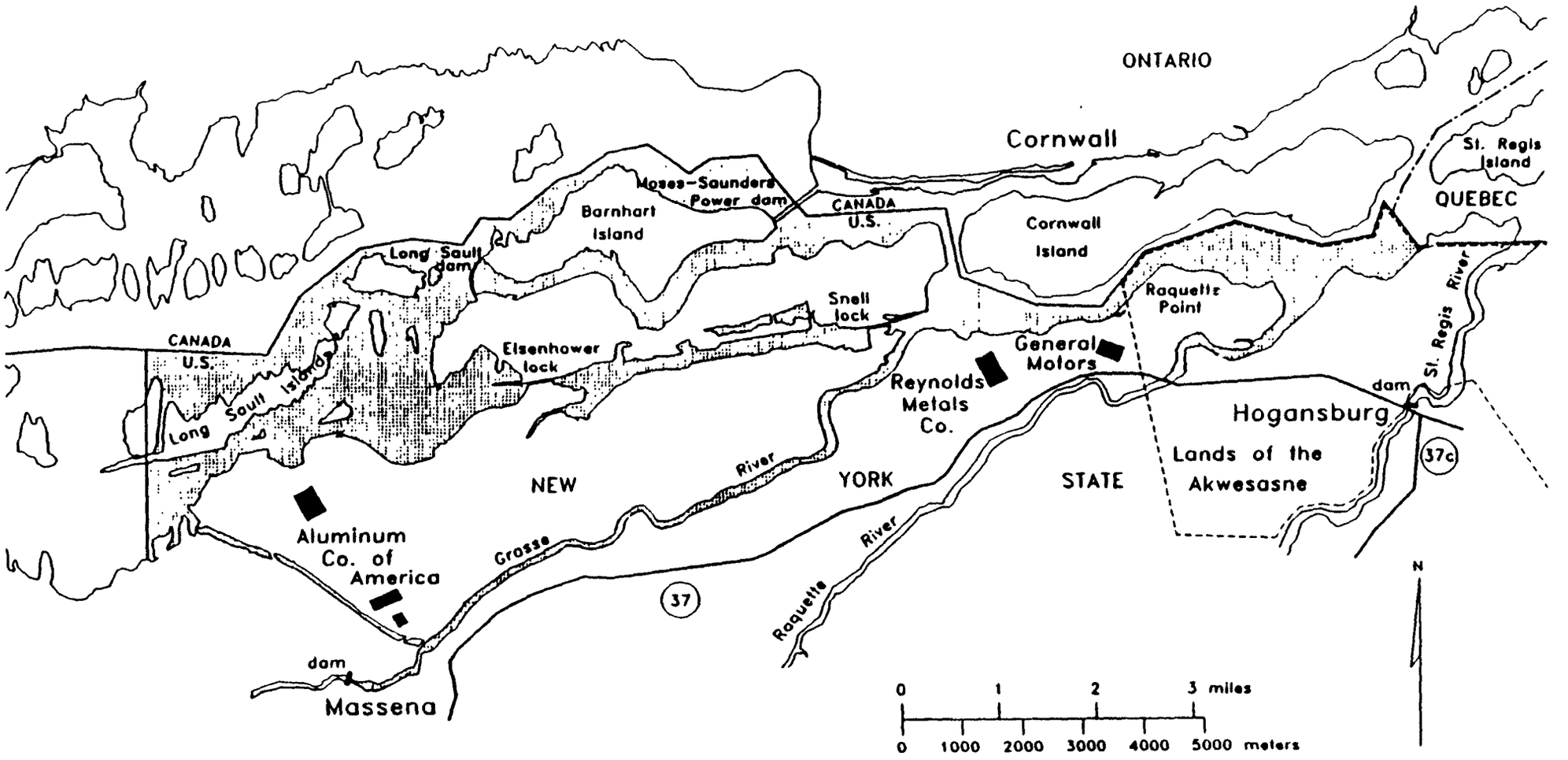
It was mentioned by the State that assistance in the form of benthic sampling and testing would be helpful in order to determine what should be done about the impairment of the benthos. When the RAP committee begins to address this impairment, it is believed that they will then have to address the issue of the toxic sediments. At that point, they would need assistance in obtaining more recent sediment data.

St. Lawrence River (Massena)

Location of Site

The St. Lawrence River includes areas of both New York State and Ontario, Canada. The St. Lawrence River AOC is centered around Massena, New York, on the south shore of the St. Lawrence, and is centered around Cornwall and Maitland, Ontario on the north shore. The US St. Lawrence River AOC includes Massena, New York and the Akwesasne Indian Reservation. The Massena portion of the St. Lawrence AOC (referred to as the Massena AOC) can be defined as New York State's waters which include the New York portion of the St. Lawrence River upstream of the Canadian boundary to the Massena public water supply intake, the Grasse River from the mouth upstream to the first dam, the Raquette River from the mouth upstream to the New York State route 420 bridge and the St. Regis River from the mouth upstream to the dam at Hogansburg (Figure 23). Located within the Massena AOC are 2 Aluminum reduction plants, an integrated Aluminum production mill, an Aluminum foundry and the village of Massena.

Figure 23: The St. Lawrence (Massena) Area of Concern



As part of the sediment remediation process, the bottom sediments of the St. Lawrence and Grasse Rivers in the Massena area have been listed by New York State as an inactive hazardous waste site. The river segment that was listed as the inactive hazardous waste site includes the St. Lawrence River from the St. Lawrence-Franklin County line upstream to Snell Lock, along the south shore of the river excluding the shipping canal and the Grasse River from the Massena power canal discharge to the river mouth (NYSDEC 5, 1990). Superfund is additionally involved with three sites in the Massena AOC. Administrative Orders were designed so that one facilities' investigative and remedial responsibility takes over where another facilities' responsibility ends. Therefore, all major contaminated sediment areas are covered under one of the three Federal Orders.

Contaminants Polluting Sediments

Within the Massena AOC, sediments in some areas have been determined to be heavily polluted with heavy metals and PCBs. The heavy metals of concern include Arsenic, Chromium, Copper, Lead, Mercury, Nickel and Zinc. It is generally known that the PCBs are concentrated near the ALCOA, Reynolds Metals and General Motors discharge points , however more specific characterization of the sediments for PCBs is still needed. Additionally, dioxin, mirex, DDT, PAHs, phenols and hexachlorobenzene have been impacting the use of the Massena AOC.

Volume of Contaminants or Contaminated Sediments

EPA has estimated that there are approximately 62,000 cubic yards of sediments with PCB concentrations above 1 ppm that must be removed from the river system by GM. Additionally, the selected remedy from the Reynolds ROD included the dredging and/or excavation of around 51,500 cubic yards of sediments and shoreline soils with PCB concentrations above 1 ppm (USEPA Region II, 1993). However, no estimates as to the total volume of contaminated sediments within the Massena AOC are available.

Fish Consumption Advisories

Currently, in addition to the general state fish consumption advisories, there are specific fishing advisories in effect in the Massena AOC for american eel, channel catfish, lake trout, large salmon and rainbow and brown trout. The advisories are the result of sediment contamination by PCBs, Mercury, mirex and dioxin. Due to this contamination, the Akwesasne Mowhawk Tribe has been directly affected because fish and waterfowl have traditionally been important parts of their diets.

Enforcement History Relating to Superfund Sites

There are three Federal Superfund sites, Aluminum Corporation of America (ALCOA), Reynolds Metals and General Motors (GM), within the Massena AOC that are presently addressing the contaminated sediment issues within the St. Lawrence River. Additionally, the NYS Superfund Program is addressing the terrestrial contamination at these sites. The major substance of concern for these three PRPs are PCBs, although other contaminants are present.

ALCOA has already removed PCB contaminated sediments from an outfall and a small marsh and currently, under Superfund, are scheduled to do a phase I removal of 15,000 cubic yards of highly contaminated sediments in the Grasse River. This removal should occur sometime next spring, with a ROD following the removal action in 1 to 2 years.

Reynolds Metal removed sediments below two outfalls prior to Superfund involvement in

the site. Most recently, the Reynolds ROD has just been released and the description of the selected remedy included two major divisions (USEPA Region II, 1993):

1. Dredging and/or excavation of approximately 51,500 cubic yards of sediments and shoreline soils with PCB concentrations above 1 ppm, PAH concentrations above 10 ppm and total dibenzofuran (TDBF) concentrations above 1 ppb from contaminated areas in the St. Lawrence River and from the associated riverbank.
2. Treatment of approximately 14,500 cubic yards of dredged/excavated material with PCB concentrations above 25 ppm by thermal desorption. Untreated sediments and non-hazardous treatment residuals with PCB concentrations below 10 ppm will be disposed on-site, preferably in the Black Mud Pond, and covered. Contaminants condensed in the thermal desorption process will be transported off-site and burned at a commercial incinerator.

General Motors used PCBs in a die casting process from 1959 to 1974. In 1990, EPA proposed a remedial action for the first portions of the GM site that included dredging approximately 62,000 cubic yards of PCB contaminated sediments. This remedial action will involve dredging the sediments down to 1 ppm PCBs in front of the plant and down to .1 ppm in front of the reservation. The first phase of the dredging is scheduled to be completed by next year.

Dredging History Not Related to Superfund Actions

There are currently no restrictions on dredging activities in the navigation channel of the St. Lawrence River in the Massena AOC. Periodic maintenance dredging is required and the most recent dredging was in 1988, during which 15,000 cubic yards were removed and in 1990, when 28,000 cubic yards were dredged. These dredged materials were deposited in an approved upland disposal area after testing to determine if they meet land disposal criteria.

Technical Tools In Use and Needed

Most of the remedial activity within the Massena AOC is occurring under the direction of Superfund. They are developing the clean-up plans and deciding upon the clean-up levels for the Massena sediments. After these Superfund and PRP activities are completed, more sediment sampling will be conducted in order to directly pinpoint and highlight the location and extent of remaining contaminated sediments. After the sediment investigations, risk assessments will be performed before any more remediation of the sediments is attempted.

State Requests

It was mentioned by the State that it would be very helpful if some research was done to determine what level of clean-up is needed to make the sediment "clean" to allow for delisting the site as an AOC. Also it was believed that it would be good to have some data available as to what should be the legitimate standard to determine clean-up levels; for example, is it financial or is it to protect birds and fish or is it to protect human health. In answering these difficult questions it was believed that the EPA sediment criteria, currently being developed, would be very helpful.

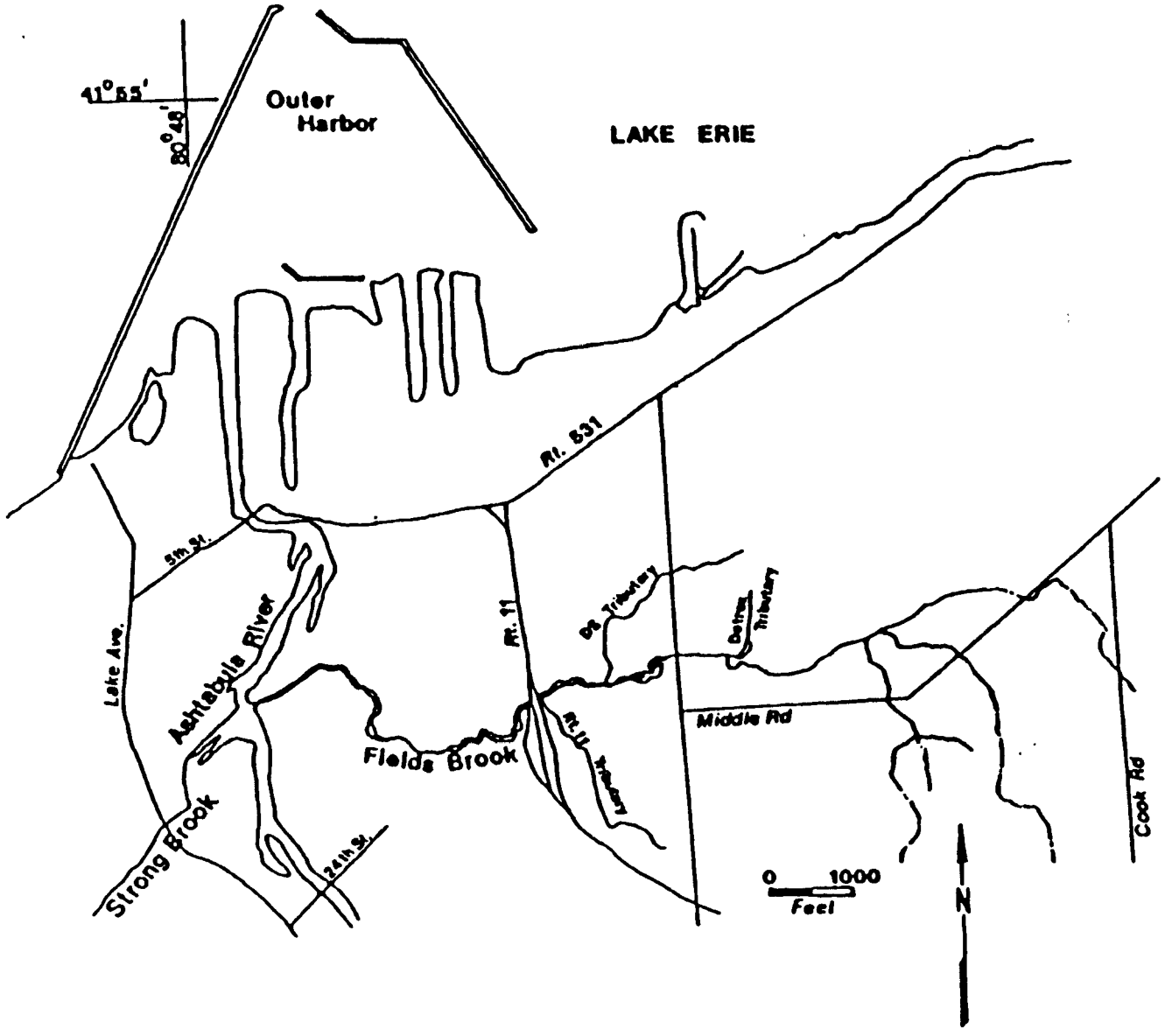


Figure 24: The Ashtabula River Area of Concern

Ohio

Ashtabula River

Location of Site

The Ashtabula River is located in northeast Ohio and flows into Lake Erie at the city of Ashtabula, between Cleveland, Ohio and Erie, Pennsylvania. The watershed of the Ashtabula River includes the 6 surrounding townships of Ashtabula, Austinburg, Kingsville, Plymouth, Saybrook and Sheffield. The main section of the river is 23 miles long and originates at the confluence of the east and west branches, which are 10 and 16 miles long, respectively. Major tributaries of the Ashtabula River include Fields Brook, Hubbard Run and Ashtabula Creek. Additionally, Strong Brook is a minor tributary to the river. The AOC includes the lower 2 miles of the Ashtabula River, Fields Brook and the nearshore areas of Lake Erie (Figure 24).

Industrial development is concentrated along Fields Brook, which empties into the Ashtabula River approximately 1.5 miles from the mouth. The main section of Fields Brook is 3.5 miles long and has 5 tributaries. Fields Brook has such contaminated sediment that it was classified as hazardous and is presently being addressed by Superfund. All of the brook, except for the very upstream segments, is identified as the Superfund site.

Contaminants Polluting Sediments

The major pollutants contaminating the sediments of the Ashtabula River are heavy metals, such as Arsenic, Barium, Cadmium, Chromium, Lead, Mercury and Zinc, and organics such as PCBs, PAHs, hexachlorobutadiene, hexachlorobenzene and trichloroethylene. PCBs have been found throughout the AOC at concentrations ranging from 0 to 660 ppm, with an average of 11.9 ppm, however most other organics are more localized in certain "hot spots" (OEPA 1, 1991). The horizontal distribution of the sediment constituents shows the upper turning basin to be a "hot spot" and a "sink" for the sediments. Concentrations, for the most part, decrease down river toward the harbor (Woodward-Clyde Consultants, 1992). The upper turning basin is such a "hot spot" because that is where Fields Brook flows into the Ashtabula River and all the contaminated sediment being carried is thus deposited there. As for a vertical characterization of the sediments, no one trend for vertical distribution was representative of all parameters, however most concentrations increased with depth and then decreased. Additionally, the sediment in the upper 2 feet was found to be less impacted compared to the overall average (Woodward-Clyde Consultants, 1992).

The following concentrations of contaminants are a few examples of what levels have been found in the sediments within the Ashtabula River AOC. These concentrations are from a variety of sources and are summarized in Tatem, H.E., et al. (1990):

Arsenic: 56 ppm
Chromium: 2,200 ppm
Lead: 350 ppm
Mercury: 4.7 to 14 ppm
Zinc: 830 ppm
PCBs: 120 ppm
hexachlorobutadiene: 22 ppm
hexachlorobenzene: 32 ppm
PAHs: 188 ppm

Volume of Contaminants or Contaminated Sediments

It has been estimated that within the Ashtabula River AOC there are approximately 500,000 cubic yards of contaminated sediment. Of this 500,000 cubic yards, 200,000 to 300,000

cubic yards is TSCA material, which means it has a PCB concentration greater than 50 ppm. Fields Brook has an estimated 40,000 cubic yards of highly contaminated sediment, while the outer harbor of the Ashtabula River has around 100,000 to 200,000 cubic yards of moderately contaminated sediment.

Fish Consumption Advisories

Due to elevated levels of toxic substances found in fish tissue, a fish consumption advisory for the lower 2 miles of the Ashtabula River was issued in 1983. This "no consumption" advisory is still in effect today and is applicable to all species. The advisory was initially issued due to the high levels of PCBs found in fish samples from 1978 to 1981. In addition to PCBs, other organic chemicals polluting the sediments were also detected in the fish tissue samples including, hexachlorobenzene, hexachlorobutadiene, pentachlorobenzene, tetrachloroethane and octachlorostyrene (OEPA II, 1991). Recent fish sampling has shown that concentrations of contaminants in fish tissues has declined considerably, however the advisory will not be revoked until further data is available.

Enforcement History Relating to Superfund Sites

Fields Brook, which is a major tributary of the Ashtabula River, has been designated as a Superfund site. In September, 1986, after two years of study, the USEPA decided that incinerating, solidifying and landfilling the contaminated sediment would be the final clean-up method. Additionally, it was determined that two other studies needed to be conducted. These studies were: 1.) identification of current sources of contamination to Fields Brook and the development of ways to stop further contamination, and 2.) determination of the type and amount of contamination in the Ashtabula River and Harbor. In order to address these studies, three tasks were decided upon by Superfund and were proposed in the Fields Brook ROD. Two of the three tasks directly address the contaminated sediment problem. The two sediment related tasks and the current activities occurring in conjunction with these tasks are as follows (USEPA Region V, 1993):

1. A sediment operable unit was created which involves the clean-up of contaminated sediment in Fields Brook, its tributaries and the wetland and floodplain areas. Work within this unit is intended to determine the amount of sediment in Fields Brook to be excavated, treated and disposed; the best means for incinerating the sediment; the best means of solidifying the sediment before disposal; the best location for the incinerator and treatment and disposal facility; and the amount of contaminated sediment in Fields Brook wetlands and floodplains.
2. The Ashtabula River investigation was designed to determine the type and amount of contamination in the river, the effects Fields Brook and other continuing sources have had on the river's sediments, and the risks to human health and the environment that are present. Within this investigation, USEPA has decided that a hydrodynamic and sediment transport assessment needs to be done for the river study area. This will assess potential scour and movement of contaminated sediments in the river. This information will be used to determine any potential ecological and human risks posed by the contamination and will assist in making final decisions on potential Superfund remedies.

The PRPs are responsible for paying only the clean-up costs for Fields Brook. No decision has yet been made concerning who will pay for the clean up of the river.

Dredging History Not Related to Superfund Actions

The Ashtabula River has not been dredged since 1962. In 1979 and 1983, sediment

sampling confirmed that river sediments were highly toxic and polluted. This complicated dredging and disposal issues and required special treatment of these toxic sediments. In order to address these sediments, dredging operations have been proposed and environmental impact statements have been submitted by the USACE. However, no dredging project was attempted due to the inability to agree on a disposal site and the escalating cost of the dredging. In June of 1992, a site was finalized for the disposal of the sediments from the Ashtabula River. The use of this site involved the leasing of land from Conrail for 3 years, after which the sediment has to be removed to a permanent location. The purpose of this was to allow the sediment to dry out so it would eventually be easier to move. Before the Conrail site could be used, it first had to be rehabilitated into a suitable disposal site, and then, following the rehabilitation, 23,500 cubic yards of sediment were scheduled to be dredged from the river. After three years, the dewatered sediments will most likely be disposed upland and the old disposal facility will be allowed to develop into a wetland habitat. This summer, the USACE is planning to dredge to 6 feet below Low Water Datum (LWD) in the river and to 4 feet below LWD in the upper turning basin. The sediment that will be dredged does not contain high contaminant levels and will be placed at the Conrail site. The dredging is scheduled to be completed by September, 1993.

Additionally, commercial navigation at the mouth of the river has been impeded due to the accumulation of highly polluted sediments that must be CDF disposed. In order to alleviate this problem, a CDF is scheduled to be built by 1998. This CDF is intended to contain heavily polluted sediments from the outer harbor and commercial navigation channel.

Technical Tools In Use and Needed

As one of the 5 ARCS priority sites, a baseline human health risk assessment and a fish tumor study were performed for the Ashtabula River AOC. In the human health risk assessment, the study concluded that the greatest risk to public health resulted from eating contaminated fish collected from the AOC. The study urged people to avoid eating bottom-feeding fish, like carp, because they tend to accumulate unhealthy levels of pollutants (Crane, J.L. (3), 1992). The fish tumor study sampled fish from the river, the harbor and an area near the breakwater. The study was performed as a method of determining possible impacts of contaminated sediments on resident fish populations. The analysis of the collected fish showed that approximately 20% of the total catch had livers with preneoplastic lesions, with the largest percentage having been obtained from the river. Therefore, it was concluded that there was a higher probability of "tumors" in fish from the river as compared to fish from the harbor or breakwater area (Mueller, M.E., 1992).

The hydrodynamic and sediment transport model that was proposed in the Fields Brook ROD is an important technical tool that is presently needed. Before taking remedial action, it will be helpful to assess the potential scour and movement of contaminated sediments in the river. With this information, potential ecological and human risks posed by the contamination can be identified and incorporated into the remedial decision-making process.

Much work has been done in an attempt to characterize the sediments within the Ashtabula River AOC. Work within this AOC is at a point where decision-makers are investigating options other than removing all sediments because complete dredging would cost over $20 million. The possibility of dredging only the "hot spots" is also being investigated. Decision-makers are trying to find the remedial option which will pose the lowest risk for the lowest cost.

State Requests

Since a high incidence of tumors was found in brown bullheads within this AOC, it would be helpful to have a better indication of the impact of PAHs upon the river environment. Additionally, it would assist in making remedial decisions if the risk to humans and the environment was known for the present situation and for situations following various clean-up scenarios. As soon as remedial decisions are made, funding for the remediation will be needed.

Black River

Location of Site

The Black River is located in northcentral Ohio and flows into Lake Erie at the city of Lorain, between the cities of Cleveland and Sandusky. The river extends south, from the city of Lorain on the south shore of Lake Erie, about 15.5 miles to the city of Elyria. The Black River AOC includes Lorain Harbor, which is defined by the inner and outer harbor, and the section of the river between Lorain Harbor and the city of Elyria (Figure 25). The inner harbor consists of the lower 3 miles of the river while the outer harbor extends from the mouth of the Black River to an area within the confines of multiple breakwaters. When writing the Stage I and Stage II RAPs, the Black River RAP Coordinating Committee is viewing the AOC as the entire Black River Basin.

Contaminants Polluting Sediments

Within the Black River AOC, the greatest concentrations of contaminated sediments are found in the vicinity of industrial outfalls. Elevated levels of Cadmium, Copper, Iron, Lead, Zinc, Cyanide, phenols, PAHs, oil and grease were present in sediments adjacent to the old US Steel (now USS/Kobe Steel Company) Coke Plant outfall. This portion of the contaminated sediments has since been dredged by USS/Kobe and the sediment contamination is believed to have been taken care of. Before dredging however, sediment concentrations of PAHs ranged from 4.8 to 390 ppm.

Volume of Contaminants or Contaminated Sediments

Approximately 50,000 cubic yards of sediments, previously contaminated by USX Coke Plant discharges, were removed from the Black River in 1990. Estimates as to the remaining volume of contaminated sediments are currently unavailable.

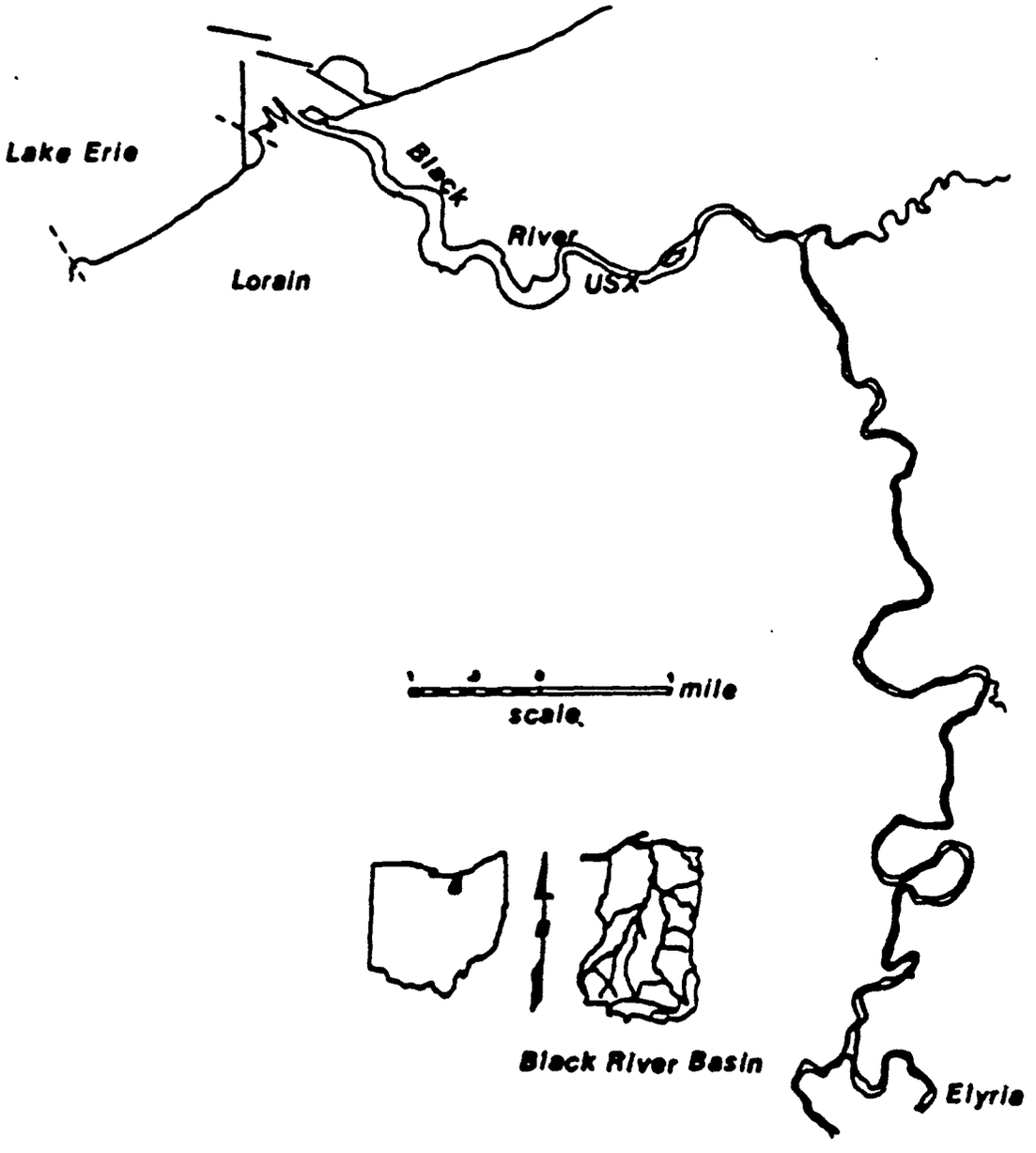
Fish Consumption Advisory

Within the Black River AOC, carp and brown bullhead have shown high body burdens of PAHs, PCBs, DDT and several other pesticides. The PAH contaminated sediments are believed to be the cause of a high incidence of tumors in the bottom dwelling brown bullhead populations in the river. The discovery of high levels of PAHs and PCBs in carp and brown bullhead resulted in the issuance of a health advisory in 1983 for the lower 5 miles of the river. A fish consumption advisory for all species remains in effect for the Black River AOC.

Enforcement History Relating to Superfund Sites

Presently, there are no Superfund sites within the Black River AOC that are responsible for the remediation of any contaminated sediments. However, sediment remediation in conjunction with an enforcement action, taken by USEPA against US Steel (now USS/Kobe Steel Company), was recently completed, and it is believed that this activity has removed all of the in-

Figure 25: Black River Area of Concern



place pollutants from the Black River.

In 1979, USEPA sued US Steel for alleged Clean Water Act violations at its Lorain facility. In 1980, USEPA and USS filed a Consent Decree mandating USS to spend $4 million to suppress dust. In 1985, EPA and US Steel filed an amendment to the 1980 Consent Decree under which US Steel agreed to dredge sediments contaminated with PAHs and Cadmium around the US Steel outfall. In 1990, USS/Kobe (formerly US Steel) began dredging approximately 50,000 cubic yards of sediments, pursuant to the 1985 agreement, at a cost of $1.5 million to USS/Kobe. The dredged material was placed in a hazardous waste landfill located on USS/Kobe property. All dredging was completed in December 1990 and subsequent sampling indicated that the contaminated material had been removed. USS/Kobe has additionally closed down their coke plant and has significantly decreased the pollutant loadings from the other outfalls.

Dredging History Not Related to Superfund Actions

Dredging of the navigation channel by the USACE occurs every year. The dredge spoil is placed in a CDF located at the mouth of the Black River.

Technical Tools In Use and Needed

The Ohio EPA completed an intensive survey of the Black River in October, 1992, and a comprehensive report detailing the survey results is expected to be completed by August 10, 1993. The intensive survey involved the biological, sediment and water quality sampling of multiple locations within the Black River Basin. One of the goals of this study was to evaluate the effects of the toxic sediment removal from the river. It is expected that after this data is available and can be incorporated into the Stage I RAP, that the RAP process will be able to move forward. The Stage I RAP is expected to be available by late 1993. It is hoped that the information from this intensive study will help in making decisions concerning what remedial actions need to be taken and what further study needs to take place. If it is shown to be true that the contaminated sediment problems have been removed by all the USS/Kobe dredging, then the remaining remedial focus will be on controlling erosion and agricultural runoff.

State Requests

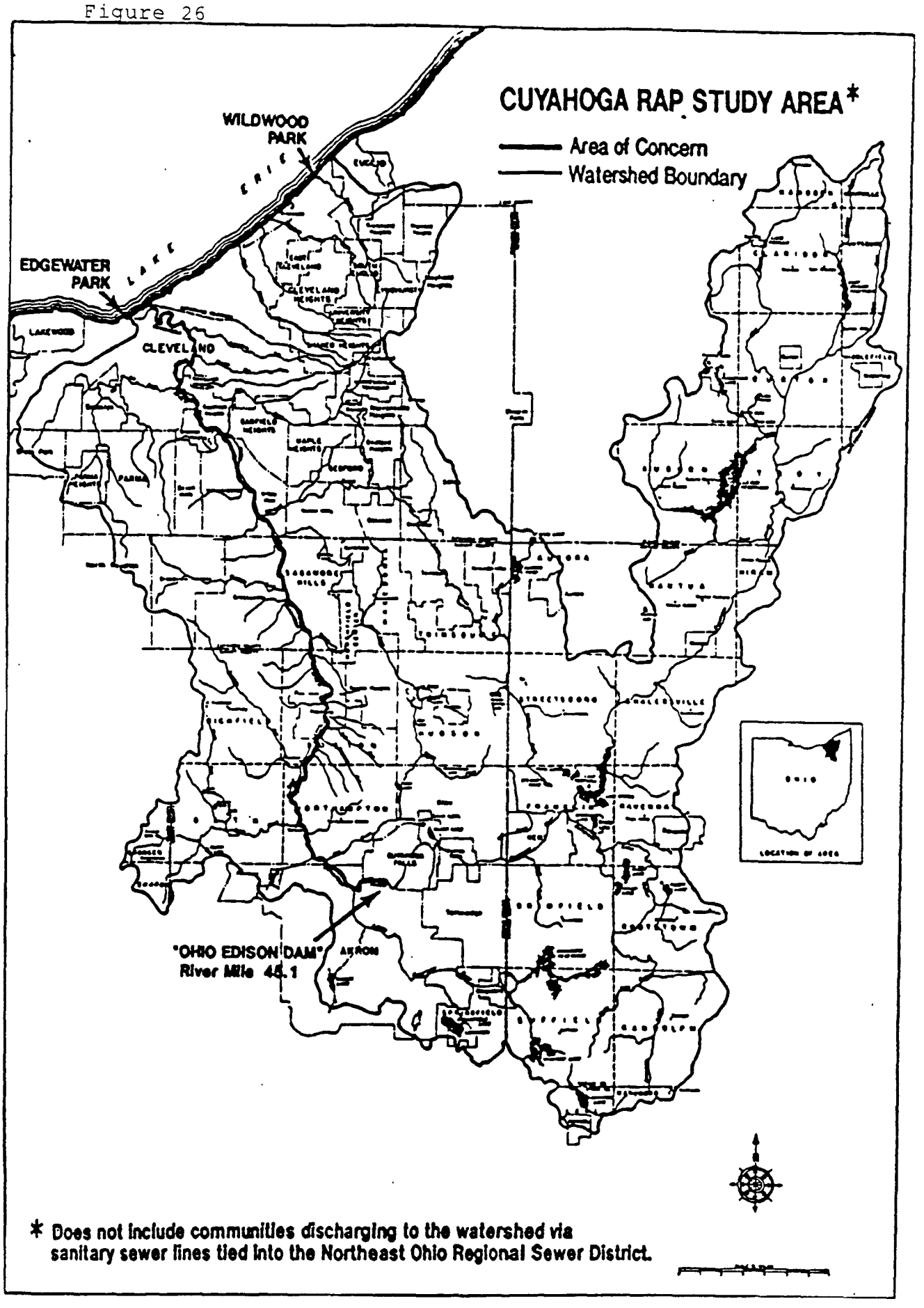
Currently, for the Black River AOC, there is a need for more fish tissue sampling data that could help determine whether or not a fish consumption advisory is still necessary. This project would involve three years of sampling and presently lacks funding. The data from last year showed that the fish were fine for consumption and there is now a desire to open the Black River for game fishing, but this cannot be done until more definitive results are available.

Cuyahoga River

Location of Site

The Cuyahoga River is located in northeastern Ohio and flows southwest from its headwaters, turns north near Akron and enters Lake Erie through the Cleveland Harbor. The AOC is identified as the lower 45 miles of the river and includes the portion of the river below the Akron WWTP, the shipping channel and the nearshore area of Lake Erie inside the Cleveland Harbor breakwater (Figure 26). The lower 6 miles of the river flowing through Cleveland are considered to be the most degraded (Cuyahoga River RAP Coordinating Committee, 1992).

Figure 26


CUYAHOGA RAP STUDY AREA*
Area of Concern
Watershed Boundary
WILDWOOD PARK
EDGEWATER PARK
LAKE ERIE
CLEVELAND
"OHIO EDISON DAM"
River Mile 45.1
AKRON
* Does not include communities discharging to the watershed via sanitary sewer lines tied into the Northeast Ohio Regional Sewer District.

Contaminants Polluting Sediments

Sediments within the Cuyahoga River AOC, specifically in the shipping channel, have been determined to be heavily polluted with PCBs, PAHs, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Nickel, Zinc, volatile solids, Cyanide, DDT, phtalates, TKN, oil and grease. All dredged sediments must be placed in a CDF. A 1991 Cuyahoga River sediment survey by OEPA found the following maximum concentrations for these parameters (OEPA 2, 1991):

Cadmium: 7.60 ppm	Manganese: 874 ppm
Chromium: 174.0 ppm	Nickel: 391 ppm
Copper: 597.0 ppm	Zinc: 2,500 ppm
Iron: 41,700 ppm	Napthalene: 7,200 ppb
Lead: 605.0 ppm	Fluoranthene: 11,000 ppb

Volume of Contaminants or Contaminated Sediments

No estimates are currently available as to the total volume of contaminated sediments within the Cuyahoga River AOC.

Fish Consumption Advisories

On Lake Erie, a health advisory is in place warning people not to eat carp or channel catfish caught from the lake because these fish have been found with levels of PCBs greater than FDA standards. However, in the Cuyahoga River, fish caught along the entire length of the river below the Ohio Edison Dam in Cuyahoga Falls have elevated levels of PCBs that fall below the standards. Therefore, the Ohio Department of Health does not feel that a consumption advisory is warranted.

Data reinforcing this decision was obtained from a 1989 fish tissue study, which found that levels within the fish of 10 volatile organic compounds, 12 pesticide and PCB compounds and 1 heavy metal, Mercury, did not exceed any current FDA action levels (Cuyahoga River RAP Coordinating Committee, 1992). Additionally, fish tissue data from 1990, 1991 and 1992 studies should soon be available.

Enforcement History Relating to Superfund Sites

Currently, there is no contaminated sediment remedial activity occurring in conjunction with any Superfund sites within the Cuyahoga River AOC.

Dredging History Not Related to Superfund Actions

The USACE dredges the navigation channel annually. This dredging includes the lower 5.6 miles of the Cuyahoga River and removes approximately 300,000 to 400,000 cubic yards of sediment each year. The USACE additionally dredges the harbor area every 3 to 4 years and removes around 25,000 cubic yards from the East Outer Harbor and 75,000 cubic yards from the West Outer Harbor. Open lake disposal of sediments from the river and harbor has not occurred since, respectively, 1968 and 1974. The Cuyahoga River AOCs situation is greatly helped by the annual USACE dredging of the lower 5.6 miles of the river. This dredging prevents a serious sediment build-up problem.

There is also some dredging that is done by businesses located on the Cuyahoga Riverbank in order to maintain the areas around docks and marina slips. One-half of the businesses find up-land disposal sites, while the other half of the businesses pay the ACE for permission to dispose of sediments in the CDF.

Technical Tools In Use and Needed

Much work has recently been done within this AOC to evaluate the PAHs in the sediment for fish tumorigenic potential. A study was completed that focused on the Cuyahoga River, from river mile 0 to river mile 91, and the river's tributaries. The results varied from very low to high, with 11 sites rating high out of the 27 having usable data (Estenik, J.L., 1993).

The remedial process for contaminated sediments is presently at a standstill because of the large amount of money that is needed to undertake some remedial activity. There is presently no money available from the State or any PRPs.

State Requests

Because of the lack of funding, the characterization work on the sediments of the Cuyahoga River AOC is not as intensive as desired by the RAP Coordinating Committee. It would be helpful to perform more assessments of the sediments and currently, OEPA is trying to have some sediment bioassays funded by USEPA. Specifically, it was mentioned that one area which would be helpful to have characterized and eventually cleaned up is Kingsbury Run, which used to be an open stream but is now a storm sewer. Kingsbury Run enters the Cuyahoga River at approximately river mile 4.0 and has sediment problems caused by leaching, industrial spills, illegal discharge and CSOs. Within the 1993 Cuyahoga River and Cuyahoga River Tributaries Evaluation of Sediment PAHs for Fish Tumorigenic Potential, Kingsbury Run was rated as an area with high tumorigenic potential. Presently, work on this area is stalled due to lack of funds.

Maumee River

Location of Site

The Maumee River AOC, located in northern Ohio on the western shore of Lake Erie, includes the lower 22.8 miles of the river, containing the mouth of the river, Maumee Bay, the nearshore area of Lake Erie southeast of the mouth and the lower segments of several tributaries to the river and bay (Figure 27). The AOC includes direct drainage into the Maumee River and Bay that is within Lucas, Ottawa and Wood Counties. This includes Swan Creek, Duck Creek, Otter Creek, Cedar Creek, Grassy Creek, Crane Creek and the Ottawa River. The most contaminated sections are the shipping channel in the lower 6.6 miles of the river, the Ottawa River, lower Swan Creek, Otter Creek and the bay. The Maumee River is the largest tributary to Lake Erie and flows through both industrial and agricultural regions, including the city of Toledo.

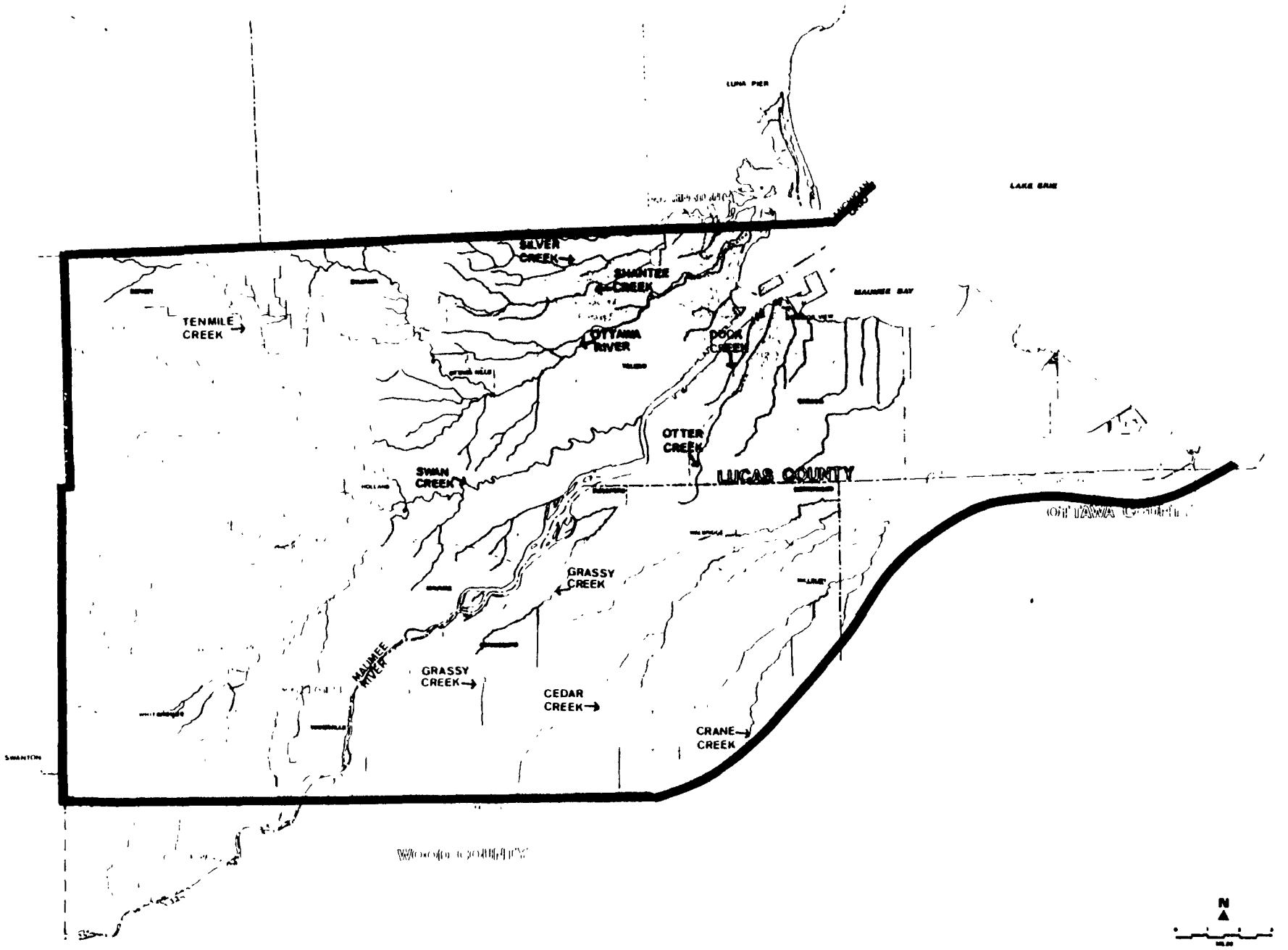
Contaminants Polluting Sediments

There is extremely limited sampling data currently available for the Maumee River AOC. Once more extensive sampling is completed, however it is believed that most of the sediment problem will be due to dumps and landfills that have been leaching contaminants into the river. It is thought that these sites are a more significant problem to the condition of the AOC than the agricultural NPS problems and the CSOs which are being worked on by the city of Toledo.

The only available sediment data is from 1983 and 1988 USACE studies and a 1986 OEPA study. The following points summarize the findings of the three studies (Maumee River RAP Advisory Committee, 1990):

1. USACE shipping channel sediment data collected in 1983 and 1988 showed a serious

Figure 27: Maumee River Area of Concern and Its Streams



heavy metal contamination problem. The metals of particular concern included Cadmium, Chromium, Copper, Lead, Manganese and Nickel.

2. The 1986 OEPA data showed that only Cadmium was "non-polluted" at all sampling sites within the Maumee River, the Ottawa River, Swan Creek, Otter Creek and Duck Creek. All others, Arsenic, Chromium, Copper, Lead, Nickel and Zinc, had at least one "highly polluted" and one "moderately polluted" rating. Arsenic was by far the worst problem having the most "highly polluted" ratings (USEPA Region V, 1977).

Additionally, there is contamination of the Maumee River sediments by PCBs, PAHs and phthalates. The area with the most serious PAH and PCB contamination is believed to be the Ottawa River.

Volume of Contaminants or Contaminated Sediments

To date, no studies have been done to determine the volume of contaminated sediment within the Maumee River AOC.

Fish Consumption Advisories

A public health advisory was issued in 1987 and 1988 against consumption of carp and channel catfish taken from Lake Erie. This advisory affects Maumee Bay and the estuarine portion of the Maumee River and was based on PCB levels, frequently exceeding the USFDA tolerance limit, that were detected in these species.

Additionally, in April, 1991, the Ohio Department of Health issued a fish advisory for channel catfish and carp in the Ottawa River. This decision was based on a fish filet sample collected from the Ottawa River which was found to have a PCB concentration of 65 ppm. The USFDA health standard for PCBs is 2 ppm.

Enforcement History Relating to Superfund Sites

Currently, there are no Superfund sites that are affecting the sediments within the Maumee River AOC, however, two sites are being evaluated for placement on the NPL. Both of these sites are landfills and are suspected of having serious leachate problems.

Dredging History Not Related to Superfund Actions

The Toledo shipping channel, which begins at RM 7.0 and extends out into Maumee Bay to LM 18, is vitally important to the economic well-being of the region, and is the only commercial navigation route in the AOC. The USACE dredges approximately 1,000,000 cubic yards of materials from the channel each year. Before 1975, the materials were disposed of in CDFs or by open lake disposal. From 1975 to 1985, dredge spoils were placed in the currently active CDF to protect the environment from contaminated sediments. In 1985, USEPA approved open lake disposal of materials dredged from less polluted areas of the channel, if chemical analysis showed that the materials to be disposed of were similar to sediment in certain areas of the Western Basin where disposal had occurred in the past (Maumee River RAP Advisory Committee, 1990).

Presently, the Toledo Harbor is dredged annually and the dredge spoils from RM 5.0 of the shipping channel to I-75 go into a CDF, while spoils from RM 5.0 out to the lake can be open lake disposed. Since this situation has become complicated and controversial, there is work in progress to develop a long-term dredged material management plan for the Toledo Harbor.

Technical Tools In Use and Needed

At this time, there is work in progress to better assess the sediment situation in the Maumee and Ottawa Rivers and other tributaries. This is happening as a result of a USEPA Region V grant. Sediment data from 1992 has not yet been interpreted, therefore it is not available in published form. The 1992 data was used to pick 1993 sampling sites in addition to being used for sediment characterization. After the Maumee and Ottawa Rivers are characterized, the sediment situation in Otter and Duck Creeks will need to be addressed. There is also a proposed sampling regime for 1994, which will include samples to be collected in tributaries that were not sampled in 1993 and additional samples to be taken from sites in the 1993 study where severity of contamination or suspected problems dictated a need for a larger body of evidence.

State Requests

It was mentioned by the State that a lot of work is needed in characterizing the sediments and therefore the funding of sediment studies would greatly help. Specifically, assistance in sampling within the Maumee Bay is desired because very little research has been done there. However, it is important to discover what is going on in the Maumee Bay area since that is where the contamination from the Ottawa River is deposited. Baseline biological criteria is also needed for the Maumee Bay nearshore area.

Pennsylvania

Presque Isle Bay

Location of Site

In January 1991, the US designated Presque Isle Bay as the 43rd Area of Concern. Presque Isle Bay, a shallow estuary with an average depth of 13.1 feet, is the oldest harbor in the Great Lakes and is located in the northwest corner of Pennsylvania on the southern shore of Lake Erie. The bay is bounded by Presque Isle to the north and west, and the mainland and the city of Erie to the south and east. Principal tributaries to Presque Isle Bay are Mill Creek (including Garrison Run) and Cascade Creek. For the purpose of the RAP process, the AOC for Presque Isle Bay consists of the entire bay and its tributary watershed areas (Figure 28). Land use within the Presque Isle Bay Watershed is approximately 80% urban and 20% rural. More than one-half of the total watershed is residential, followed by 16% open areas, 11% commercial, 8% public and only 7% industrial use (PADER, 1992).

Contaminants Polluting Sediments

The sediments within the Presque Isle Bay AOC have been determined to be contaminated with heavy metals, Cyanide, Volatile Solids, oil and grease, and possible PAHs. Heavy metals of concern include Arsenic, Barium, Cadmium, Chromium, Copper, Iron, Lead, Manganese, Nickel and Zinc.

This AOC is still very involved in the initial information gathering stage. Based on the lack of conclusive sampling data and acceptable sediment criteria, the State is currently not ready to definitively say whether or not the sediments are seriously polluted and, if polluted, to what degree. This issue is complicated by the fact that while most of the beneficial indicators show that the condition of the sediments is not severely impacting the Presque Isle Bay ecosystem, the large problem with tumors in brown bullheads would indicate otherwise. It is known that the cause of the high tumor incidences is most likely contaminated sediments, however, much information still needs to be gathered to thoroughly evaluate the problem.

One known fact is the texture of the sediment within Presque Isle Bay is very fine (silts and clays) and it would be quite challenging to remove all contaminated sediments. In light of this, instead of dredging, the remedial activities selected for Presque Isle Bay may be to cap and/or lock the sediments in place.

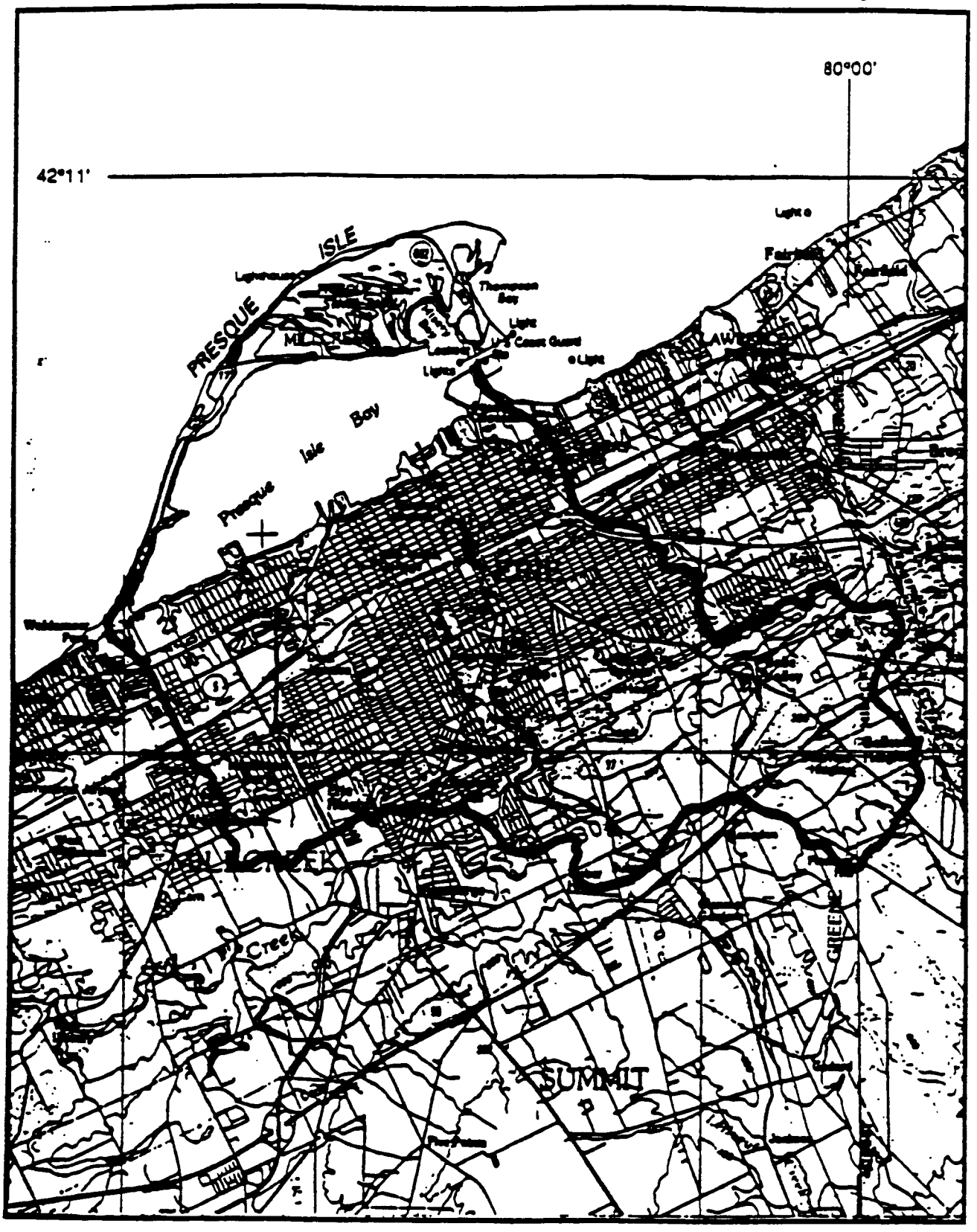
Volume of Contaminants or Contaminated Sediments

As of yet, no definitive numbers have been obtained for the volume of contaminated sediments within the Presque Isle Bay AOC. The volumes have not been established largely because there is no standard sediment criteria available to help determine what is and what is not "contaminated".

Fish Consumption Advisories

There are no AOC specific fish consumption advisories for Presque Isle Bay. The advisories issued to date apply generally to the PA waters of Lake Erie rather than to any specific locations. Overall, Presque Isle Bay is considered a "very diverse and excellent fishery" with over 40 species (PADER, 1992). The only species of fish considered to be in need of restoration to a healthy status are brown bullheads, which have shown an incidence of tumors and are believed to be affected by PAHs in the sediments or other tumor promoters.

Figure 28: Presque Isle Bay Area of Concern and Drainage Basin



Enforcement History Relating to Superfund Sites

Currently, no definitive link has been established between the contamination of the sediments and activities within the Superfund sites in the Presque Isle Bay AOC.

Dredging History Not Related to Superfund Actions

No dredging in relation to the remediation of contaminated sediments has ever occurred within the Presque Isle Bay, however, both the harbor basin and entrance channel sites are subject to periodic maintenance dredging.

Dredging by the USACE occurs on an "as needed" basis and has decreased over the last few years. The need for dredging is assessed annually and is generally influenced by the severity of the previous years' storms. The outer harbor dredge spoil is usually open lake disposed, while inner bay (harbor) sediments have normally been confined disposed in the CDF located adjacent to the AOC. This is largely because the outer harbor sediments are sandy, more coarsely textured and are less likely to absorb the contamination, while the inner harbor sediments, normally finely textured, have a higher absorption capacity. In addition to the USACE, local marinas also maintenance dredge sediments within Presque Isle Bay.

Technical Tools In Use and Needed

Before beginning the process of developing sediment remediation alternatives, additional sampling should be conducted with careful attention to undisturbed sediment profiles, so that it can be determined whether the pollutants of concern are evenly distributed throughout the bay or are located in specific "hot spots" (Patomac-Hudson Engineering, Inc., 1991). This AOC is still predominantly in the sampling and information gathering modes. Immediate future needs in helping to better characterize the sediment situation include performing sediment toxicity testing and identifying sediment quality through the analysis of sediment cores.

Within the Presque Isle Bay AOC there is also much work focused on the brown bullhead tumor problem. It has been determined that the problem is carcinogenic and not viral, so the PAHs in the sediments, the suspected cause, are currently being closely analyzed. Intensive research is progressing in an attempt to pick up the link between the sediments and the tumors in the brown bullheads.

State Requests

In general, it would be most helpful to the Presque Isle Bay RAP decision-makers if the new USEPA sediment criteria were available to provide guidance in determining the level of pollution within the sediments. The questions of whether or not the sediments are polluted and to what degree they may be polluted could then be answered. In the meantime, sediment coring studies and benthic community studies are presently in need of funding.

Wisconsin

Fox River/Lower Green Bay

Location of Site

The Lower Green Bay and the Fox River are located in northeastern Wisconsin at the southern end of Green Bay, Lake Michigan. Green Bay, into which the Fox River flows, runs approximately 119 miles northeast to beyond the city of Escanaba, Michigan. The AOC includes the city of Green Bay, the lower 7 miles of the Fox River from the last dam to the river's mouth and the south end of Green Bay extending north to Long Trail Point and Point au Sable (Figure 29). Industry and agriculture are highly concentrated in the Fox River/Lower Green Bay AOC, with a great concentration of pulp and paper mills located within the watershed.

Contaminants Polluting Sediments

Toxics, which originate from a variety of sources, have for many years, washed through the watershed and settled into the bottom sediments of the river and bay. Thus, sediments within the Fox River/Lower Green Bay AOC are now contaminated with PCBs, PAHs, heavy metals, pesticides, oil and grease. The contaminants of greatest concern within this AOC are PCBs. Concentrations for PCBs ranging from 0 to 220 ppm have been found throughout the Fox River/Lower Green Bay AOC, with the maximum levels having been sampled from a 40 acre "hot spot" of PCB contaminated bottom sediments in Little Lake Butte des Morts near Appleton, Wisconsin. It is estimated that this "hot spot" contains around 18% of PCB mass in the Lower Fox River above DePere Dam. The characterization of PCBs in the sediments within the Fox River/Lower Green Bay AOC is fairly extensive, however, data concerning the rest of the sediment pollutants is not as thorough.

The most recent levels of some sediment contaminants other than PCBs were determined by the USACE in a 1988 sampling study and were reported as follows (EPA Region V, 1992):

Cadmium: 4.10 to 5.90 ppm
Chromium: 68 to 150 ppm
Copper: 44 to 86 ppm
Lead: 130 to 210 ppm
Mercury: .68 to 3.6 ppm
Nickel: 20 to 26 ppm
Zinc: 150 to 270 ppm

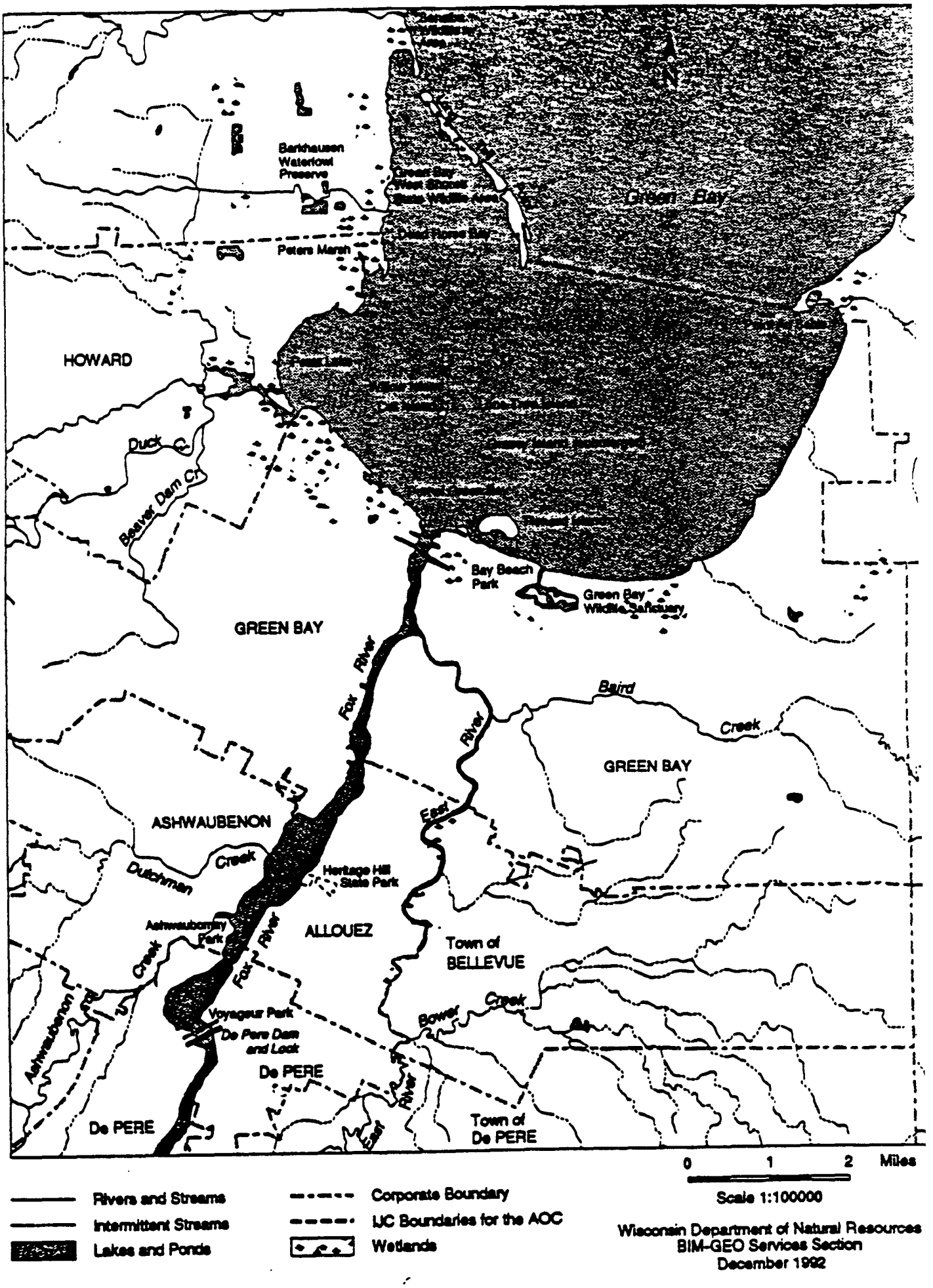
Volume of Contaminants or Contaminated Sediments

It has been estimated that there are approximately 7 million to 9 million cubic meters of contaminated sediment within the Fox River/Lower Green Bay AOC. Of this 7 to 9 million cubic meters, 2 million cubic meters are located within the 32 miles from DePere Dam, upstream to Little Lake Butte des Morts, while 5 to 7 million cubic meters are located in a 7 mile range from the DePere Dam, downstream, to the mouth of the river. Additionally, it has been estimated that there are 4,000 kg of PCBs upstream and 20 to 40,000 kg downstream of the DePere Dam.

Fish Consumption Advisories

The contamination of some fish in the Lower Green Bay is so great that the WDNR has, since 1976, issued warnings regarding human consumption of walleye, trout, salmon, white bass, white suckers, carp and catfish. Currently, because of high levels of PCBs, fish consumption advisories are in effect for most fish, except perch, within the AOC. Additionally, a waterfowl consumption advisory exists for mallard ducks in river reaches between Lake

Figure 29: Lower Green Bay and Fox River Area of Concern



Winnebago and the northeast limits of Kaukauna and within the Area of Concern.

Enforcement History Relating to Superfund Sites

In 1988, USEPA proposed the Fort Howard Paper Company sludge lagoons in the city of Green Bay as a NPL site. No remediation of contaminated sediments within the Fox River/Lower Green Bay AOC has occurred in conjunction with activity at this Superfund site.

Though it is not a Federal Superfund site, it is worthwhile to mention that the PCB contamination at Little Lake Butte des Morts (LLBM) is being addressed. The LLBM Remedial Investigation Project is a clean-up demonstration project directed by WDNR. No remedial options have yet been selected, but the project is working to initially address the contaminated sediments in the deposit containing the largest mass of PCBs (called "Deposit A").

Dredging History Not Relating to Superfund Actions

No dredging of contaminated sediments has occurred within the Fox River/Lower Green Bay AOC. In 1993, the USACE maintenance dredging goal for navigational purposes was to remove 400,000 cubic yards. This amount will be 200,000 cubic yards less than averages prior to 1985.

Technical Tools In Use and Needed

A very important technical tool that has been implemented within this AOC is the Green Bay Mass Balance Study. This study represents the first attempt to fully account for every source, all modes of transport and the various fates of a toxic industrial chemical contaminant in an ecosystem. The principal benefit of the study was to enable the WDNR to evaluate the most cost-effective remedies for dealing with PCB contamination. The Mass Balance Study was a joint effort of USEPA, WDNR, WI Sea Grant Institute and other agencies to provide key information about the flow of toxic materials, specifically PCBs, Cadmium, Lead and dieldrin, into, within and out of the Green Bay ecosystem. By monitoring and quantifying all sources of toxic materials, information can be gathered about how toxics enter the bay, what happens to the toxics while in the bay and how and when toxics leave the bay, if in fact they do.

The following information outlines preliminary findings and long term predictions based upon results from the Green Bay Mass Balance:

1. 4,000 kg of PCBs are in the sediment of the Fox River between Lake Winnebago and DePere. Most of the PCBs are in the top 35 cm of the sediment. 25,000 to 40,000 kg of PCBs are in the sediment of the last 7 miles of the Fox River downstream of the DePere dam. Much of this contamination is buried fairly deep with significant PCB concentrations extending 5 meters in some sediment cores. Also, 8,500 to 15,000 kg of PCBs are in the top 12 cm of the Green Bay sediments.
2. During the mass balance study year of 1989, 175 kg of PCB was transported over the DePere dam in the Fox River, while 283 kg of PCB was transported from the mouth of the Fox River to Green Bay. Almost all PCBs transported originated in the Fox River sediments between Lake Winnebago and Green Bay. Point sources of PCBs accounted for less than 1% of the total transport to Green Bay. The upstream load from Lake Winnebago and the estimated load from urban runoff were also very small. The Fox River accounted for about 75% of all PCB inputs to Green Bay.
3. Some of the more contaminated deposits upstream of DePere are expected to remain pretty much in tact for more than 25 years with the potential to cause continued contamination of local fish and aquatic life. PCB transport is predicted to follow a similar

trend to the transport at DePere, but the trend is much more sensitive to variations in future flows.

4. Remediation of 540,000 cubic meters of contaminated sediment upstream of DePere was predicted to reduce the PCB transport to Green Bay over the next 25 years from 1,740 to 1,515 kg. Remediation would also eliminate the effect of some of the "hot spots" on the local fish and aquatic life. An additional remediation of 4,300,000 cubic meters of contaminated sediment below the DePere dam is predicted to further reduce the 25 year transport to Green Bay to 931 kg.

As for another technical tool, in a project closely related to the Green Bay Mass Balance Study, WDNR is conducting an assessment of the sources and movements of PCBs in the Lower Fox River. Through massive sediment sampling, the WDNR and the US Geological Survey are mapping sediments, quantifying the presence and sources of PCBs and modeling the movement of PCBs in the Fox River from Little Lake Butte des Morts to the DePere Dam.

State Requests

An important project for the Fox River is to perform a pre-remediation site assessment for the Fox River, and Brown, Outagamie and Winnebago Counties. This would involve collecting and analyzing sediment and water column samples from one to four soft sediment deposits in the Fox River upstream of the DePere Dam. The sites were chosen by using a ranking system based on a procedure which evaluated PCB mass delivery of pollutants to the water column under varying flow conditions. The purpose of these assessments would be to characterize the lateral and vertical extent of PCB contamination, determine physical characteristics of the sediments and identify other pollutants which could affect a choice of remedial option. This study would need to be completed to proceed to design and engineering phases of a selected remedial action. Field work for this project will hopefully take place from May to June of 1994.

Menominee River

Location of Site

The Menominee River is the boundary between northeastern Wisconsin and the Upper Peninsula of Michigan. The river's headwaters originate in both states. The main stem of the river flows between the cities of Menominee, Michigan and Marinette, Wisconsin before emptying into Green Bay. The AOC includes the lower three miles of the river up to the second Scott Paper Company Dam, the cities of Marinette and Menominee and the adjacent nearshore area of Green Bay extending three miles north and south of the river mouth. Land use within the AOC is primarily industrial and residential. Chemical companies, a paper mill, a municipal WWTP, a ship building company and a foundry are located along the south shore of the river, while another paper mill, shipping warehouse and municipal WWTP are located on the river's north shore.

Contaminants Polluting Sediments

A primary problem within the Menominee River AOC is sediment contamination by Arsenic, a heavy metal. Sediments in certain areas of the river are highly contaminated with Arsenic. The main source of Arsenic is the Ansul Fire Protection Company in Marinette that produced herbicides. Arsenic contaminated salt was discharged directly into the river when the company began operations in the 1950's. Ansul's property, some of the groundwater beneath the site and the river's sediments adjacent to the site are currently contaminated with Arsenic.

Sampling by the USACE in 1986 found Arsenic concentrations between .5 to 1,953 ppm in the sediments within the Menominee River AOC. Later USACE sampling in 1990 obtained a range from 1.29 to 15.43 ppm (USEPA Region V, 1992). There is also contamination of the sediments by Cadmium, Chromium, Lead, Mercury, Zinc, PCBs, PAHs, oil and grease.

Volume of Contaminants or Contaminated Sediments

The only estimates of contaminated sediment were generated by the USACE in 1986 for navigational dredging. The assessment determined that the portion of the turning basin needing to be dredged for navigational purposes includes some 40,000 cubic yards of contaminated sediment. Of this total, some 28,900 cubic yards of sediment were estimated to contain Arsenic concentrations three times greater than the 278 ppm that would be classified in the RCRA program as a hazardous waste.

Fish Consumption Advisories

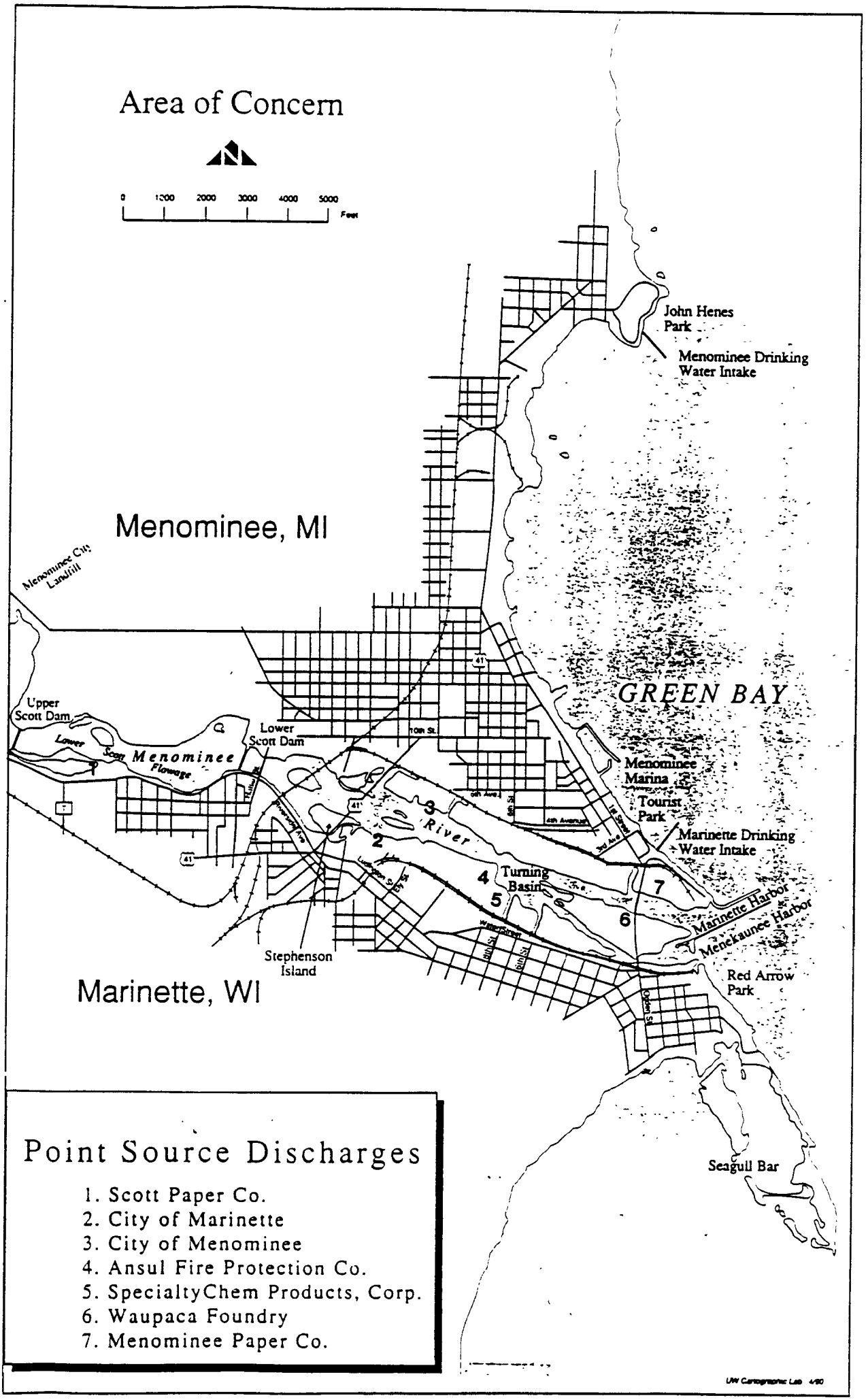
Both Wisconsin and Michigan have issued health advisories for people who eat fish caught in Green Bay and the Menominee River up to the first dam. In Wisconsin, there are two sets of consumption recommendations, one for risks from PCBs and pesticides and one for risks from Mercury. The species included within the advisories are rainbow, brown and brook trout, chinook salmon, smallmouth, rock and white bass, northern pike, walleye, perch, bullhead, white sucker, carp and sturgeon. The consumption recommendations for these species vary depending upon the size of the fish and the location from which it was caught.

Enforcement History Relating to Superfund Sites

Currently, there is no remediation of the sediments occurring in conjunction with any Federal Superfund site. However, there is important work in progress under a RCRA Corrective Action Consent Order. The RCRA Corrective Action involves the Ansul Fire Protection Company, a former herbicide manufacturing facility, which stored and discharged an Arsenic waste salt and ultimately contaminated the groundwater and sediments. In 1981, in compliance with a Consent Order issued by WDNR, Ansul pumped 16 million gallons of Arsenic contaminated groundwater from the company's property. It was estimated that this action removed 95% of the Arsenic from a sand layer 15 to 30 feet beneath the surface. In 1990, as part of the RCRA Consent Order, Ansul submitted a RCRA Facility Investigation (RFI) to assess the remaining contamination. This plan was subsequently rejected by EPA in 1991 which noted that the workplan was "extremely deficient and inadequate". A revised RFI proposal was submitted by Ansul in 1992 and is presently being reviewed by EPA and WDNR. Initial review comments indicate that the second RFI proposal is still inadequate to assess the site.

There is also valuable work occurring under a RCRA Corrective Action Order (EPA and WDNR) and an Administrative Order to address a paint sludge contamination site and investigate a historic PAH contaminated coal gasification site.

The paint sludge site is located along one-half mile of both off shore and upland areas. This site was once the dumping grounds for a furniture manufacturing facility for more than 10 years. Work is presently underway to clean-up the sludge deposits averaging three feet thick and containing Lead, along with other metals and organic compounds. A water proof dike is being constructed around the contaminated site. Water inside the dike will be pumped out to facilitate clean-up of the site which is expected to take place in 1994. To date there has been no sediment removed or remediated at this site.


Area of Concern
0 1000 2000 3000 4000 5000
Feet
John Henes Park
Menominee Drinking Water Intake
Menominee, MI
Menominee City Landfill
GREEN BAY
Upper Scott Dam
Lower Scott Dam
Lower Scott Menominee Flowage
Menominee Marina
Tourist Park
Marinette Drinking Water Intake
River
Turning Basin
Marinette Harbor
Menekaunee Harbor
Red Arrow Park
Stephenson Island
Marinette, WI
Seagull Bar
Point Source Discharges
1. Scott Paper Co.
2. City of Marinette
3. City of Menominee
4. Ansul Fire Protection Co.
5. SpecialtyChem Products, Corp.
6. Waupaca Foundry
7. Menominee Paper Co.
UW Cartographic Lab 4/90

High concentrations of PAHs have been detected at the site of a historic coal gasification operation. In 1991, solid phase toxicity tests with sediments collected from this site resulted in 100 percent toxicity using a 48 hour acute toxicity test.

Dredging History Not Related to Superfund Actions

Dredging of the turning basin has not occurred since 1962 due to sediment contamination. Much of the Arsenic contaminated sediment in the turning basin would be classified as a hazardous waste if it was removed without first being treated. Maintenance dredging of the shipping (main) channel to its current depth of 21 feet and the entrance channel to its depth of 23 feet last occurred during the summer of 1991. Dredged materials were disposed of in the Michigan waters of Green Bay about three miles north of the AOC.

Technical Tools In Use and Needed

Most of the sediment related activity within the Menominee River AOC is occurring in conjunction with the EPA/WDNR RCRA Corrective Action Enforcement Program and with an investigation into coal tar (PAH) contamination of the river sediment adjacent to the Marinette WWTP. Sediment sampling and analysis of the Lower Menominee River is needed in order to compliment the ongoing planning and enforcement initiatives. This data will help better characterize the sediment situation within the entire Menominee River AOC to assist in remedial decision-making for sections of the river not being addressed by the enforcement activities.

State Requests

An extensive sediment assessment survey is needed for the Menominee River AOC in order to determine the condition of the sediments. The proposed survey is recommended by WDNR to be conducted in deposition zones adjacent or below six point source pollution dischargers: Scott Paper, Marinette WWTP, City of Menominee WWTP, Ansul-Specialty Chemical outfall, Waupaaca Foundry and Menominee Paper. In addition, samples have been recommended to be collected in the Sixth Street Slip, the south channel of the river, the nearest deposition zone adjacent to 2 CSOs and the turning basin adjacent to the Ansul Company. Surficial grab samples and core samples would both be helpful.

Milwaukee Estuary

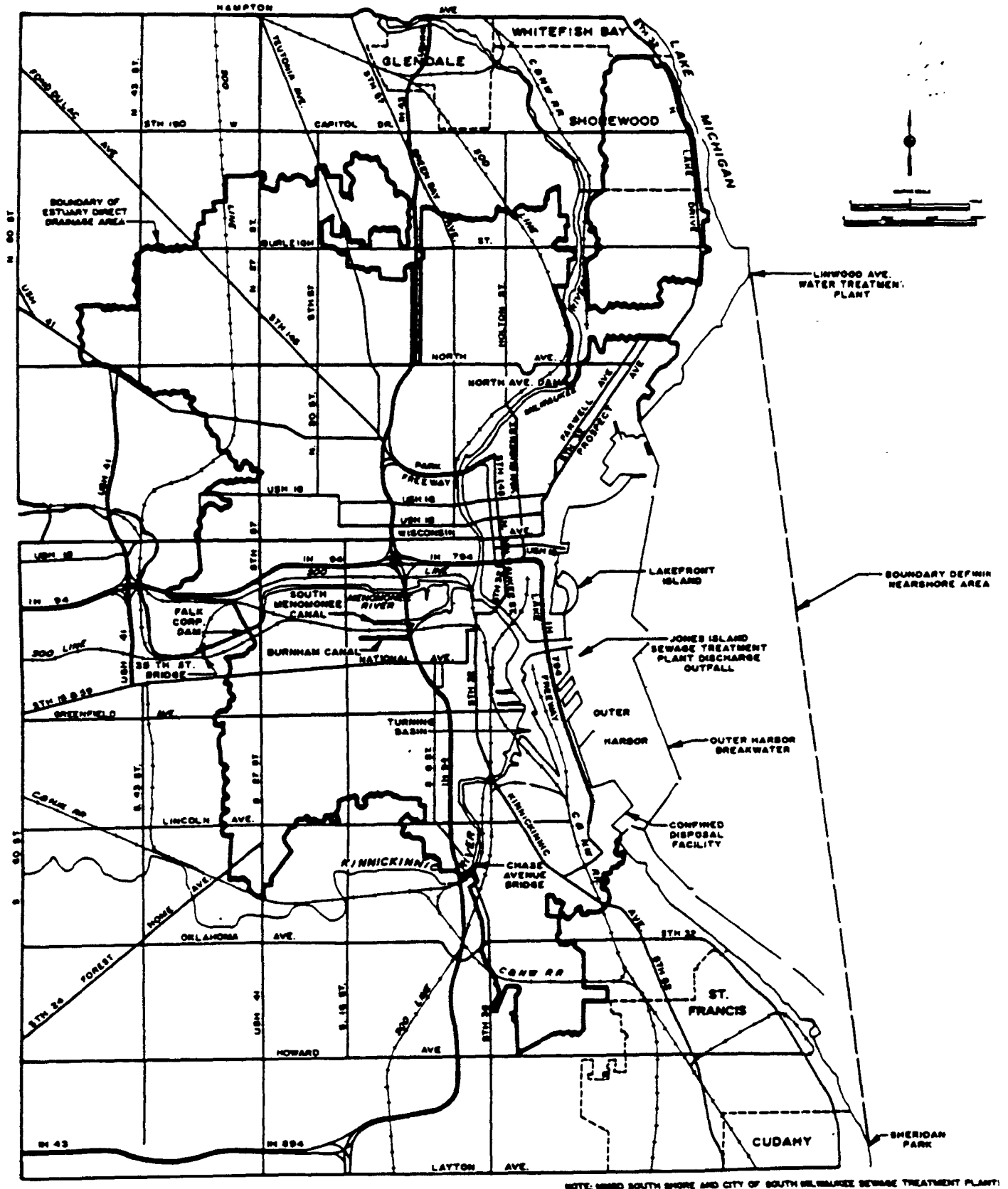
Location of Site

The Milwaukee Harbor is located on the Wisconsin shore of Lake Michigan. The Milwaukee Estuary AOC includes the Milwaukee Harbor Estuary and the nearshore areas of Lake Michigan, outside the Outer Harbor, bounded by a line extending north from Sheridan Park northwest to the city of Milwaukee's Linnwood water intake. The Milwaukee Estuary encompasses the lower 3.1 miles of the Milwaukee River downstream of the North Avenue Dam, the lower 3.0 miles of the Menominee River downstream of 35th Street, the lower 2.5 miles of the Kinnickinnic River downstream of Chase Avenue and the Outer Harbor, the part of Lake Michigan enclosed within the breakwalls (WDNR 1, 1991). The AOC is primarily industrial and contains large shipping and port facilities, while residential and commercial districts are also present along the river.

Contaminants Polluting Sediments

Sediments within the Milwaukee Estuary AOC are heavily polluted with heavy metals,

Figure 31: Milwaukee Estuary Area of Concern and Direct Drainage Area



Source: Wisconsin Department of Natural Resources and SEWRPC.

PAHs, PCBs, pesticides, oil and grease. Heavy metals of concern include Arsenic, Cadmium, Chromium, Lead, and Zinc. The pollutants causing the greatest problems in this AOC are PAHs and PCBs. One example of this contamination is the Moss-American Superfund site, a known source of PAHs to the Milwaukee AOC, which has a PAH concentration within the sediments near the site ranging from 5.9 to 4,600 ppm (WDNR 1, 1991). Sediment sampling results from the Moss-American site have also indicated that background levels for total PAHs lie between 6.9 and 24 ppm. An example of the PCB problem, concentrations as high as 41,000 ppm, were discovered in recent WDNR analysis of sediment cores from Ruck Pond, a source of contamination to the Milwaukee River. Some other ranges of sediment contaminants, obtained from 1989 USACE sampling, are as follows (USEPA Region V, 1992):

Inner Harbor
Arsenic: 5.3 to 8.3 ppm
Cadmium: 1.5 to 2.5 ppm
Chromium: 200 to 3,100 ppm
Lead: 100 to 390 ppm
Zinc: 240 to 420 ppm

Outer Harbor
Arsenic: 1.4 to 12 ppm
Chromium: 23 to 650 ppm
Lead: 3.6 to 120 ppm
Zinc: 55 to 390 ppm

Additionally, mass balance modeling conducted on the Cedar Creek (a tributary to the Milwaukee River) impoundments has identified relatively confined deposits of PCB contamination. However, there is limited knowledge of deposits of contamination on other portions of the Milwaukee system. A study conducted by University of Milwaukee-Wisconsin researchers found increasing concentrations of both PCBs and PAHs at increased depths within the Milwaukee Estuary AOC. Because the cores were only approximately 1.5 meters in length, the extent of contamination has yet to be determined. This study is considered preliminary, and extensive characterization of the sediments within the Milwaukee Estuary AOC remains to be completed. Some depositional areas were found in the study, but it has not been definitively determined whether the contamination is concentrated in "hot spots" or if it remains relatively distributed.

Volume of Contaminants or Contaminated Sediments

No estimates are currently available as to the volume of contaminated sediments present within the Milwaukee Estuary AOC. As part of the Cedar Creek Mass Balance Study, a volume of 69,250 cubic meters was estimated for the total amount of sediment in Ruck, Columbia, Wire and Nail and Hamilton Ponds, however, it was not determined what volume of this sediment was contaminated. In addition, the UW-Milwaukee researchers estimated the volume of soft sediment in the AOC proper. The method used was never verified for accuracy and the study did not estimate the mass of contaminated sediment or the full extent to which the sediment deposits were contaminated.

It is recognized that upstream sources of pollution, such as the Cedar Creek impoundments and the Moss-American Superfund site, are contributing to the degradation of the Milwaukee Estuary AOC. There is little information on the volume of contaminated sediment within the three river systems in the basin.

Fish Consumption Advisories

Fish consumption advisories have been issued by the state since 1976. These advisories are for both migratory and resident fish species and are based on levels of PCBs and pesticides that exceed uniformly acceptable levels. Specifically, within the Milwaukee Estuary AOC, the advisory recommends that the following fish should not be eaten because of contamination

from PCBs and pesticides: crappie, northern pike, carp, redhorse, smallmouth bass and white sucker. In addition to Lake Michigan carp and catfish, the following trout and salmon pose a moderate to great health risk and should not be eaten: lake trout over 20", chinook salmon over 21", coho salmon over 26" and any brown trout, especially those over 23".

Enforcement History Relating to Superfund Sites

The Moss-American Federal Superfund site, a source of PAHs to the Little Menominee River, was placed on the NPL in 1983. This site is approximately 15 miles upstream of the AOC and is 88 acres in size. The Moss-American site is a former wood preserving facility where railroad ties were treated with a creosote and fuel oil mixture. During operation, liquid wastes were discharged to settling ponds which drained into the Little Menominee River. Environmental problems observed at the site relate to the use and disposal of creosote, which resulted in the release of PAHs to the environment. The Moss-American ROD proposed construction of a clean channel to eliminate the river from coming in contact with contaminated sediments. This option will entail rerouting the river to a clean area, remediating the contaminated sediment and backfilling the existing channel with clean fill. It has been determined by WDNR that sediment clean-up should be to 6 to 8 ppm cPAHs. The first year of three-years of Pre-Remedial Design activities was initiated in 1992.

Dredging History Not Related to Superfund Actions

Prior to 1970, when the Milwaukee Harbor was dredged, the spoils were open lake dumped into Lake Michigan. In 1975, the USACE constructed a CDF along the shoreline in the southern portion of the Milwaukee Outer Harbor. The CDF covers 53 acres and has a capacity of 1.6 million cubic yards. It is expected that this one cell unit will be filled and capped in the mid-1990s. The ACE is currently looking for other options for disposal of dredged material. It has not been determined whether the ACE is looking to expand the facility, or whether other disposal options will be selected.

The USACE, the City of Milwaukee, the Milwaukee Metropolitan Sewerage District and private riparian property owners all conduct maintenance dredging in the Milwaukee Estuary. From 1978 to 1989, a total of 1,458,500 cubic yards of sediment was removed in conjunction with maintenance dredging operations under federal and state projects (WDNR 1, 1991). This dredge spoil was CDF disposed. The CDF is expected to be filled around 1997.

Technical Tools In Use and Needed

To date, WDNR has not had the opportunity to perform extensive sampling studies in order to better characterize the sediments within the Milwaukee Estuary AOC, but there are hopes to initiate this data collection soon. Most work has been focused on the serious PAH and PCB contamination at, respectively, the Moss-American Superfund site and the Cedar Creek impoundments. None of the planned remedial activity has been started on the Moss-American site, however, the consent decrees for remediation have all been signed. Currently, the PRP for the site is awaiting permission by Milwaukee County to proceed with an assessment of the site. Mass balance modeling initiated in 1990, was completed for the Cedar Creek impoundments in order to obtain a better understanding of the loading and movement of PCBs from the impoundments into the Milwaukee River.

Additionally, as part of the research for a second CDF, a study is being proposed that will focus on routes of contaminant transport out of the CDF. The results of this study will help determine what will be done to the CDF once it is filled.

State Requests

The needs mentioned by the State for the Milwaukee Estuary AOC centered on plans to perform sediment studies in order to better define sediment contamination throughout the AOC and in the upstream reaches of the river systems. Specifically, sediment analysis is needed to supplement the Milwaukee River Mass Balance Study. Currently, there is money available to pay for water quality monitoring, but, no funding is available for mapping and sediment coring. The State would like to collect 100 sediment samples to analyze for TOC, total PCBs and congeners and PAHs. Additionally, assistance with the implementation of sediment remediation of the North Avenue Dam impoundment would be helpful. The North Avenue Dam is a 92 acre impoundment with sediment depth up to 15 feet, however, not all of the sediment is contaminated. Finally, there is also a need for general soft deposit determination within the Milwaukee Estuary AOC.

Sheboygan River and Harbor

Location of Site

The Sheboygan River enters Lake Michigan at the city of Sheboygan. The AOC includes both Sheboygan Harbor and the lower 14 miles of the river from Sheboygan Falls to the harbor mouth. Within the AOC, the river flows through the city of Sheboygan Falls, the Village of Kohler and the city of Sheboygan. The river also has two major tributaries, the Mullet and Onion Rivers. Land use within the Sheboygan River and Harbor AOC is industrial and residential, while land use is agricultural along the tributaries from regions west of the city.

Contaminants Polluting Sediments

Sediments within the Sheboygan River and Harbor AOC are heavily polluted with PCBs and heavy metals. PCBs are the most significant problem in the AOC, while metals such as Chromium, Copper and Lead have also contributed to the sediment pollution. Analyses of harbor sediments have indicated that the most highly contaminated sediments are located near the river mouth, and exceed 50 ppm below a depth of 2 feet from the sediment-water interface. PCB levels upstream of the Lower Kohler Dam in Kohler have been found to range between 27 and 81 ppm. Sampling, in conjunction with various USEPA Region V Superfund investigations from 1985 to 1990, discovered a maximum PCB concentration of 4500 ppm within the AOC prior to remedial dredging. Currently, the maximum PCB concentration in the river is 503 ppm, but most of the river contains PCBs in concentrations less than 20 ppm. Additionally, in some areas within the AOC, floodplain soils have been found to be contaminated with PCB concentrations between 200 and 300 ppm.

Volume of Contaminants or Contaminated Sediments

In the upper river portions of the AOC, approximately 5,000 cubic yards of the most highly contaminated sediment have been removed and are currently located in two holding tanks on the Tecumseh Products Corporation property in Sheboygan Falls. No estimates are available as to the volume of contaminated sediments that remain to be remediated from the Sheboygan AOC.

Fish Consumption Advisories

Due to the level of PCB contamination in fish, a "no consumption" advisory has been

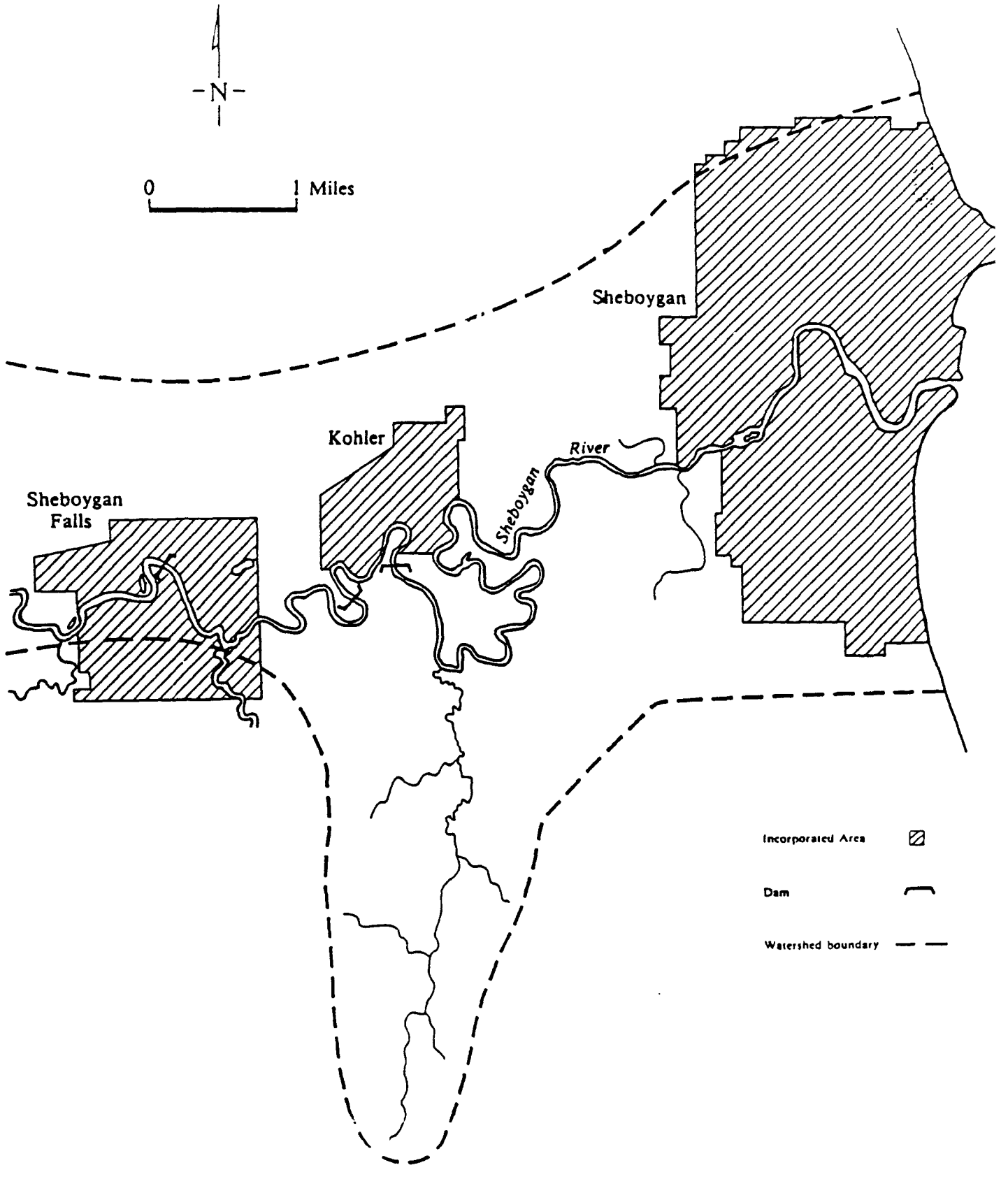


Figure 32: Sheboygan River Area of Concern

issued by the WDNR and the Wisconsin Division of Health for all resident fish species, including smallmouth bass, walleye and panfish, as well as for migratory species such as chinook salmon and steelhead trout. Despite the fish advisories, some people continue to consume fish from the Sheboygan River and Harbor. The fishing advisory was established in 1978 due to PCB concentrations in excess of the 2 ppm USFDA health-based level.

In 1987, WDNR discontinued stocking trout and salmon in the Sheboygan River due to elevated levels of PCBs within the river. In 1990, an experimental program was initiated to determine the PCB uptake and body burden of small and adult steelhead and coho salmon. The results of the study will determine the feasibility of the Sheboygan River as a stocking site for Lake Michigan Fishes. This study will evaluate the levels of PCBs in returning migratory species, and determine the feasibility of continued stocking in the Sheboygan River.

Enforcement History Relating to Superfund Sites

Much of the Sheboygan AOC comprises a Federal Superfund site, the Sheboygan River and Harbor site. In 1985, USEPA nominated the 14-mile river and 96-acre harbor onto the National Priorities List. In 1986, Tecumseh Products Company agreed to conduct the RI/FS for this site. The RI/FS included collecting sediment, soil and water samples from the river and harbor over a period beginning in May, 1987, to the present. At the completion of the RI in 1988, a Remedial Investigation/Enhanced Screening (RI/ES) Report was completed. The RI/ES summarized and documented the RI activities and findings, and contained a preliminary evaluation of potential remedial alternatives for addressing the contamination problems associated with the site. The RI/ES also included an endangerment assessment that indicated some conditions at the site present an unacceptable long-term risk to human health and the environment (Blasland and Bouck Engineers, 1990). Upon review of the RI/ES, EPA requested that the 3 sediment areas with the highest PCB concentrations be removed from the upper river and treatability studies be conducted on the sediment.

The next phase of the project involved an Alternative Specific Remedial Investigation (ASRI). The ASRI incorporated a number of studies, including the removal of approximately 2,500 cubic yards of sediment from the upper river; their placement into a Confined Treatment Facility (CTF), a rectangular structure comprised of four cells in which bioremediation is being studied; various other treatability studies of sediment treatment technologies; a pilot study of armoring; and monitoring of water, sediment and biota. In January 1991, the Construction Documentation Report documenting the construction, dredging and armoring activities was completed. A draft ASRI Report was completed in March 1992, and discussed the results of the various studies. These results are currently being evaluated and discussed. In addition, the results of the pilot bioremediation study in the CTF are being evaluated to determine whether the pilot study should be continued another year. The preliminary findings indicate that the pilot study results have not achieved the same level of degradation as the bench-scale studies. The pilot bioremediation project is being performed with technical assistance from the ARCS Program and constitutes the Sheboygan AOC Demonstration Project.

A removal action was done in 1991. Approximately 2,700 cubic yards of PCB contaminated sediment was dredged from the upper river and was placed into a Sediment Management Facility (SMF-a tank) built on Tecumseh's property for interim storage. The Record of Decision (ROD) for the site will determine the ultimate fate of the sediment in both the CTF and SMF.

Additionally, in 1984, the Kohler Company Landfill was placed on the NPL due to the potential for groundwater contamination. This landfill is a probable source of pollutants, including heavy metals, to the Sheboygan River and Harbor. The Kohler Company is the PRP for the landfill and has also been identified as a PRP for the heavy metals contamination in the Sheboygan River sediment.

Dredging Not Related to Superfund Actions

Sediment input to the Sheboygan Harbor is estimated to be 30,000 cubic yards per year. In 1981, 1984, 1985, 1987 and 1989, the USACE dredged a total of 110,481 cubic yards from the harbor mouth and used the dredge spoil as beach nourishment and industrial fill. For the navigation channel, however, no dredging has been initiated since 1969 because of disposal problems associated with contaminated sediments.

Technical Tools In Use and Needed

Most of the technical tools in use within the Sheboygan AOC are activities being performed in conjunction with the Superfund sites. Additionally, as one of the ARCS priority sites, a human health risk assessment resulting from PCB contamination was performed on the Sheboygan River and Harbor. Results from the risk assessment indicated that fish consumption should be avoided from the Sheboygan River AOC. Of the species collected, carp were the most contaminated with PCBs. In addition, dermal exposure to floodplain soils appeared to be of marginal concern under a reasonable maximum exposure scenario (Crane, J.L. (4), 1993). The results of this risk assessment were not directly comparable to the human health endangerment assessment given in the RI/ES report because different exposure parameters were often used.

State Requests

The State of Wisconsin indicated a need for assistance in funding a toxic congener assessment of sediment deposits that would involve identifying longitudinal variation. It is intended that Geographic Information Systems (GIS) be used to visualize those deposits that are most highly contaminated and also those that are most toxic. Also needed are PAH assessment and mapping within the lower Sheboygan River, and a determination of contaminated sediment loadings to Lake Michigan. The determination of contaminated sediment loadings would include a mass balance focusing on upstream to downstream loadings at strategic positions in the river. Scenarios that would be analyzed are upper river movement to Kohler Dams, movement from Kohler Dams to the Harbor and movement from the Harbor the Lake Michigan.

Summary

In concluding this report, it is worthwhile to provide a few remarks that summarize the most frequently occurring state requests and comments that were provided during the research. There were three areas addressed by a vast majority of the state contacts. The first, and most often mentioned, area concerned the work of the ARCS Program. It was generally felt that the ARCS work has been an integral segment of the overall sediment remedial process by providing guidance and technical assistance to the involved states within an organized framework. The majority of state contacts mentioned that it will be very important for the ARCS Program to be expanded to include AOCs other than the priority sites that have directly benefitted from the past years of work.

Second, it was often mentioned that EPA's development of sediment criteria is integral to the remedial decision-making process within many AOCs. The importance of the sediment criteria has been, and will continue to be, a heavily debated issue. However, the belief that the sediment criteria, once completed, will provide a clear-cut answer to contaminated sediment remedial decisions is present. This most likely will not be the case. Apparently, there has been a communication gap between the federal and state levels concerning the importance of the sediment criteria. It would be helpful if this problem could be addressed by EPA in some manner so remedial decisions within the AOCs are not stalled "because they are waiting for sediment guidelines" before further addressing the contaminated sediments.

Last, it was also mentioned that it would be informative if a full-scale demonstration was performed under the ARCS program so that the recovery process of an AOC could be studied. While pilot demonstrations that remove a small amount of sediment for testing have been very useful, a great deal more could be learned by completely remediating a site and monitoring the response of the ecosystem. Complete remediation of an AOC is an area that has, as of yet, remained untouched and providing an example for other sites to follow would be extremely valuable. The only site specifically suggested was Manistique Bay, a relatively small and contained AOC which has a clearly defined sediment problem.

This report was intended to provide an overview of the sediment issues and activities that have been completed and are in progress within the United States Great Lakes Areas of Concern. It is hoped that this report will create opportunities for information sharing between AOCs in order to help the states with the monumental challenge of completely remediating these sites.

References

ARCS Program. Pilot Scale Demonstration of Remediation Technologies' Thermal Desorption Unit on Contaminated Sediments from the Buffalo River (Draft). 1993.

Benzie, S. for MDNR. Strategy for Addressing Contaminated Sediments in the Detroit River and Trenton Channel. June 21, 1993. Surface Water Quality Division.

Blasland and Bouck Engineers for Foley and Lardner/Tecumseh Products Company. Remedial Investigation/Enhunced Screening Report: Sheboygan River and Harbor. May, 1990. Sheboygan Falls, WI.

Blasland and Bouck Engineers for Tecumseh Products Company. Alternative Specific Remedial Investigation Report: Sheboygan River and Harbor (Draft). March, 1992. Volume 1 of 4. Sheboygan Falls, WI.

Brandon, D.L., Lee, C.R., Simmers, J.W., Tatem, H.E. and Skogerboe, J.G. "Information Summary, Area of Concern: Saginaw River and Saginaw Bay". 1991. Miscellaneous Paper EL-91-7. US Army Engineer Waterways Experiment Station. Vicksburg, MS.

Crane, J.L.(1) for USEPA GLNPO. Baseline Human Health Risk Assessment: Grand Calumet River/Indiana Harbor Canal, Indiana, Area of Concern (Draft). September, 1992. Environmental Research Laboratory. Athens, GA.

Crane, J.L. (2) for USEPA GLNPO. ARCS Baseline Human Health Risk Assessment: Saginaw River, Michigan, Area of Concern. December, 1992. Environmental Research Laboratory. Athens, GA.

Crane, J.L. (3) for USEPA GLNPO. Baseline Human Health Risk Assessment: Ashtabula River, Ohio, Area of Concern. December, 1992. Environmental Research Laboratory. Athens, GA.

Crane, J.L. (4) for USEPA GLNPO. Baseline Human Healts Risks Resulting from PCB Contamination at the Sheboygan River, Wisconsin, Area of Concern. February, 1993. Environmental Research Laboratory. Athens, GA.

Cuyahoga River Remedial Action Plan Coordinating Committee. Cuyahoga River Remedial Action Plan Stage I Report. June 1992. Cleveland, OH.

Estenik, J.F. Cuyahoga River and Cuyahoga River Tributaries Evaluation of Sediment PAHs for Fish Tumorigenic Potential. February 1, 1993. OEPA. Division of Water Quality Planning and Assessment.

Hartig, J.H. and R.L. Thomas. "Development of Plans to Restore Degraded Areas in the Great Lakes". Environmental Management. Volume 12. Number 3. Pages 327-347.

Hey and Associates, Inc. for IEPA. Waukegan Area of Concern Remedial Action Plan (Draft). January 8, 1992. Chapter 5 (Draft). April 12, 1993. Chapter 6,7 and 10 (Draft). September 3, 1992. Chapter 8 (Draft). February 28, 1992. Chapter 9 (Draft). October

6,1992. Libertyville, IL.

IDEM. The Remedial Action Plan for the Indiana Harbor Canal, Grand Calumet River and the Nearshore Lake Michigan. Stage I. January, 1991.

Maumee River Remedial Action Plan Advisory Committee. Maumee River Remedial Action Plan Stage I Investigative Report. October, 1990. OEPA.

MDNR 1. Remedial Action Plan for Clinton River Area of Concern. November, 1988. Surface Water Quality Division. Lansing, MI.

MDNR 2. Remedial Action Plan for Deer Lake Area of Concern. October 27, 1987. Surface Water Quality Division. Lansing, MI.

MDNR 3. Kalamazoo River Remedial Action Plan (First Draft). September, 1987. Surface Water Quality Division. Lansing, MI.

MDNR 4. Remedial Action Plan for Muskegon Lake Area of Concern. October 27, 1987. Surface Water Quality Division. Lansing, MI.

MDNR 5. River Raisin Area of Concern Remedial Action Plan (Third Draft). August, 1987. Surface Water Quality Division. Lansing, MI.

MDNR 6. A Sediment Survey of the Rouge River Basin. Wayne and Oakland Counties, MI. February-November, 1989. Staff Report. June, 1992. Surface Water Quality Division. Lansing, MI.

MDNR 7. Remedial Action Plan for Saginaw River/Bay Area of Concern. September, 1988. Surface Water Quality Division. Lansing, MI.

MDNR and OME. Stage I Remedial Action Plan for the Detroit River Area of Concern (Draft). November 5, 1990. Lansing, MI and Sarnia, Ontario.

MDNR and SEMCOG. Remedial Action Plan for the Rouge River Basin. Volume 1: Executive Summary. September, 1990. Prepared for: Michigan Water Resources Commission.

Monroe County Department of Planning and Development. Rochester Embayment Remedial Action Plan (Draft Stage I). January, 1993.

MPCA and WDNR. The St. Louis River System Remedial Action Plan Stage I. April, 1992.

Mueller, Dr. M.E. for ARCS. Ashtabula River and Buffalo River Tumor Surveys Final Report. December, 1992. USFWS. Ann Arbor, MI.

NYSDEC 1. Buffalo River Remedial Action Plan Summary. November, 1989. Buffalo, NY.

NYSDEC 2. Buffalo River Remedial Action Plan Annual Report. June, 1990. June, 1991. June, 1992. Division of Water. Buffalo, NY.

NYSDEC 3. Niagara River Remedial Action Plan (Draft). March, 1993. Volume I and II. Division of Water.

NYSDEC 4. Oswego River Remedial Action Plan. Stage I. June 1991. Stage II. June 1991. Division of Water.

NYSDEC 5. St. Lawrence River at Massena Remedial Action Plan Stage I. November, 1990. Great Lakes Section, Division of Water.

OEPA 1. Ashtabula River Remedial Action Plan Stage I Investigation Report. December, 1991.

OEPA 2. Cuyahoga River and Nearshore Lake Erie Sediment Data (Draft). 1991.

PADER and the Presque Isle Bay Public Advisory Committee. Presque Isle Bay Remedial Action Plan. December, 1992.

Potomac-Hudson Engineering, Inc. for PADER. Presque Isle Bay Ecosystem Study Background Report. June, 1991. Bethesda, MD.

SAIC 1. Manistique River Area of Concern Remedial Action Plan (Revised Draft). July 1987. McLean, VA.

SAIC 2. White Lake Area of Concern Remedial Action Plan (Initial Draft). April 28, 1987. McLean, VA.

SAIC 3. Eighteenmile Creek/Olcott Harbor Area of Concern Remedial Action Plan (Initial Draft). June 15, 1987.

SAIC 4. Resources Conservation Company B.E.S.T. Solvent Extraction Technology Applications Analysis Report (Final Draft). March 1993. Risk Reduction Engineering Laboratory. Cincinnati, OH.

Simmers, J.W., Lee, C.R. Brandon, D.L., Tatem, H.E., and Skogerboe, J.G. 1991. "Information Summary, Area of Concern: Grand Calumet River, Indiana. "Miscellaneous Paper EL-91-10. US Army Engineer Waterways Experiment Station. Vicksburg, MS.

Tatem, H.E., Brandon, D.L., Lee, C.R., Simmers, J.W. and Skogerboe, J.G. "Information Summary, Area of Concern: Ashtabula River, Ohio." 1990. Miscellaneous Paper EL-90-22. US Army Engineer Waterways Experiment Station. Vicksburg, MS.

United States and Canada. IJC. Great Lakes Water Quality Agreement of 1978. Revised as amended by Protocol. November 18, 1987.

USEPA GLNPO. Assessment and Remediation of Contaminated Sediments (ARCS) 1992 Work Plan. Chicago, IL.

USEPA Region II. Decision Summary, Reynolds Metals Company Site Study Area. 1993. Massena, New York.

USEPA Region V. Guidelines for the Pollutional Classification of Great Lakes Harbor Sediments. April, 1977. Chicago, IL.

USEPA Region V. Inventory of Contaminated Sediment Sites (Draft). Wisconsin Sites. July 31, 1992.

USEPA Region V. USEPA Proposed Plan for Torch Lake Site. May, 1992.

USEPA Region V Office of Public Affairs. Fields Brook Superfund Site Project Update. May, 1993.

Wayne County Department of Public Service. Rouge River National Wet Weather Demonstration Program. 1992. Grant Application under Public Law 102-139, Section 104.

WDNR 1. The Milwaukee Estuary Remedial Action Plan: A Plan to Clean up Milwaukee's Rivers and Harbor. March, 1991. Wisconsin Water Quality Management Program.

WDNR 2. The Sheboygan River Remedial Action Plan. July 1, 1989. Southeast District Headquarters. Milwaukee, WI.

Woodward-Clyde Consultants. Ashtabula River Investigation, Ashtabula, Ohio (Draft Report, Second Revision). February 21, 1992. Chicago, IL.

APPENDIX A

Status of Beneficial Uses Within the U.S. Areas of Concern

	Restrictions on Fish and Wildlife Consumption	Tainting of Fish and Wildlife Flavor	Degradation of Fish or Wildlife Populations	Fish Tumors or other Deformities	Bird or Animal Deformities or Reproductive Problems	Degradation of Benthos	Restrictions on Dredging Activities	Eutrophication or Undesirable Algae	Restrictions on Drinking Water Consumption	Beach Closings	Degradation of Aesthetics	Added Costs to Agriculture or Industry	Degradation of Plankton Populations	Loss of Fish and Wildlife Habitat
Indiana														
Grand Calumet River/ Indiana Harbor Canal	I	I	I	I	L	I	I	I	L	I	I	I	I	I
Illinois														
Waukegan Harbor	I	U	U	U	U	I	I	U	U	I	U	U	U	I
Michigan														
Clinton River	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Deer Lake/Carp River/ Carp Creek	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Detroit River	I	N	N	I	N	I	I	N	I	I	N	N	U	I
Kalamazoo River	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Manistique River	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Muskegon Lake	*	*	*	*	*	*	*	*	*	*	*	*	*	*
River Raisin	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Rouge River	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Saginaw River/Bay	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Torch Lake	*	*	*	*	*	*	*	*	*	*	*	*	*	*
White Lake	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Minnesota														
St. Louis River/Bay	I	U	I	I	U	I	I	N	N	I	I	N	N	I
New York														
Buffalo River	I	L	L	I	L	I	I	–	–	–	–	–	–	I
Eighteenmile Creek	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Niagra River	I	N	L	I	L	I	I	N	N	N	N	N	N	I
Oswego River	L	U	L	U	U	U	N	L	–	–	U	N	U	L
Rochester Embayment	I	U	I	U	I	I	I	I	I	I	I	I	U	I
St Lawrence River	I	N	L	L	L	L	N	N	N	N	N	N	U	I
Ohio														
Astabula River	I	N	I	I	N	I	I	N	N	N	N	N	N	I
Black River	*	*	*	*	*	*	*	*	*	*	*	*	*	*
Cuyahoga River	I	U	I	I	U	I	I	I	U	I	I	N	L	I
Maumee River	I	U	L	L	U	L	N	L	I	N	U	U	U	U
Pennsylvania														
Presque Isle Bay	N	N	N	U	N	N	I	N	N	L	N	N	U	N
Wisconsin														
Fox River/ Lower Green Bay	N	N	I	N	N	I	N	I	I	I	I	I	I	I
Menominee River	I	I	I	N	N	I	I	N	N	I	I	N	I	I
Milwaukee Estuary	I	N	I	I	N	I	I	I	N	I	I	N	I	I
Sheboygan River/Harbor	I	U	I	U	U	U	I	N	U	N	U	U	U	I

Symbol Key

I indicates the impairment of the beneficial use

L indicates the beneficial use is likely impaired

N indicates the beneficial use is not impaired

U indicates it is unknown if the beneficial use is impaired

– indicates the beneficial use is not applicable

* indicates that a site did not address IJC beneficial uses in RAP or has not submitted Stage I RAP

APPENDIX B

State Request Contributors/Contacts

Illinois -- Waukegan Harbor

Mr. Robert Schacht
Illinois EPA
1701 First Avenue
Maywood, IL 60153
(708)531-5900

Indiana -- Grand Calumet River/Indiana Harbor Canal

Mr. Joseph D. Thomas
Indiana Department of Environmental Management
504 North Broadway, Suite 418
Gary, IN 46402
(219)881-6712

Michigan -- All Sites

Ms. Diana Klemans
Planning and Special Programs Section
Surface Water Quality Division
Michigan Department of Natural Resources
P.O. Box 30028
Lansing, MI 48909

Clinton River	Mr. Bob Sweet	(517)335-4182
Deer Lake	Mr. Roger Eberhardt	(517)335-1119
Detroit River	Ms. Susan Benzie	(517)335-4188
Kalamazoo River	Mr. Scott Hanshue	(517)335-4179
Manistique River	Mr. Roger Eberhardt	(517)335-1119
Muskegon Lake	Mr. John Wuycheck	(517)335-4195
River Raisin	Mr. Roger Jones	(517)373-4704
Rouge River	Ms. Cathy Bean	(313)953-1441
Saginaw River/Bay	Mr. Greg Goudy	(517)335-3310
Torch Lake	Mr. Roger Eberhardt	(517)335-1119
White Lake	Mr. John Wuycheck	(517)335-4195

Minnesota -- St. Louis River/Bay

Mr. Brian Fredrickson/Ms. Mary Schubauer-Berigan
Minnesota Pollution Control Agency
Government Services Center
Suite 704
320 West Second Street
Duluth, MN 55802
(218)723-4663 or (218)723-4837

New York

Buffalo River -- Eighteenmile Creek -- Niagara River

Mr. Rich Swiniuch
New York State Department of Environmental Conservation
270 Michigan Avenue
Buffalo, NY 14203
(716)851-7070

Oswego River

Mr. Dick Draper
New York State Department of Environmental Conservation
50 Wolf Road
Albany, NY 12233-3501
(518)485-7786

Rochester Embayment

Ms. Margy Peet
Monroe County Department of Planning and Development
47 S. Fitzhugh Street, Room 200
Rochester, NY 14614
(716)428-5336

St. Lawrence River (Massena)

Mr. Burt Mead
New York State Department of Environmental Conservation
317 Washington Street
Watertown, NY 13601
(315)785-2514

Ohio

Ashtabula River -- Cuyahoga River

Ms. Julie Letterhos
Ohio Environmental Protection Agency, DWQPA
P.O. Box 1049
1800 Water Mark Drive
Columbus, OH 43266-0149
(614)644-2871

Black River

Mr. Kelvin Rodgers
Ohio Environmental Protection Agency
NE District Office
2110 E. Aurora Road
Twinsburg, OH 44087
(216)425-9171

Maumee River

Mr. Tom Balduf
Ohio Environmental Protection Agency
NW District Office
347 N. Dunbridge Road
P.O. Box 466
Bowling Green, OH 43402-0466
(419)352-8461

Pennsylvania -- Presque Isle Bay

Mr. Mike Zimmerman
Pennsylvania Department of Environmental Resources
1012 Water Street
Meadville, PA 16335
(814)332-6942

Wisconsin -- All Sites

Mr. Greg Hill
Great Lakes Unit Leader
Bureau of Water Resources Management
101 S. Webster Street
P.O. Box 7921
Madison, WI 53707-7921
(608)267-9352