

REMEDIAL ACTION PLAN STAGE II
INTERNATIONAL JOINT COMMISSION
SUBMITTAL DOCUMENT

December 1997

CURRENT ACTIVITIES ADVANCING THE RESTORATION OF BENEFICIAL USES

RAP II ACTIONS TO ATTAIN GOALS		BENEFICIAL USES THAT ARE IMPAIRED IN THE GRAND CALUMET AREA of CONCERN														KEY IMPLEMENTATION ELEMENTS				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	OWNER or PRINCIPLE DRIVER (Person or Organization)	PLANS IN PLACE (Yes, No or TBD)	INDICATORS ESTABLISHED (Yes, No or TBD)	START DATE (Date or TBD)	END DATE (Date or TBD)
<div style="border: 1px solid black; border-radius: 15px; padding: 5px; display: inline-block;"> REVISED 11/5/97 </div> <p>ACTIVITIES CURRENTLY IN PROGRESS *</p>		Restrictions on Fish & Wildlife Consumption	Tainting of Fish & Wildlife Flavor	Degraded Fish & 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 & Odor Problems	Beach Closings	Degradation of Aesthetics	Added Costs to Agriculture or Industry	Degradation of Phytoplankton & Zooplankton Populations	Loss of Fish & Wildlife Habitat					
A	Voluntary Action Initiated Through the RAP																			
1.	The Cooperative Partnership Effort	●	●	●	●	●	●	●	●	●	●	●	●	●	●	Steering Committee	Yes	TBD	1996	TBD
2.	Sediment Cleanup Restoration Alternatives Project (SCRAP)		○	○	○	○	○	○	○	○	○	○	○	○	○	IDEM	Yes	TBD	1996	TBD
3.	The Native Revegetation of Steel Slag Project	□	□	●	□	□	□	□	□	□	●	□	□	●	Inland & Hammond San. Dist.	Yes	TBD	1996	TBD	
4.	The RAP GIS System	●	●	●	●	●	●	●	●	●	●	●	●	●	IDEM	Yes	TBD	1995	TBD	
B	Additional Voluntary Actions Supporting RAP Goals																			
1.	Corridor Planning	□	□	○	□	○	○	○	○	○	○	○	○	○	○	Grand Cal Task Force	Yes	TBD	1997	TBD
2.	Public Outreach and Education	●	●	●	●	●	●	●	●	●	●	●	●	●	All reps	Some	TBD	TBD	TBD	
3.	Citizen Advisory Groups	○	○	○	○	○	○	○	○	○	○	○	○	○	CAC's	Yes	TBD	TBD	TBD	
4.	The Southern Lake Michigan Conservation Initiative	□	□	●	□	○	□	□	□	□	●	□	□	●	The Nature conservancy	Yes	TBD	In Progress	TBD	
5.	The Ivanhoe Nature Preserve Restoration	□	□	●	□	○	□	□	□	□	●	□	□	●	The Nature conservancy	Yes	TBD	In Progress	TBD	
6.	The Clarke & Pine Nature Preserve, Eastern Addition Restoration	□	□	●	□	○	□	□	□	□	●	□	□	●	IDEM / IDNR / USFWS	Yes	TBD	In Progress	TBD	
7.	The Lost Marsh Restoration	□	□	●	□	○	□	□	○	□	○	□	□	●	AMOCO	Yes	TBD	In Progress	TBD	
8.	Interagency Technical Task Force on E. coli	□	□	□	□	□	□	□	○	●	●	□	□	□	IDEM / IDNR	Yes	TBD	1997	TBD	

EXAMPLE

● = Directly Related; ○ = Supportive; □ = Not Related
 (Definitions at end of Matrix)

* Activities listed as presented in Chapter 5

CURRENT ACTIVITIES ADVANCING THE RESTORATION OF BENEFICIAL USES (CONT'D)

RAP II ACTIONS TO ATTAIN GOALS		BENEFICIAL USES THAT ARE IMPAIRED IN THE GRAND CALUMET AREA of CONCERN														KEY IMPLEMENTATION ELEMENTS				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	OWNER or PRINCIPLE DRIVER (Person or Organization)	PLANS IN PLACE (Yes, No or TBD)	INDICATORS ESTABLISHED (Yes, No or TBD)	START DATE (Date or TBD)	END DATE (Date or TBD)
<div style="border: 1px solid black; border-radius: 15px; padding: 5px; display: inline-block;"> REVISED 11/5/97 </div> <p>ACTIVITIES CURRENTLY IN PROGRESS *</p>		Restrictions on Fish & Wildlife Consumption	Tainting of Fish & Wildlife Flavor	Degraded Fish & 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 & Odor Problems	Beach Closings	Degradation of Aesthetics	Added Costs to Agriculture or Industry	Degradation of Phytoplankton & Zooplankton Populations	Loss of Fish & Wildlife Habitat					
B	Additional Voluntary Actions Supporting RAP Goals (Cont'd)																			
9.	Indianapolis Boulevard Sewer Project															INDOT / AMOCO / IDEM	Yes	TBD	Began in ____?	Finished already '93?
10.	Amoco Bank Cleaning and Stabilization Project															Amoco	Yes	TBD	TBD	TBD
11.	Coordinated Resource Management Process															IDEM	Yes	TBD	TBD	TBD
12.	Great Lakes Watershed Initiative															IDEM	TBD	TBD	1994	TBD
13.	Sediment Transport Model															Army Corps of Engineers		TBD	TBD	TBD
14.	Dredged Sediments Disposal															IDEM / USEPA	Yes	TBD	1997	TBD
15.	Memorandum of Cooperation (MOC)															Five Companies	Yes	TBD	1994	TBD
16.	Lake Michigan Air directors Consortium															LADCO	Yes	TBD	1990	1991
17.	Ridesharing															Air Pollution Boards	Yes	TBD	1993	TBD
18.	Clean Cities Program															USDOE	Yes	TBD	TBD	TBD
19.	Ozone Action Days															Three States	Yes	TBD	1995	TBD
20.	Ozone Transport Assessment Group (OTAG)															OTC	Yes	TBD	1995	TBD
21.	Atmospheric Deposition															USGS	Yes	TBD	1992	1998

● = Directly Related; ○ = Supportive; □ = Not Related
(Definitions at end of Matrix)

* Activities listed as presented in Chapter 5

CURRENT ACTIVITIES ADVANCING THE RESTORATION OF BENEFICIAL USES (CONT'D)

RAP II ACTIONS TO ATTAIN GOALS		BENEFICIAL USES THAT ARE IMPAIRED IN THE GRAND CALUMET AREA of CONCERN														KEY IMPLEMENTATION ELEMENTS					
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	OWNER or PRINCIPLE DRIVER (Person or Organization)	PLANS IN PLACE (Yes, No or TBD)	INDICATORS ESTABLISHED (Yes, No or TBD)	START DATE (Date or TBD)	END DATE (Date or TBD)	
<div style="border: 1px solid black; border-radius: 15px; padding: 5px; width: fit-content; margin: 0 auto;"> REVISED 11/5/97 </div>	ACTIVITIES CURRENTLY IN PROGRESS*	Restrictions on Fish & Wildlife Consumption	Tainting of Fish & Wildlife Flavor	Degraded Fish & 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 & Odor Problems	Beach Closings	Degradation of Aesthetics	Added Costs to Agriculture or Industry	Degradation of Phytoplankton & Zooplankton Populations	Loss of Fish & Wildlife Habitat						
C	Federal, State and Local Regulatory Actions that Support RAP Goals																				
	1. Natural Resource Damage Assessment																IDEM / IDNR / USFWS / NOAA / NPS	Yes	TBD	1996	TBD
	2. Soil and Water Conservation District (SWCD) Programs																Local	Yes	TBD	TBD	TBD
	2a. The south bank of the Grand Calumet River in Gary, Ambridge/Mann area																Lake Co SWCD	Yes	TBD	TBD	TBD
	2b. Roxanna Marsh in East Chicago																Lake Co SWCD	Yes	TBD	TBD	TBD
	2c. The east shore of Wolf Lake in Hammond																Lake Co SWCD	Yes	TBD	In Progress	TBD
	3. Costal Coordination Project																IDNR	Yes	TBD	In Progress	TBD
	4. Watershed Management Program																IDEM	Yes	TBD	1996	TBD
	5. Water Quality Certification																ACoE / USEPA / IDEM	Yes	TBD	TBD	TBD
	6. Storm Water Control Program, Including Best Management Practices																IDEM	Yes	TBD	TBD	TBD
	7. Control of Urban Runoff																IDEM	Yes	TBD	TBD	TBD
	8. U.S. Army Corps of Engineers' Indiana Harbor and Canal Dredging Project																ACoE	Yes	TBD	1972	TBD
	9. Raiston Street Lagoon																GSD	Yes	TBD	TBD	TBD
	10. Elimination of the Use of Slag as Fill Material																IDNR	Yes	TBD	TBD	TBD
	11. U.S. EPA Advanced Identification of Sites (AIDS) Program																USEPA	Yes		1985	TBD
	12. Hazardous Waste - Facilities regulated under the Resource Conservation and Recovery Act																IDEM	Yes	TBD	1990	TBD

● = Directly Related; ○ = Supportive; □ = Not Related
(Definitions at end of Matrix)

* Activities listed as presented in Chapter 5

CURRENT ACTIVITIES ADVANCING THE RESTORATION OF BENEFICIAL USES (CONT'D)

RAP II ACTIONS TO ATTAIN GOALS	BENEFICIAL USES THAT ARE IMPAIRED IN THE GRAND CALUMET AREA of CONCERN														KEY IMPLEMENTATION ELEMENTS				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	OWNER or PRINCIPLE DRIVER (Person or Organization)	PLANS IN PLACE (Yes, No or TBD)	INDICATORS ESTABLISHED (Yes, No or TBD)	START DATE (Date or TBD)	END DATE (Date or TBD)
<div style="border: 1px solid black; border-radius: 10px; padding: 5px; display: inline-block;"> REVISED 11/5/97 </div> <p>ACTIVITIES CURRENTLY IN PROGRESS *</p>	Restrictions on Fish & Wildlife Consumption	Tainting of Fish & Wildlife Flavor	Degraded Fish & 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 & Odor Problems	Beach Closings	Degradation of Aesthetics	Added Costs to Agriculture or Industry	Degradation of Phytoplankton & Zooplankton Populations	Loss of Fish & Wildlife Habitat					
C	Federal, State and Local Regulatory Actions that Support RAP Goals (Cont'd)																		
13. Solid Waste (Illegal Dumps)										○					IDEM / Legal	Yes	Yes	In Existence	TBD
14. State Clean Up															IDEM	Yes	Yes	In Existence	TBD
15. Superfund															USEPA	Yes	Yes	In Existence	
16. Waste Minimization															USEPA / IDEM	Yes	Yes	1984	TBD
17. Transportation Programs															IDEM	Yes	TBD	In Existence	TBD
18. Air Toxics Program															IDEM	Yes	TBD	1997	2001
19. Mercury															IDEM	Yes	TBD	1997	TBD
20. Dioxin															USEPA	Yes	TBD	TBD	1999
21. Accidental Releases															IDEM / USEPA	Yes	TBD	1997	TBD
22. Particulate Matter (PM10)															IDEM	Yes	TBD	TBD	TBD
23. Ozone															USEPA	Yes	Yes	1997	2007
24. Reformulated Gasoline															Local	Yes	In Existence	1995	TBD

● = Directly Related; ○ = Supportive; □ = Not Related
(Definitions at end of Matrix)

* Activities listed as presented in Chapter 5

CURRENT ACTIVITIES ADVANCING THE RESTORATION OF BENEFICIAL USES (CONT'D)

RAP II ACTIONS TO ATTAIN GOALS		BENEFICIAL USES THAT ARE IMPAIRED IN THE GRAND CALUMET AREA of CONCERN														KEY IMPLEMENTATION ELEMENTS				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	OWNER or PRINCIPLE DRIVER (Person or Organization)	PLANS IN PLACE (Yes, No or TBD)	INDICATORS ESTABLISHED (Yes, No or TBD)	START DATE (Date or TBD)	END DATE (Date or TBD)
<div style="border: 1px solid black; border-radius: 15px; padding: 5px; display: inline-block;"> REVISED 11/5/97 </div> <p>ACTIVITIES CURRENTLY IN PROGRESS *</p>		Restrictions on Fish & Wildlife Consumption	Tainting of Fish & Wildlife Flavor	Degraded Fish & 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 & Odor Problems	Beach Closings	Degradation of Aesthetics	Added Costs to Agriculture or Industry	Degradation of Phytoplankton & Zooplankton Populations	Loss of Fish & Wildlife Habitat					
C	Federal, State and Local Regulatory Actions that Support RAP Goals (Cont'd)																			
	<i>The Environmental Performance Partnership Agreement</i>															IDEM / USEPA	Yes	2 Yr. EnPPA	To be Negotiated	To be Negotiated
25a	Prevention / Reduction of Pollutants Entering the System															IDEM / USEPA	Yes	2 Yr. EnPPA	To be Negotiated	To be Negotiated
25b	Achievement of Air Quality Standards															IDEM / USEPA	Yes	2 Yr. EnPPA	To be Negotiated	To be Negotiated
25c	Meet Surface Water Quality Standards															IDEM / USEPA	Yes	2 Yr. EnPPA	To be Negotiated	To be Negotiated
25d	Prevention of Sediment Accumulation															IDEM / USEPA	Yes	2 Yr. EnPPA	To be Negotiated	To be Negotiated
25e	Municipal solid waste disposal will be reduced by 50 percent before January 1, 2001. Non-Municipal solid waste disposal will be reduced.															IDEM / USEPA	Yes	2 Yr. EnPPA	To be Negotiated	To be Negotiated
25f	Solid waste disposal will be safely managed.															IDEM / USEPA	Yes	2 Yr. EnPPA	To be Negotiated	To be Negotiated
25g	Protect Ground Water															IDEM / USEPA	Yes	2 Yr. EnPPA	To be Negotiated	To be Negotiated
25g	Prevent and Clean Up Contaminated Sites															IDEM / USEPA	Yes	2 Yr. EnPPA	To be Negotiated	To be Negotiated
25i	Increase Protection and Restoration of Critical Habitat by 100 percent by the Year 2007.															IDEM / IDNR / USFWS				

● = Directly Related; ○ = Supportive; □ = Not Related
(Definitions at end of Matrix)

* Activities listed as presented in Chapter 5

CURRENT ACTIVITIES ADVANCING THE RESTORATION OF BENEFICIAL USES (CONT'D)

RAP II ACTIONS TO ATTAIN GOALS		BENEFICIAL USES THAT ARE IMPAIRED IN THE GRAND CALUMET AREA of CONCERN														KEY IMPLEMENTATION ELEMENTS				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	OWNER or PRINCIPLE DRIVER (Person or Organization)	PLANS IN PLACE (Yes, No or TBD)	INDICATORS ESTABLISHED (Yes, No or TBD)	START DATE (Date or TBD)	END DATE (Date or TBD)
<div style="border: 1px solid black; border-radius: 15px; padding: 5px; display: inline-block;"> REVISED 11/5/97 </div> ACTIVITIES CURRENTLY IN PROGRESS *		Restrictions on Fish & Wildlife Consumption	Tainting of Fish & Wildlife Flavor	Degraded Fish & 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 & Odor Problems	Beach Closings	Degradation of Aesthetics	Added Costs to Agriculture or Industry	Degradation of Phytoplankton & Zooplankton Populations	Loss of Fish & Wildlife Habitat					
D	Administrative Orders, Agreed Orders and Consent Decrees that Support RAP Goals																			
1.	H & H Autofluf Containment Removal Project														USEPA	Yes	No	TBD	TBD	
2.	Amoco Pipeline Company														IDEM / AMOCO	Yes	TBD	TBD	TBD	
3.	U.S. Steel (water decree)														USEPA	No	No	TBD	TBD	
4.	U.S. Steel (sediment)														USEPA / USS	No	No	TBD	TBD	
5.	Inland Steel Sediment Characterization Study in the IHSC														USEPA / INLAND	Yes	No	TBD	TBD	
6.	Removal Action by LTV Steel														USEPA / LTV	Yes	No	Completed	19977	
7.	Gary Sanitary District (GSD)														USEPA / IDEM / GSD	No	No	TBD	TBD	
8.	Amoco Soil characterization Work Plan and Ground Water Evaluation														IDEM / AMOCO	Yes	No	1995	TBD	
9.	Amoco Agreed Order														IDEM / AMOCO	Yes	No	In Existence	TBD	
10.	Gary Lagoons Removal Site; 5622 and 5624-34 Industrial Highway														USEPA	Yes	No	1996	TBD	
11.	United States Steel Corporation (U.S. Steel)														IDEM / USS	Yes	TBD	In Existence	TBD	

● = Directly Related; ○ = Supportive; □ = Not Related
(Definitions at end of Matrix)

* Activities listed as presented in Chapter 5

CURRENT ACTIVITIES ADVANCING THE RESTORATION OF BENEFICIAL USES (CONT'D)

RAP II ACTIONS TO ATTAIN GOALS		BENEFICIAL USES THAT ARE IMPAIRED IN THE GRAND CALUMET AREA of CONCERN														KEY IMPLEMENTATION ELEMENTS				
		1	2	3	4	5	6	7	8	9	10	11	12	13	14	OWNER or PRINCIPLE DRIVER (Person or Organization)	PLANS IN PLACE (Yes, No or TBD)	INDICATORS ESTABLISHED (Yes, No or TBD)	START DATE (Date or TBD)	END DATE (Date or TBD)
<div style="border: 1px solid black; border-radius: 15px; padding: 5px; display: inline-block;"> REVISED 11/5/97 </div> <p>ACTIVITIES CURRENTLY IN PROGRESS *</p>		Restrictions on Fish & Wildlife Consumption	Tainting of Fish & Wildlife Flavor	Degraded Fish & 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 & Odor Problems	Beach Closings	Degradation of Aesthetics	Added Costs to Agriculture or Industry	Degradation of Phytoplankton & Zooplankton Populations	Loss of Fish & Wildlife Habitat					
Additional Actions Necessary to Delist Impaired Beneficial Uses																				
A	Protection of critical habitats															CARE Habitat Sub-Comm.	No	TBD	TBD	TBD
B	Riparian Restoration															Several	Some	TBD	1996	TBD
C	Wetland Protection / Restoration															IDEM	Yes	TBD	TBD	TBD
D	Instream Habitat Restoration															Several	Some	TBD	1996	TBD
E	Invasive Plant Control															Several	Some	TBD	TBD	TBD
F	Underground Storage Tanks															IDEM				

CURRENT SYMBOL DEFINITION:

- = If the activity, action, process or tool is carried through, it will substantively advance the restoration of beneficial uses.
- = This activity, action, process or tool supports the restoration of beneficial uses.
- = No apparent *direct effect* on the restoration of beneficial uses.

* Activities listed as presented in Chapter 5

PREFACE

This document is the Stage II Remedial Action Plan submittal to the International Joint Commission for the Calumet area of Northwest Indiana. The plan identifies the challenges and supplies the tools and blueprints necessary for the people, the industries, and governments in this area to renew and rebuild the outstanding resources of the Grand Calumet region.

Northwest Indiana contributes significantly to the industrial and economic strength of this country. Nearly 40 percent of the nation's steel is produced in Northwest Indiana. Hundreds of millions of barrels of petroleum are refined here each year. The Indiana Harbor Ship Canal is the second most heavily used shipping port on Lake Michigan. These facts may be apparent to anyone who drives through Northwest Indiana.

Less obvious, however, is the remnant dune and swale topography. It gives rise to habitat that supports Karner Blue butterflies and dozens of other endangered and threatened species of insects, plants, and animals.

Those of us, who work, live, and raise our families in Northwest Indiana have learned to treasure these economic and ecological resources. We are committed to the revitalization of the Grand Calumet community and environment. Northwest Indiana is blessed with outstanding human resources. This Stage II Remedial Action Plan represents years of work by a wide variety of people. Steel executives, teachers, municipal representatives, nationally renowned local environmentalists, petroleum industry environmental managers, biologists, geologists, toxicologists, social scientists, bureaucrats, homemakers and local citizens all contributed their knowledge, their time and their passion.

Much of the real work of the Remedial Action Plan remains to be accomplished. Just as the crafting of the Stage II document was a multi-stakeholder process, commitment to implementation of the Remedial Action Plan must include many stakeholders. The Remedial Action Plan is deficient in the sense that it does not contain an assessment of each impaired use and the mechanism for its restoration. The Citizens Advisory for the Remediation of the Environment (CARE) Committee has developed a foundation for this process in the attached matrix. The matrix describes actions that are directly related, possibly related or not related to restoration of impaired uses. The matrix is a tool that will assist in determining restoration and will evolve over time.

The CARE Committee and IDEM have initiated the compilation of a draft matrix of actions underway and beneficial use impairments as a starting point for a more in depth analysis. The list of matrix activities is located in the table of contents for Chapter Five. The matrix describes actions that are directly related, supportive or not related to the restoration of impaired uses. The CARE Committee has currently defined "directly related" as follows: If the activity, action, process or tool is carried through, it will substantively advance the restoration of

beneficial uses. The CARE Committee has currently defined "supportive" as follows: This activity, action, process or tool supports the restoration of beneficial uses. It should be noted that cause-and-effect between activities and impaired beneficial uses has not been demonstrated or discussed in the context of these definitions and should not be inferred.

The Stage II document provides a framework for addressing the 14 beneficial use impairments in an ecosystem context and presents the current environmental conditions in the Area of Concern. The document identifies the physical, biological and chemical stresses to the ecosystem (key ecological processes) and links these stresses to the fourteen beneficial use impairments. While the Stage II document provides a draft matrix of actions underway and beneficial use impairments, an analysis of the matrix has yet to be completed. Further, prioritization of the beneficial use impairments and actions underway is critical in the next stage and will be submitted to the International Joint Commission as an addendum to the Stage II document in the fall of 1998.

In order to initiate an assessment of the matrix, IDEM and the CARE Committee will consider a number of issues surrounding the matrix. The matrix identifies many (60-plus) activities occurring in the Area of Concern that are expected to lead to restoration of beneficial uses that are currently impaired. IDEM and the CARE Committee will finalize the matrix in the coming year by using a systematic ecosystem approach.

Some of the activities are driven by regulation, such as the Air Toxics Program. Other activities are voluntary efforts, taken in cooperation with IDEM, such as the Amoco Agreed Order. All of these activities, and more, promise to improve the overall environmental quality of Northwest Indiana and the Area of Concern.

The Grand Calumet River and Indiana Harbor Ship Canal await restoration. To accomplish this task we will need the energy, strength and resources of the diverse communities and interests in the Area of Concern and beyond. The members of the CARE Committee look forward to working with you to implement this Remedial Action Plan.

EXECUTIVE SUMMARY

In 1978 the Great Lakes Water Quality Agreement (Agreement) was established between the United States and Canada. The Agreement addresses forty-three Areas of Concern recognized in the Great Lakes Basin. These Areas of Concern were identified by having one or more specific impairment to the fourteen beneficial uses of the Great Lakes ecosystem. This led to the initiation of the Remedial Action Plan, the blueprint for restoring the beneficial uses.

All fourteen beneficial uses are impaired in the Grand Calumet River and Indiana Harbor Ship Canal. As part of the Remedial Action Plan process, former Indiana Department of Environmental Management (IDEM) Commissioner, Kathy Prosser, appointed a group of individuals to oversee the development of a Remedial Action Plan. This group is composed of representatives of industry, local government, citizen groups, and education to assist in the development and coordination of the Remedial Action Plan, and is known as the CARE Committee.

The International Joint Commission requires Remedial Action Plans to be submitted in three separate stages. Stage I, released in 1992, defined the environmental problems and identified the beneficial uses that are impaired. Stage II includes remedial and regulatory measures to restore the Area of Concern. The Stage II addendum will establish priorities and time frames for implementation. Stage III will include a monitoring strategy and will identify the degree of restoration of the beneficial uses. A biennial status report will be published by IDEM and the CARE Committee. The goals incorporated in this Stage II document deal specifically with restoring the fourteen beneficial uses by taking an ecosystem approach in designing remedial measures.

Chapter One provides an explanation of the goals of this document and public's role in developing these goals. The International Joint Commission requires each Stage II Remedial Action Plan to name specific Remedial Action Plan goals and quantifiable objectives, and their relationship to use impairments. The achievement of the Remedial Action Plan goals, includes participation by environmental groups, the public, state and federal agencies, local government, business and industry.

Chapter Two supplements the Stage I document by detailing the ecological process; habitat found in the area; and state of the water, ground water, sediment, soil and air. This chapter addresses the International Joint Commission's reservations by outlining an ecosystem approach to restoration in approving the Stage I document for this Area of Concern. The ecological resources of the area include eighteen natural community types, more than seven hundred species of plants, and more than two hundred species of birds. Seven of the community types, eighty-five of the plant species, and eighteen of the nesting bird species are globally or state significant. Important natural processes that contributed to the development of the region's diversity have been altered by human development. Ecological succession and hydrologic

interconnections have been disrupted by stressors such as habitat fragmentation, fire suppression, hydrologic modification, exotic species, shoreline alteration and environmental contamination. As a result of these stressors, the critical habitat areas remain in varying states of degradation, from minimally disturbed to severely degraded. Some of these critical habitat areas include the Miller Woods and Dunes area, the Clarke and Pine East preserve, the DuPont Dune and Swale area, the Gary Airport Sedge Meadow area, and Roxanna Marsh.

Environmental conditions in the Area of Concern exist in a wide range of extremes. There are multiple heavily contaminated National Priorities List sites side by side with natural areas of significant biological diversity. The area contains ecological resources of global significance that are immediately threatened by adjacent contaminated sites. Water in the Grand Calumet River, Indiana Harbor Ship Canal and nearshore Lake Michigan fails to meet its designated standards. Contaminated sediments, contaminated groundwater, and air deposition contribute to this problem. Diverse terrestrial and wetland communities contrast with degraded aquatic communities. Fish that are able to survive in the system are so heavily contaminated that they are unfit for human consumption.

Chapter Three identifies several stressors on the environment. These stressors are contamination, fragmentation and loss of physical habitat, altered hydrology, shoreline alterations, exotic species introduction, and fire suppression. The significant amount of stress in the Area of Concern has caused much of the degradation of the ecosystem, resulting in the loss of habitat, increased sedimentation, and lack of or excessive nutrient loadings. The stress can occur from either biological, physical, or chemical factors. The six leading contributors to the high level of stress are almost all derived from human activity.

Chapter Four focuses on the evolution of the Remedial Action Plan; its origination and its current activities. Public participation is a major component of the Remedial Action Plan process. Citizens, environmental groups and government agencies concerned about the impact of the polluted Grand Calumet River sought ways to bring attention to the problems of the Grand Calumet River. This concern led to the formation of the Grand Calumet Task Force. It was through the creation of the Task Force that a Remedial Action Plan for the site designated by the International Joint Commission as an Area of Concern was formed. Historically, little attention was paid to conservation in land use planning in the Area of Concern. However, recently combined efforts between the public, state and local agencies has led to the purchase and dedication of land as nature preserves. IDEM and other regulatory agencies constantly continue to encourage the public to identify potential problems and to call these problems to the attention of local, state or federal officials.

Chapter Five broadens the description of activities in the Area of Concern and includes actions in progress to remediate and restore the environment. The chapter ends with a section on identified additional actions necessary to delist the impaired beneficial uses in the Area of Concern. There are several ongoing activities; some are voluntary, others are driven by statutes and rules. Improvements in water quality, air quality, and reductions in non point source

pollution have all occurred. Some natural areas have been restored, others are now protected. Chapter Five provides a detailed discussion of the points incorporated in the matrix located at the beginning of this document.

Chapter Six identifies data gaps. Studies to quantify and address data gaps are listed. Those listed may be completed within a five-year time frame. Complete ecosystem recovery will take a long time and the need for further action may be determined as studies progress and actions are undertaken.

Chapter Seven reveals an outline of the surveillance and monitoring program and the environmental indicators that will be used to measure the state of the environment through the Remedial Action Plan. IDEM staff are currently developing surveillance and monitoring strategies for each of the fourteen impaired beneficial uses. The Environmental Performance Partnership Agreement (EnPPA) between the U.S. EPA and IDEM will aid in the restoration of these impaired beneficial uses by the creation of environmental indicators. Some of these indicators will be the building blocks for which surveillance and monitoring strategies are established and revised. Each strategy may address just one or many impaired beneficial uses that can lead to the delisting of each beneficial use.

Chapter Eight ends the document with a discussion of the strategy to coordinate the information received regarding the status of the environment and distribute it to all interested parties. As prescribed by the Remedial Action Plan Coordinating Committee, the responsibility of the Multi-Media Data Coordination team (MMDC) is to provide coherence and consistency in the data for Stage II draft documents. The MMDC team's primary tool for achieving this and showing the status of the impaired uses is to implement a geographic information system (GIS) for Northwest Indiana region, including the Area of Concern. The Remedial Action Plan GIS serves as an ongoing Stage I database and defines the baseline conditions to gauge progress in restoring beneficial uses. It represents a key effort of the Remedial Action Plan Coordinating Committee to incorporate an ecosystem approach into the Remedial Action Plan by encouraging each Technical Remedial Action Plan Team to use disparate databases in the preparation of its selected actions. The public may access this database to review the status of the beneficial uses in the ecosystem.

The Remedial Action Plan process not only challenges the limits of environmental technology, it challenges the endurance of those involved in remediating and restoring this ecosystem. Restoration of the Area of Concern will take decades. This document provides an ecosystem framework for long-term restoration. The document does not by itself guarantee the full restoration of this ecosystem.

IDEM recognizes that the active participation and commitment of other agencies, community groups, environmental organizations and industry are critical to attaining the goals of the Remedial Action Plan. Environmental management is among the highest corporate priorities and is a critical factor in maintaining responsible and constructive corporate development.

IDEM and other government agencies will provide legal and technical leadership to environmental organizations, community groups, and business and industry in a concerted effort to restore ecosystem function within the Area of Concern.

ACKNOWLEDGMENTS

The preparation of Stage II has been a cooperative effort of many individuals. Both Governor Frank O'Bannon, through Commissioner John Hamilton and former Governor Evan Bayh, through former IDEM Commissioners, Michael O'Connor and Kathy Prosser have provided the financial support and institutional leadership to develop this publication. Many individuals from IDEM and other agencies of the State of Indiana deserve recognition for their participation in the deliberations of the Technical Remedial Action Plan Teams and for providing overall guidance through the Remedial Action Plan Coordinating Committee. The names of those who participated in these groups are listed in the Appendices.

The financial and technical support provided by the federal government, primarily U.S. EPA, was critical to the completion of the Stage II document. Valdas Adamkus, former Regional Administrator of EPA Region V, and Christopher Grundler, former Director of the Great Lakes National Program Office, have provided invaluable technical resources and support. The many U.S. EPA individuals and individuals from other federal agencies who participated in the Technical Remedial Action Plan Team deliberations are listed in the Appendices.

The CARE Committee has shown great determination in seeing the Stage II document completed. The CARE members' voluntary contributions of time and expertise in representing industry, environmental organizations, education, municipalities, and citizens in the Area of Concern were crucial to the development of the Stage II document. Several CARE members also served as Remedial Action Plan Champions to lead review and implementation of the Stage II document. The Remedial Action Plan Champions are listed in the Appendices with the Agency Contacts for each group of selected action of the Stage II document.

The individuals who participated in the Subgroup deliberations are listed in the appendices. Many other Remedial Action Plan participants contributed to the development of the Stage II document. Their help is appreciated and will be instrumental in implementing the Stage II document. The organizations these individuals represent are listed in the appendices. We apologize to anyone inadvertently omitted.

TABLE OF CONTENTS

PREFACE	ii
EXECUTIVE SUMMARY	iv
ACKNOWLEDGMENTS	viii
TABLE OF CONTENTS	ix
LIST OF ACRONYMS	xvii
LIST OF TABLES	xxiv
LIST OF FIGURES	xxvi
LIST OF APPENDICES	xxvii

CHAPTER ONE

THE REMEDIAL ACTION PLAN PROCESS AND STAGE II GOALS 1

I. An Overview of the Remedial Action Plan Process	1
II. Stage II Remedial Action Plan Goals	2
III. Public Involvement in Development of the Stage II Remedial Action Plan	2
IV. Conclusion	3

CHAPTER TWO

ENVIRONMENTAL CONDITIONS 4

I. Introduction	4
II. Key Ecological Processes	5
A. Lakeplain Formation	6
B. Key Ecological Processes	8
1. <i>Natural Succession</i>	8
2. <i>Hydrology</i>	9
3. <i>Species Diversity</i>	9
4. <i>Fire</i>	9

C.	Stressors Causing Impairments to Key Ecological Processes	9
1.	<i>Pollution and Nutrient Contamination</i>	11
2.	<i>Loss of Physical Habitat/Habitat Fragmentation</i>	11
3.	<i>Altered Hydrology</i>	11
4.	<i>Shoreline Alterations</i>	11
5.	<i>Exotic Species</i>	11
6.	<i>Fire Suppression</i>	12
III.	Habitat	12
A.	Natural Heritage Data	12
B.	Floristic Quality Assessment	14
C.	The Grand Calumet River Corridor	15
1.	<i>Miller Woods and Dunes</i>	16
2.	<i>Clark and Pine East</i>	17
3.	<i>DuPont Dune and Swale</i>	17
4.	<i>Airport Sedge Meadow/Wet Prairie Wetlands</i>	18
5.	<i>Degraded Habitat Areas</i>	18
IV.	Surface Water in the Grand Calumet River and the Indiana Harbor Ship Canal	27
A.	Water Quality Monitoring	27
B.	Sediment Monitoring and Characterization	28
C.	Sediment Toxicity Analysis	34
D.	Biological Community Monitoring	36
E.	Fish Tissue (and other biological matrices) Monitoring	38
F.	Fish Consumption Advisory	39
V.	Ground Water Flows and Data	41
VI.	Air Quality	41
VII.	Conclusion	43

CHAPTER THREE
SOURCES OF ENVIRONMENTAL STRESS 44

I.	Introduction	44
II.	Contamination	46
A.	Contaminated Sediment	46
B.	Point Source Discharges	48

C.	Nonpoint Source Contributions	48
D.	Land Development, Erosion and Runoff	48
E.	Air Emission and Deposition	49
1.	<i>Ozone</i>	51
2.	<i>Nitrogen Oxides</i>	52
3.	<i>Particulate Matter</i>	54
4.	<i>Sulfur Dioxide</i>	55
5.	<i>Carbon Monoxide</i>	57
6.	<i>Lead</i>	58
7.	<i>Open Burning</i>	59
III.	Fragmentation and Loss of Physical Habitat	60
IV.	Altered Hydrology	63
V.	Shoreline Alterations	65
VI.	Exotic Species Introduction	65
VII.	Fire Suppression	66
VIII.	Conclusion	66

**CHAPTER FOUR
PARTICIPATION IN THE
REMEDIAL ACTION PLAN PROCESS** 67

I.	The Remedial Action Plan and its Origins	67
II.	Current Activities Supporting the Remedial Action Plan	68
A.	Natural Resource Protection Efforts	68
B.	Business and Industry Participation	69
C.	Public Meetings	70
D.	Participation Within Agency Processes	70
E.	Interagency Participation Processes	71
III.	Conclusion	72

**CHAPTER FIVE
ACTIONS TO ATTAIN GOALS** 73

I.	Actions in Progress	73
----	---------------------------	----

A.	Voluntary Actions Initiated Through the Remedial Action Plan	73
1.	<i>The Cooperative Partnership Effort</i>	73
2.	<i>Sediment Cleanup Restoration Alternatives Project (SCRAP)</i>	74
3.	<i>The Native Revegetation of Steel Slag Project</i>	77
4.	<i>The Remedial Action Plan Geographic Information System (GIS) System</i>	77
B.	Additional Voluntary Actions Supporting Remedial Action Plan Goals	77
1.	<i>The Grand Calumet River/Indiana Harbor Ship Canal Corridor Vision and Planning Project</i>	77
2.	<i>Public Outreach and Education</i>	78
3.	<i>Citizen Advisory Groups</i>	80
4.	<i>The Southern Lake Michigan Conservation Initiative</i>	80
5.	<i>The Ivanhoe Nature Preserve Restoration</i>	80
6.	<i>The Clark & Pine Nature Preserve, Eastern Addition Restoration</i>	80
7.	<i>The Lost Marsh Restoration</i>	81
8.	<i>Interagency Technical Task Force on E. coli</i>	81
9.	<i>Indianapolis Boulevard Sewer Project</i>	82
10.	<i>Amoco Bank Cleaning and Stabilization Project</i>	82
11.	<i>Coordinated Resource Management Process</i>	82
12.	<i>Great Lakes Watershed Initiative</i>	82
13.	<i>Sediment Transport Model</i>	83
14.	<i>Dredged Sediments Disposal</i>	84
15.	<i>Memorandum of Cooperation (MOC)</i>	84
16.	<i>Lake Michigan Air Directors Consortium</i>	85
17.	<i>Ride sharing</i>	85
18.	<i>Clean Cities Program</i>	85
19.	<i>Ozone Action Days</i>	86
20.	<i>Ozone Transport Assessment Group (OTAG)</i>	86
21.	<i>Atmospheric Deposition</i>	88
22.	<i>Coastal Environmental Management Project</i>	88
C.	Federal, State and Local Regulatory Actions that Support Remedial Action Plan Goals	89
1.	<i>Natural Resource Damage Assessment</i>	89
2.	<i>Soil and Water Conservation District (SWCD) Programs</i>	89
a.	The south bank of the Grand Calumet River in Gary, Ambridge/Mann area	89
b.	Roxanna Marsh in East Chicago	89
c.	The east shore of Wolf Lake in Hammond	90
3.	<i>Coastal Coordination Project</i>	90
4.	<i>Watershed Management Program</i>	90
5.	<i>Water Quality Certification</i>	91
6.	<i>Storm Water Control Program, Including Best Management Practices</i>	91
7.	<i>Control of Urban Runoff</i>	91

8.	<i>U.S. Army Corps of Engineers' Indiana Harbor and Canal Dredging Project</i>	92
9.	<i>Ralston Street Lagoon</i>	93
10.	<i>Elimination of the Use of Slag as Fill Material</i>	93
11.	<i>U.S. EPA Advanced Identification of Wetlands Unsuitable for Filling</i>	94
12.	<i>Hazardous Waste - Facilities regulated under the Resource Conservation and Recovery Act</i>	97
13.	<i>Solid Waste (Illegal Dumps)</i>	97
14.	<i>State Clean Up</i>	98
15.	<i>Superfund</i>	98
16.	<i>Waste Minimization</i>	98
17.	<i>Transportation Programs</i>	98
18.	<i>Air Toxics Program</i>	99
19.	<i>Mercury</i>	106
20.	<i>Dioxin</i>	107
21.	<i>Accidental Releases</i>	107
22.	<i>Particulate Matter (PM₁₀)</i>	107
23.	<i>Ozone</i>	108
24.	<i>Other Transportation Measures</i>	110
25.	<i>The Environmental Performance Partnership Agreement</i>	111
26.	<i>Oil Pipeline Memorandum of Cooperation</i>	111
D.	Administrative Orders, Agreed Orders and Consent Decrees that Support Remedial Action Plan Goals	111
1.	<i>H & H Autofluf Contaminant Removal Project</i>	111
2.	<i>Amoco Pipeline Company</i>	111
3.	<i>U.S. Steel (water decree)</i>	111
4.	<i>U.S. Steel (sediment)</i>	112
5.	<i>Inland Steel Sediment Characterization Study in the Indiana Harbor Ship Canal</i>	113
6.	<i>Removal Action by LTV Steel</i>	113
7.	<i>Gary Sanitary District (GSD)</i>	113
8.	<i>Amoco Soil Characterization Work Plan and Ground Water Evaluation</i>	114
9.	<i>Amoco Agreed Order</i>	115
10.	<i>Gary Lagoons Removal Site; 5622 and 5624-34 Industrial Highway, Gary, Indiana</i>	116
11.	<i>United States Steel Corporation (U.S. Steel)</i>	116
III.	Additional Actions Necessary to Delist Impaired Beneficial Uses	117
A.	Protection of critical habitats	118
B.	Riparian Restoration	122
C.	Wetland Protection/Restoration	122
D.	Instream Habitat Restoration	123

E.	Invasive Plant Control	123
IV.	Conclusion	124

**CHAPTER SIX
INFORMATION GAPS**

I.	Introduction	125
II.	Implementation: Transitioning from Stage II to Stage III	125
III.	Studies Proposed	126
A.	Inventory of habitats, locations, and species now occupying the habitats	126
a.	Assessment of the overall "health" or condition of habitats and species within the Area of Concern.	127
b.	Inventory of existing habitat areas and criteria used for ranking parcels to be preserved, enhanced, or restored.	127
B.	Assessment of the tolerances of native and beneficial plant and animal species to pollutants located within the Area of Concern	127
C.	Assessment of migration or patterns of movement of mobile species, including interactions of species within habitats	128
D.	Studies which evaluate the feasibility of restoring, enhancing, or recreating habitat types, to a level determined by the Remedial Action Plan committees	128
E.	Total Maximum Daily Load (TMDL)	129
F.	Storm water runoff and sediment contamination	130
G.	Assessment of Dewatering Characteristics of Odor Impacts of Grand Calumet River Sediment	130
H.	Grand Calumet River and Indiana Harbor Ship Canal Mass Balance	131
I.	Study Sediment Toxicity Sources in the Indiana Harbor Ship Canal	132
J.	Bedload and Suspended Sediment Discharge Study at the Grand Calumet River and Indiana Harbor Canal	133
K.	Fill Material Location and Assessment	134
L.	Handling of Materials and Storage Practices	134
M.	Underground Storage Tanks	135
N.	Air Deposition (Wet and Dry) Studies	135
IV.	Conclusion	136

**CHAPTER SEVEN
SURVEILLANCE AND MONITORING PROGRAM**

I.	Introduction	137
----	--------------------	-----

II.	The Impaired Beneficial Uses	137
i.	Restrictions on Fish and Wildlife Consumption	138
ii.	Tainting of Fish and Wildlife Flavor	138
iii.	Degraded Fish and Wildlife Populations	138
iv.	Fish Tumors or Other Deformities	139
v.	Bird or Animal Deformities or Reproductive Problems	139
vi.	Degradation of the Benthos	140
vii.	Restrictions on Dredging Activities	140
viii.	Eutrophication or Undesirable Algae	140
ix.	Restrictions on Drinking Water Consumption or Taste and Odor Problems ...	140
x.	Beach Closings	140
xi.	Degradation of Aesthetics	141
xii.	Added Cost to Agriculture or Industry	141
xiii.	Degradation of Phytoplankton or Zooplankton Populations	141
xiv.	Loss of Fish and Wildlife Habitat	142
III.	Environmental Indicators	142
IV.	Mapping	142
V.	Conclusion	143

CHAPTER EIGHT
MULTI-MEDIA DATA COORDINATION RESPONSIBILITIES 144

I.	Introduction	144
II.	Resource Assessment	145
III.	Data Sharing	145

Supplementary Material

Glossary of Common Terms	ii
Bibliography	viii
CARE Mission Statement	xiii
List of Current CARE Members	xiv
RAP Technical Team Members	xvi
List of Participants	xviii

LIST OF ACRONYMS

- AIDS:** Advanced Identification of Sites
- AIRs:** Aerometric Information Retrieval System
- ARCS:** Assessment and Remediation of Contaminated Sediments
- BIF:** Boiler /Industrial Furnace
- BMPs:** Best Management Practices
- °C:** Degrees Celsius
- CAA:** Clean Air Act
- CAAA:** Clean Air Act Amendments
- CAAP:** Clean Air Act Program
- CAC:** Citizen's Advisory Committee
- CARE:** Citizens' Advisory for the Remediation of the Environment
- CBOD₅:** Carbonaceous Biochemical Oxygen Demand
- CDF:** Confined Disposal Facility
- CEMS:** Continuous Emission Monitoring
- CERCLA:** Comprehensive Environmental Response, Compensation and Liability Act
- CFR:** Code of Federal Regulations
- cfs:** Cubic feet per second
- CO:** Carbon Monoxide
- CRM:** Coordinated Resource Management
- CSO:** Combined Sewer Overflow

CSOP: Combined Sewer Operational Plan

CTAP: Compliance and Technical Assistance Program

CWA : Clean Water Act

CY: Cubic yards

DEIS: Draft Environmental Impact Statement

DELT: Deformities, Eroded Fins, Lesions, and Tumors

DO: Dissolved Oxygen

DOE: Department of Energy

ECI: Energy Cooperative, Inc.

ECO: Employee Commute Options

EIS: Environmental Impact Statement

EnPPA: Environmental Performance Partnership Agreement

EPCRA: Emergency Planning and Community Right to Know

FBI: Family Biotic Index

FESOP: Federally Enforceable State Operating Permits

FFY: Federal Fiscal Year

FPH: Free Phase Hydrocarbons

GIS: Geographic Information System

GLAT: Great Lakes Action Team

GLI: Great Lakes Initiative

GLWQA: Great Lakes Water Quality Agreement

GLWQG: Great Lakes Water Quality Guidance

GRASS: Geographic Resources Analysis Support System

GSD: Gary Sanitary District

HAP: Hazardous Air Pollutants

HLP: Hammond Lead Products

HON: Hazardous Organic NESHAP

HPV: Health Protection Value

HSD: Hammond Sanitary District

IAC: Indiana Administrative Code

IACT: Indiana Association of Cities and Towns

IBI: Index of Biotic Integrity

IC: Indiana Code

IDEM: Indiana Department of Environmental Management

IDNL: Indiana Dunes National Lakeshore

IDNR: Indiana Department of Natural Resources

IHSC: Indiana Harbor Ship Canal

IITRI: Indiana /Illinois Toxic Release Inventory

ISTEA: Intermodal Surface Transportation Enforcement Act

ITM: Inland Testing Manual

LADCO: Lake Michigan Air Directors Consortium

LaMP: Lakewide Management Plan

LARE: IDNR Lake and River Enhancement Program

LMF: Lake Michigan Federation

LQERs: Lesser-Quantity Emission Rates

LQG: Large Quantity Generators

LTCP: Long Term Control Plan

LUST: Leaking Underground Storage Tanks

MACT: Maximum Achievable Control Technology

mgd: Million gallons per day

MIS: Management Information Services (IDEM)

MMDC: Multi-media Data Coordination

MOC: Memorandum of Cooperation

NAAQS: National Ambient Air Quality Standards

NESHAP: National Emission Standards for Hazardous Air Pollutants

NIPSCO: Northern Indiana Public Service Company

NIRPC: Northwestern Indiana Regional Planning Commission

NO₂: Nitrogen dioxide

NO_x: Nitrogen oxides

NPDES: National Pollutant Discharge Elimination System

NPL: National Priorities List

NPS: Nonpoint Source

NRCS: Indiana Department of Natural Resources, Division of Soil Conservation

NSPS: New Source Performance Standards

NWIAP: Northwest Indiana Action Plan

O₃: Ozone

OAM: Office of Air Management

OER: Office of Environmental Response

OPA: Oil Pollution Act

OPPTA: Office of Pollution Prevention and Technical Assistance

ORSANCO: Ohio River Valley Water Sanitation Commission

OSHWM: Office of Solid and Hazardous Waste Management

OTAG: Ozone Transport Assessment Group

OWM: Office of Water Management

PAHs: Polycyclic Aromatic Hydrocarbons

PAMS: Photochemical Assessment Monitoring Site

PCB: Polychlorinated Biphenyls

PM₁₀: Particulate Matter

POTW: Publicly Owned Treatment Works

ppb: Parts per billion

ppm: Parts per million

PSDDF: Primary Consolidation, Secondary Compression and Desiccation of Dredged Fill

RAPCC: Remedial Action Plan Coordinating Committee

RAPIDS: Regional Air Pollutant Inventory Development System

RCRA: Resource Conservation and Recovery Act

RDV: Reference Dose Value

SCRAP: Sediment Cleanup Restoration Alternatives Project

SIC: Standard Industrial Classification

SIP: State Implementation Plan

SO₂: Sulfur Dioxide

SRCER: Stream Reach Characterization and Evaluation Protocol Report

SRF: State Revolving Loan Fund

SWCD: Soil and Water Conservation District

TMDL: Total Maximum Daily Load

TNC: The Nature Conservancy

TRI: Toxic Release Inventory

TRPH: Total Recoverable Petroleum Hydrocarbons

TSCA: Toxic Substances Control Act

TSD: Treatment, storage, and disposal facilities

TSP: Total Suspended Particulate

TSS: Total Suspended Solids

U.S. ACE: United States Army Corps of Engineers

USC: United States Code

U.S. DOE: United States Department of Energy

U.S. FWS: United States Fish and Wildlife Service

U.S. EPA: United States Environmental Protection Agency

USGS: United States Geological Survey

U.S. Steel: United States Steel Corporation

VOC: Volatile Organic Compound

VOCAMP: Visible Oil Corrective Action Monitoring Program

WQBELs: Water Quality Based Effluent Limitations

WQC: Water Quality Criteria

LIST OF TABLES

Number	Title of Table	Page
01	Matrix of Stressors Causing Beneficial Use Impairments and Key Ecological Processes	10
02	Floristic Quality Assessments for Greater Calumet Wetlands Complex Ridge and Swale Sites	15
03	Floristic Quality Assessments for Miller Section	15
04	Bird Species Known From the Indiana Harbor, Indiana Harbor Ship Canal, Lake George Branch, and Grand Calumet River Area, including the ECI Site	19
05	Breeding Bird Atlas records for priority breeding blocks (west-central 1/6 of topographic map) in or near the Grand Calumet River Indiana Harbor Ship Canal Near Shore Lake Michigan Area of Concern	22
06	Mammals reported from Indiana Dunes National Lakeshore	25
07	Animals recorded in the Grand Calumet River, Indiana Ship Harbor Canal and Near Shore Lake Michigan Area of Concern that are listed as endangered, threatened or of special concern	26
08	Percent Mortality for <i>Hyalella azteca</i>	35
09	Current Fish Consumption Advisory for Lake Michigan and Tributaries	40
10	Matrix of Beneficial Use Impairments and Stressors Causing Beneficial Use Impairments	45
1	National Ambient Air Quality Standards (NAAQS)	52
2	Lake County NO ₂ Annual Arithmetic Mean 1989-1995	55
3	Lake County PM ₁₀ Second Highest 24-Hour Readings 1986-1995	57
4	Lake County SO ₂ Second Highest 24-Hour Reading 1987-1996	58
5	Lake County CO Second Highest 8-Hour Average Reading 1987-1996	60

6	Lake County Lead Highest Quarterly Mean, 1986-1995	61
16	Pollutants of Concern in the Great Lakes	105
17	Lake and Porter County 15 Percent Plan	111

LIST OF FIGURES

Figure Number	Descriptive Text	Page Number
<u>MAPS</u>		
i	Lead Horizon 1 (Composite from 0-5 feet)	29
ii	Fluoranthene Horizon 1 (Composite from 0-5 feet)	30
iii	Arsenic Horizon 1 (Composite from 0-5 feet)	31
iv	Anthracene Horizon 1 (Composite from 0-5 feet)	32
v	Cadmium Horizon 1 (Composite from 0-5 feet)	33
	Wetlands Unsuitable for Fill	98
	Critical Habitat to Preserve or Protect	122
	Wetlands	123
Figure 1.	Paleogeographic reconstruction of the shoreline progradation of Toleston Beach	7
Figure 2.	Map of Toleston Beach	64
Figure 3.	Sediment Clean Up and Restoration Alternatives Flowchart	74

LIST OF APPENDICES

Appendix Description	Name of Appendix	Number
A	Description of Regulatory and Resource Management Programs for the Northwest Indian Area of Concern Remedial Action Plan - Stage II	

IMPAIRED USE EVALUATION	LISTING GUIDELINE	DELISTING GUIDELINE	RATIONALE	EXISTING CONDITIONS	SOURCE OR CAUSE OF THE PROBLEM
<p>i. RESTRICTIONS ON FISH AND WILDLIFE CONSUMPTION</p>	<p>When contaminant levels in fish or wildlife populations exceed current standards, objectives or guidelines, or public health advisories are in effect for human consumption of fish or wildlife. Contaminant levels in fish and wildlife have been mitigated.</p>	<p>When contaminant levels in fish and wildlife populations do not exceed current standards, objectives or guide, and no public health advisories are in effect for human consumption of fish or wildlife. Contaminant levels in fish and wildlife must be due to contaminant input from the watershed.</p>	<p>Accounts for jurisdictional and federal standards; emphasizes local watershed sources.</p>	<p>Extremely pollution tolerant forms of fish such as carp, and invertebrates such as Oligochaetes, are dominant. There is a lack of a stable fish community in the Grand Calumet River and Indiana Harbor Ship Canal. Existing information is not comprehensive and is too sparse to accurately and fully describe conditions.</p> <p>Indiana currently has fish consumption advisories for mercury in certain sizes of Carp, Longnose Sucker, and White Sucker; and for PCBs in certain sizes of Black Crappie, Brook Trout, Brown Trout, Carp, Catfish, Chinook Salmon, Coho Salmon, Lake Trout, Largemouth Bass, Longnose Sucker, Northern Pike, Pink Salmon, Rainbow Trout, Walleye, Whitefish, and White Sucker. (See 1997 Indiana Fish Consumption Advisory for more details).</p>	<ul style="list-style-type: none"> -Contaminated sediments - industrial and municipal effluents -Combined sewer overflows -Urban surface runoff -Spills -Groundwater contamination -Atmospheric deposition of mercury

IMPAIRED USE EVALUATION	LISTING GUIDELINE	DELISTING GUIDELINE	RATIONALE	EXISTING CONDITIONS	SOURCE OR CAUSE OF THE PROBLEM
ii. TAINING OF FISH AND WILDLIFE FLAVOR	When ambient water quality standards, objectives, or guidelines, for the anthropogenic substance(s) known to cause tainting, are being exceeded or survey results have identified tainting of fish or wildlife flavor.	When survey results confirm no tainting of fish or wildlife flavor.	Sensitive to ambient water quality standards for tainting substances: emphasizes survey results	There is currently a consumption advisory on various types and sizes of fish in the Grand Calumet River and the Indiana Ship Canal, making this data difficult to obtain.	-Contaminated sediments
iii. DEGRADED FISH AND WILDLIFE POPULATIONS	When fish and wildlife management programs have identified degraded fish or wildlife populations due to a cause within the watershed. In addition, this use will be considered impaired when relevant, field-validated, fish or wildlife bioassays with appropriate quality assurance/quality controls confirm significant toxicity from water column or sediment contaminants.	When environmental conditions support healthy, self-sustaining communities of desired fish and wildlife at predetermined levels of abundance that would be expected from the amount and quality of suitable physical, chemical and biological habitat present. An effort must be made to ensure that fish and wildlife objectives for Areas of Concern are consistent with Great Lakes ecosystem objectives and Great Lakes Fishery Commission fish community goals. Further, in the absence of community structure data, this use will be considered restored when fish and wildlife bioassays confirm no significant toxicity from water column or sediment contaminants.	Emphasizes fish and wildlife management program goals; consistent with Agreement and Great Lakes Fishery Commission goals; accounts for toxicity bioassays.	Extremely pollution tolerant forms of fish, such as carp, and invertebrates such as Oligochaetes, are dominant. There is a lack of a stable fish community in the river and harbor. Existing information is not comprehensive and is too sparse to accurately and fully describe conditions.	<ul style="list-style-type: none"> -Introduction of exotic species. -Contaminated sediments -Industrial and municipal effluents -Combined sewer overflows -Urban surface runoff -Inputs from industries and municipalities -Spills -Groundwater contamination -Degradation/removal of physical spawning and nursery habitat from aquatic system and destruction of physical habitat in terrestrial system -Over fishing -Loss of genetic diversity in native populations -Atmospheric deposition of mercury

IMPAIRED USE EVALUATION	LISTING GUIDELINE	DELISTING GUIDELINE	RATIONALE	EXISTING CONDITIONS	SOURCE OR CAUSE OF THE PROBLEM
iv. FISH TUMORS OR OTHER DEFORMITIES	When the incidence rates of fish tumors or other deformities exceed rates at unimpacted control sites or when survey data confirm the presence of neoplastic or preneoplastic liver tumors in bullheads or suckers.	When the incidence rates of fish tumors or other deformities do not exceed rates at unimpacted control sites and when survey data confirm the absence of neoplastic or preneoplastic liver tumors in bullheads or suckers.	Consistent with expert opinion on tumors; acknowledges background incidence rates.	DELT Anomalies are documented to occur at 3.5% in the Grand Calumet River and up to 12.5% in the Indiana Harbor Ship Canal. Reference conditions would be 0.1% for Lake Michigan Tributaries. See <u>Central Cornbelt Region</u> , "Development of Index of Biotic Integrity, Expectations for the Ecoregions of Indiana, EPA document number 905/9-91/025	<ul style="list-style-type: none"> -Contaminated sediments -Bacterial, fungal, viral, and parasitic infections, neoplastic diseases, and chemicals -Chemical pollutants, overcrowding, improper diet, excessive siltation, and other perturbations -Dischargers of industrial and municipal wastewater -CSO and urban runoff <p>For more detailed information see Remedial Action Plan Support Document, "Pre-remedial Biological and Water Quality Assessment of the East Branch of the Grand Calumet River," U.S. FWS, 6/94</p>
v. BIRD OR ANIMAL DEFORMITIES OR REPRODUCTIVE PROBLEMS	When wildlife survey data confirm the presence of deformities (e.g. cross-bill syndrome) or other reproductive problems (e.g. egg-shell thinning) in sentinel wildlife species.	When the incidence rates of deformities (e.g. cross-bill syndrome) or reproductive problems (e.g. egg-shell thinning) in sentinel wildlife species do not exceed background levels in inland control populations.	Emphasizes confirmation through survey data; makes necessary control comparisons.	U.S. Fish & Wildlife Service has confirmed limited bird/animal deformities in the Grand Calumet River system and Lake George. Reproductive impairments have been documented in several bird species in or feeding in the Area of Concern.	<ul style="list-style-type: none"> -Toxics -Contaminated fish tissue -Degraded water quality -Contaminated sediments -Combined sewer overflows -Urban runoff -Contaminated groundwater -Air toxics -Inputs from industries and municipalities

IMPAIRED USE EVALUATION	LISTING GUIDELINE	DELISTING GUIDELINE	RATIONALE	EXISTING CONDITIONS	SOURCE OR CAUSE OF THE PROBLEM
vi. DEGRADATION OF BENTHOS	When the benthic macroinvertebrate community structure significantly diverges from unimpacted control sites of comparable physical and chemical characteristics. In addition, this use will be considered impaired when toxicity (as defined by relevant, field-validated, bioassays with appropriate quality assurance/quality controls) of sediment-associated contaminants at a site is significantly higher than controls.	When the benthic macroinvertebrate community structure does not significantly diverge from unimpacted control sites of comparable physical and chemical characteristics. Further, in the absence of community structure data, this use will be considered restored when toxicity of sediment-associated contaminants is not significantly higher than controls.	Accounts for community structure and composition; recognizes sediment toxicity; uses appropriate control sites.	Only pollution tolerant species (communities) exist in benthos. No information available for benthos in fluvial-lacustrine zone.	<ul style="list-style-type: none"> -Contaminated sediments -Industrial and municipal effluents -Combined sewer overflows -Urban runoff -Inappropriate nearshore dredging and deposition -Non-conventional inputs to POTWs -Offshore dumping -Spills and chemical treatment of water column -Groundwater contamination -Siltation of aquatic habitats -Loss of Riparian habitat -Loss of aquatic habitat from debris and litter
vii. RESTRICTIONS ON DREDGING ACTIVITIES	When contaminants in sediments exceed standards, criteria, or guidelines such that there are restrictions on dredging or disposal activities.	When contaminants in sediments do not exceed standards, criteria, or guidelines such that there are restrictions on dredging or disposal activities.	Accounts for jurisdictional and federal standards; emphasizes dredging and disposal activities.	The bottom sediments in the Indiana Harbor Ship Canal are contaminated and unsuitable for open water disposal in Lake Michigan. Neither are they suitable for unconfined disposal or for beneficial use.	<ul style="list-style-type: none"> -Contaminated sediments -Industrial and municipal effluents -Combined sewer overflows -Urban runoff Currently no feasible or cost effective facility exists to dispose of the contaminated sediments.
viii. EUTROPHICATION OR UNDESIRABLE ALGAE	When there are persistent water quality problems (e.g. dissolved oxygen depletion of bottom waters, nuisance algal blooms or accumulation, decreased water clarity, etc.) attributed to cultural eutrophication.	When there are no persistent water quality problems (e.g. dissolved oxygen depletion of bottom waters, nuisance algal blooms or accumulation, decreased water clarity, etc.) attributed to cultural eutrophication.	Consistent with Annex 3 of the Agreement; accounts for persistence of problems.	No data available.	<ul style="list-style-type: none"> -Contaminated sediments -Introduction of exotic species -Nutrient loadings

IMPAIRED USE EVALUATION	LISTING GUIDELINE	DELISTING GUIDELINE	RATIONALE	EXISTING CONDITIONS	SOURCE OR CAUSE OF THE PROBLEM
ix. RESTRICTIONS ON DRINKING WATER CONSUMPTION OR TASTE AND ODOR PROBLEMS	When drinking water supplies are impacted to the extent that: 1) densities of disease-causing organisms or concentrations of hazardous or toxic chemicals or radioactive substances exceed human health standards, objectives or guidelines; 2) taste and odor problems are present; or 3) treatment needed to make raw water suitable for drinking is beyond the standard treatment used in comparable portions of the Great Lakes which are not degraded (i.e. settling, coagulation, disinfection).	For treated drinking water supplies: 1) when densities of disease-causing organisms or concentrations of hazardous or toxic chemicals or radioactive substances do not exceed human health objectives, standards or guidelines; 2) when taste and odor problems are absent; and 3) when treatment needed to make raw water suitable for drinking does not exceed the standard treatment used in comparable portions of the Great Lakes which are not degraded (i.e. settling, coagulation, disinfection).	Consistency with the Agreement; accounts for jurisdictional standards; practical; sensitive to increased cost as a measure of impairment.	Currently, there are no drinking water restrictions in either Lake or Porter County.	-Unknown

IMPAIRED USE EVALUATION	LISTING GUIDELINE	DELISTING GUIDELINE	RATIONALE	EXISTING CONDITIONS	SOURCE OR CAUSE OF THE PROBLEM
x. BEACH CLOSINGS	When waters, which are commonly used for total-body contact or partial-body contact recreation, exceed standards, objectives, or guidelines for such use.	When waters, which are commonly used for total-body contact or partial-body contact recreation, do not exceed standards, objectives, or guidelines for such use.	Accounts for use of waters; sensitive to jurisdictional standards; addresses water contact recreation; consistent with the agreement.	Indiana criteria for swimmable waters for <i>E. coli</i> counts is 235 colonies per 100 ml of water for a single sample and a monthly average geometric mean of 126 colonies per 100 ml of water. While in 1995 the National Park Service at Indiana Dunes National Lakeshore documented 45 exceedences of State criteria for <i>E. coli</i> , there were very few beach closings.	<ul style="list-style-type: none"> -Contaminated sediments -Treatment facilities -Underground injection wells -Industrial waste -Combined sewer overflows -Septic systems improperly maintained -Loss or degradation of wetlands -Urban runoff -Agricultural runoff -Land application -Wildlife -Commercial and recreational operation of vessels -Operations of marinas and ports -Human recreational activities -Domestic animals on beaches -Natural phenomena

IMPAIRED USE EVALUATION	LISTING GUIDELINE	DELISTING GUIDELINE	RATIONALE	EXISTING CONDITIONS	SOURCE OR CAUSE OF THE PROBLEM
xi. DEGRADATION OF AESTHETICS	When any substance in water produces a persistent objectionable deposit, unnatural color or turbidity, or unnatural odor (e.g. oil slick, surface scum).	When the waters are devoid of any substance which produces a persistent objectionable deposit, unnatural color or turbidity, or unnatural odor (e.g. oil slick, surface scum).	Emphasizes aesthetics in water; accounts for persistence.	<p>Debris litters the Banks of the Grand Calumet River and the Canal. The banks of the harbor appear to be saturated with petroleum. The river and the harbor often have oily sheen. The Lake Michigan waters often appear murky at the mouth of the Indiana Harbor Ship Canal.</p> <p>Copious amounts of debris found in some benthic areas of aquatic system.</p> <p>Riparian emergent vegetation covered with oil along most of east branch and canal.</p> <p>Strong sewage and petroleum odors.</p>	<ul style="list-style-type: none"> -Contaminated sediments -Combined sewer overflows -Groundwater contamination -Spills -Public littering, especially from recreational activities -Commercial dumping -Poor management for land and water litter control -Natural turbulence (storms)
xii. ADDED COSTS TO AGRICULTURE OR INDUSTRY	When there are additional costs required to treat the water prior to use for agricultural purposes (i.e. including, but not limited to, livestock watering, irrigation and crop-spraying) or industrial purposes (i.e. intended for commercial or industrial applications and noncontact food processing).	When there are no additional costs required to treat the water prior to use for agricultural purposes (i.e. including, but not limited to, livestock watering, irrigation and crop-spraying) and industrial purposes (i.e. intended for commercial or industrial applications and noncontact food processing).	Sensitive to increased cost and a measure of impairment.	<p>Various docks are restricted, causing double handling of bulk commodities.</p> <p>Ships must enter the Harbor at less than optimum vessel drafts.</p>	<ul style="list-style-type: none"> -Contaminated sediments -Inadequate channel depth (no dredging for 20 years)

IMPAIRED USE EVALUATION	LISTING GUIDELINE	DELISTING GUIDELINE	RATIONALE	EXISTING CONDITIONS	SOURCE OR CAUSE OF THE PROBLEM
<p>xiii. DEGRADATION OF PHYTOPLANKTON AND ZOOPLANKTON POPULATIONS</p>	<p>When phytoplankton or zooplankton community structure significantly diverges from unimpacted control sites of comparable physical and chemical characteristics. In addition, this use will be considered impaired when relevant, field-validated, phytoplankton or zooplankton bioassays (e.g. Ceriodaphnia; algal fractionation bioassays) with appropriate quality assurance/quality controls confirm toxicity in ambient waters.</p>	<p>When phytoplankton and zooplankton community structure does not significantly diverge from unimpacted control sites of comparable physical and chemical characteristics. Further, in the absence of community structure data, this use will be considered restored when phytoplankton and zooplankton bioassays confirm no significant toxicity in ambient waters.</p>	<p>Accounts for community structure and composition; recognizes water column toxicity; uses appropriate control sites.</p>	<p>IDEM has never conducted zooplankton work. The most recent phytoplankton work was performed four years ago, but the results were inconclusive and the study was discontinued.</p>	<ul style="list-style-type: none"> -Introduction of exotic species -Contaminated sediments

IMPAIRED USE EVALUATION	LISTING GUIDELINE	DELISTING GUIDELINE	RATIONALE	EXISTING CONDITIONS	SOURCE OR CAUSE OF THE PROBLEM
xiv. LOSS OF FISH AND WILDLIFE HABITAT	When fish and wildlife management goals have not been met as a result of loss of fish and wildlife habitat due to a perturbation in the physical, chemical, or biological integrity of the Boundary Waters, including wetlands.	When the amount and quality of physical, chemical, and biological habitat required to meet fish and wildlife management goals have been achieved and protected.	Emphasizes fish and wildlife management program goals; emphasizes water component of Boundary Waters.	-Poor habitat quality because of physical and chemical reasons. -Limited habitat	<ul style="list-style-type: none"> -Industrialization -Draining and filling of wetlands -Degraded water quality -Contaminated sediments -Destruction of terrestrial natural areas and wetlands -Destruction of macrophyte communities in Nearshore (Coastal Shore) communities -Loss of aquatic habitat from debris and litter -Loss of riparian zone vegetation -Siltation of aquatic habitats -Disconnection of coastal lagoons from Lake Michigan -Thermal increases of the river system from non-contact cooling water -Large scale disturbance due to inappropriate river and nearshore dredging, deposition and construction

CHAPTER ONE THE REMEDIAL ACTION PLAN PROCESS AND STAGE II GOALS

I. An Overview of the Remedial Action Plan Process

The Great Lakes Water Quality Agreement of 1978 (Agreement) between the United States and Canada identified forty-three Areas of Concern in the Great Lakes Basin. Each Area of Concern has specific impairments to one or more of the fourteen identified beneficial uses of the Great Lakes ecosystem. The Agreement directed that a Remedial Action Plan be developed for each Area of Concern in order to restore the impaired beneficial uses. The International Joint Commission is responsible for the review and approval of each Remedial Action Plan, and has provided guidance on Remedial Action Plan implementation. The Grand Calumet River and the Indiana Harbor Ship Canal in Northwest Indiana were designated an Area of Concern by the International Joint Commission in the mid 1980s.

In order to more specifically address the environmental problems plaguing Northwest Indiana, former Governor Evan Bayh directed former IDEM Commissioner, Kathy Prosser, to create a Northwest Indiana Regional Office. This office has allowed IDEM to work closely with local governments, interest groups, industry, the United States Environmental Protection Agency (U.S. EPA), and other state and federal regulatory agencies.

Former IDEM Commissioner Kathy Prosser appointed the CARE Committee. The CARE Committee meets publicly every month to provide input to the Remedial Action Plan. Members of the public, industry, and local government attend the public meetings of the CARE Committee and also provide input into the Remedial Action Plan process. The CARE Committee meetings offer the first opportunity for public involvement. IDEM will continue to seek additional opportunities for public outreach throughout the implementation of the Remedial Action Plan.

The Stage I Remedial Action Plan for Northwest Indiana's Area of Concern was published in January 1991 and defined all fourteen beneficial uses as impaired. It also described in detail the environmental problems found in the Area of Concern. IDEM submitted the Stage I Remedial Action Plan to the International Joint Commission in January 1991. The International Joint Commission approved the Stage I Remedial Action Plan in 1994 with reservations. The Stage II document addresses the International Joint Commission's reservations in the Stage I document by detailing the ecological process in the Area of Concern; describing habitat found in the area; and discussing the state of the water, ground water, sediment, soil and air and also by outlining an ecosystem approach to restoration.

Stage II of the Remedial Action Plan includes remedial and regulatory measures to restore the Area of Concern. Stage III will include a monitoring strategy and will indicate the degree of restoration of the impaired beneficial uses. The Remedial Action Plan process is a learning process. It is dynamic and evolving. There are no clear lines between the different stages. The CARE committee and IDEM will also provide updates throughout the process.

II. Stage II Remedial Action Plan Goals

The vision of the Remedial Action Plan is one of ecological integrity. The goal is to restore the fourteen beneficial uses by addressing the stressors that impair the key ecological processes and result in use impairments in the Area of Concern. The combined impact of the stressors has created such extensive environmental degradation that it is imperative to take an ecosystem approach in designing remedial measures that address beneficial use impairments in the Area of Concern. The Stage II Remedial Action Plan builds a framework for ecosystem restoration that provides continuity and cohesiveness to the myriad of actions that are underway and that will be undertaken in the future.

The Remedial Action Plan seeks to balance land use with ecological restoration to achieve delisting while maintaining the economic vitality of the region. Ecosystem integrity is measured both in terms of biological integrity and in terms of human health. For development to be ecologically sustainable, the knowledge gained from the accumulation of ecological insights concerning the impacts of human activities on health and biological integrity must feed back into economic development and planning processes and must be used to adjust those activities to protect the integrity of the ecosystem. The depletion of non-renewable resources and expenditures of ecological capital through the destruction of unique habitats and biodiversity cannot continue.

The Stage II Remedial Action Plan provides a framework for addressing the fourteen beneficial use impairments in an ecosystem context and presents the current environmental conditions in the Area of Concern. While the Stage II document provides a draft matrix of actions underway and beneficial use impairments, an analysis of the matrix has yet to be completed. IDEM and the CARE Committee will complete the matrix and associated definitions in an addendum. The addendum will be submitted to the International Joint Commission in the fall of 1998.

III. Public Involvement in Development of the Stage II Remedial Action Plan

Through the Remedial Action Plan process, IDEM forged relationships with local governments, environmental and community groups, and industry to address the long-term remediation and restoration challenges in the Area of Concern. The CARE Committee and IDEM staff have supported and guided the activities of Remedial Action Plan participants. Public involvement in the Remedial Action Plan process has evolved with recruitment of

individuals and institutions for specific projects and subgroups. Participating institutions have provided personal and financial resources to foster this public involvement. To facilitate public input into the Stage II document, the CARE Committee designated members to serve as "champions" for each technical area. CARE Champions contributed to the formation of the document and provided IDEM's technical teams with detailed reviews. The document also reflects the efforts of the three CARE subcommittees: the Northwest Indiana Pollution Reduction Workgroup; the Habitat Subcommittee; and the Grand Calumet Lagoon Subcommittee.

During the development of the Stage II document, a Remedial Action Plan Coordinating Committee, largely staffed by IDEM program managers, coordinated the work of the technical teams. These technical teams obtained guidance from other governmental agencies such as the Indiana Department of Natural Resources (IDNR), U.S. EPA, and the United States Fish and Wildlife Service (U.S. FWS). A new Remedial Action Plan Coordinating Committee has been selected to foster an ongoing collaborative approach among key institutions during Remedial Action Plan implementation. A responsible program manager for each remedial action has also been selected. The Northwest Indiana Coordinator from IDEM's Indianapolis Office will coordinate the implementation of Stage III.

IV. Conclusion

The Stage II goals deal specifically with restoring the fourteen impaired beneficial uses by taking an ecosystem approach in designing remedial measures. The Stage II Remedial Action Plan is aimed at balancing the ecosystem restoration processes and the pertinent land uses in the ecosystem. Public involvement has been instrumental in its construction and coordination. Institutions and individuals have contributed their time and financial support in order to plan and fulfill the Remedial Action Plan which will help restore this ecosystem.

CHAPTER TWO ENVIRONMENTAL CONDITIONS

I. Introduction

The complexity of current environmental conditions in the Grand Calumet River basin is evident in the contrasts of the landscape. Four Superfund Sites (National Priority List) and 56 other sites identified as uncontrolled hazardous waste sites for possible remediation through the Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) are located within the Area of Concern. Amongst these sites are remnants of the natural landscape that harbor some of the most diverse native plant and animal communities in the Great Lakes basin. The physical, chemical and biological structure of in-stream habitat in the Grand Calumet River is extremely degraded and results in severely impaired invertebrate and fish communities. Yet, within one mile of the river channel is Clarke and Pine Nature Preserve, which supports the highest concentration of rare and endangered species in the state. Reconciling these extremes into a better integrated landscape is one challenge of the Remedial Action Plan.

Industrial and urban development have caused stress that negatively impacted the integrity of the southern Lake Michigan lakeplain ecosystem through the years. The natural processes that once controlled the ecology of the Area of Concern have been eclipsed by human activity, creating a new set of environmental conditions that will shape the future of the region as much as the natural systems shaped the past. The purpose of the Remedial Action Plan is to balance land use with ecological restoration in order to remove impairments to the beneficial uses, but not to fully restore the landscape to pre-industrial conditions. Considering this, two fundamental issues face the Remedial Action Plan:

- What threats to human health and ecosystem integrity have urban industrial development created, as expressed in the beneficial use impairments? and
- To what extent can these threats be removed and the damage caused to the landscape be repaired?

Ecosystem integrity stems from the health of the biological populations and interactive communities and the ability of the ecosystem to withstand or adapt to stress. An essential concept in ecosystems is that ecological communities are dynamic and exist within ranges of conditions that occur as the result of natural forces. Communities exist in balance with these natural conditions and composition changes throughout various states that tend toward stability and increasingly complex interrelationships. Healthy systems are characterized by their resiliency and their ability to self organize and recover from stress or disruption. The diversity of genetic traits within species and among them supports the ability of ecosystems to survive and prosper even though challenged by changing conditions. Native species and natural communities contain within their genetic makeup the "memory" of thousands of years of conditions that have survived

within the Great Lakes Basin. An important measure of the biological integrity of the Area of Concern is its ability to sustain viable populations of native species and community types.

The remnants of the native landscape are snapshots of what was once a beautiful and dynamic natural system. They offer the potential for a new landscape that is rich in biological diversity. Conservation of these natural resources will depend on the recognition of their intrinsic value and protection and restoration of the ecological processes that support them. Restoration of the Area of Concern presents a basic problem: while the remnants of the pre-industrial landscape offer the best opportunities for conservation, restoration and preservation of ecological health to the system; the natural processes that created and kept them dynamic have been changed forever.

The ultimate success of the Remedial Action Plan, restoring the fourteen impaired beneficial uses, depends upon the designation, implementation, and coordination of site-specific remediation and restoration projects that remove impairments to these natural processes. Contamination is generally thought of as the primary cause of environmental degradation in the Area of Concern, and is the one stressor common to all beneficial use impairments. However, simply removing contamination from the system is not sufficient for delisting. Other stressors; physical destruction of habitat, fragmentation, changes in hydrologic regime, introduction of exotic species, shoreline alteration and fire suppression, disrupt the key ecological processes and must be addressed to achieve delisting of all beneficial use impairments. Removing pollutants before they enter the system is just one step toward restoring ecological health. Remediation of the environmental damage caused by historic contamination is more complex.

The combined impact of the stressors has created such extensive environmental degradation that it is imperative to take an ecosystem approach in designing remedial measures that address beneficial use impairments in the Area of Concern. This chapter establishes an ecosystem approach to environmental remediation and restoration. It links ecosystem functions and key ecological processes to the stressors that cause beneficial use impairments in the Area of Concern. Section II describes the lakeplain formation and the key ecological processes and the stresses on the environment. Section III describes how current habitat conditions reflect the impact of industrial development. Finally, sections IV through VI specifically describe the current conditions of the surface water, underlying sediment, groundwater and air.

II. Key Ecological Processes

The post-glacial landscape of the southern Lake Michigan lakeplain is constantly changing. For most of its history, regional physical processes such as climatic conditions, glacial mechanics, and fluctuating lake levels drove this dynamic system. The region's biotic communities have been influenced by the interplay of three major biomes: eastern deciduous forest, tallgrass prairie, and boreal forest. The changing physical terrain and the availability of diverse genetic material created an ecological rhythm that marked time with constantly evolving biotic communities. The ecological processes of natural succession, hydrology (link between the groundwater and surface water, including Lake Michigan), species diversity (interplay of three

major biomes), and periodic fire shaped and sustained the natural communities.

A. Lakeplain Formation

The following geologic history of the lakeplain and formation of the Grand Calumet River are summarized from *Geologic History of the Little Calumet and Grand Calumet Rivers* by Steve E. Brown, Indiana Geological Survey, Indiana University, 1996.

Sixteen-thousand years ago the Lake Michigan Lobe of the Wisconsin Glacier covered the southern Lake Michigan area. Over the next 4,000 years the glacier receded and advanced several times. With each successive wave of glaciation, the retreating ice left behind till in the form of moraines. Ancestral Lake Michigan formed as the ice retreated north and the meltwater was trapped between the moraines and the receding ice.

The water level of the lake fluctuated with changes in drainage and precipitation, dropping to its current level. The dynamic history of the lake is recounted by the sand dunes, relict beaches, sandbars and spits of the Southern Lake Michigan lakeplain. These land forms mark three distinct periods of the lake; the Glenwood Beach (13,500 to 12,400 years ago), the Calumet Beach (11,800 to 11,000 years ago) and Toleston Beach (6,300 years ago to present).

Prior to the formation of Toleston Beach, early forms of the Little Calumet River, Salt Creek, and Deep River served as watershed for the area, draining into ancestral Lake Michigan. As Toleston Beach formed, it blocked the rivers' outlets, preventing them from flowing directly into the lake. As the rivers backed up, they formed a large lagoon landward of Toleston Beach. Between 4,500 and 4,000 years ago, Toleston Lagoon emptied into ancestral Lake Michigan near the Indiana-Illinois border, where together they drained southward through the Sag channel. Eventually, the lake level dropped below the Sag Channel outlet transforming the rivers and lagoon into a drainage network that joined the Little Calumet River, Salt Creek, Deep River and Thorn Creek.

As the lake level continued to drop, the Toleston Strandplain formed on the lakeward side of Toleston Beach. Approximately 2,200 years ago, the Little Calumet flowed west landward of Toleston Beach and turned northeast to flow lakeward at a break in the ridge near early Lake Calumet. The lakeward reach became the Grand Calumet River, which emptied into Lake Michigan. During the formation of the strandplain, eastward directed longshore currents forced the mouth of the Grand Calumet River to migrate from west to east along the shoreline. The mouth of the river reached the area now occupied by the Grand Calumet Lagoons about 350 years ago. Figure 1 depicts the formation of the Little and Grand Calumet rivers and the Toleston strandplain (Chrzastowski and Thompson, 1992).

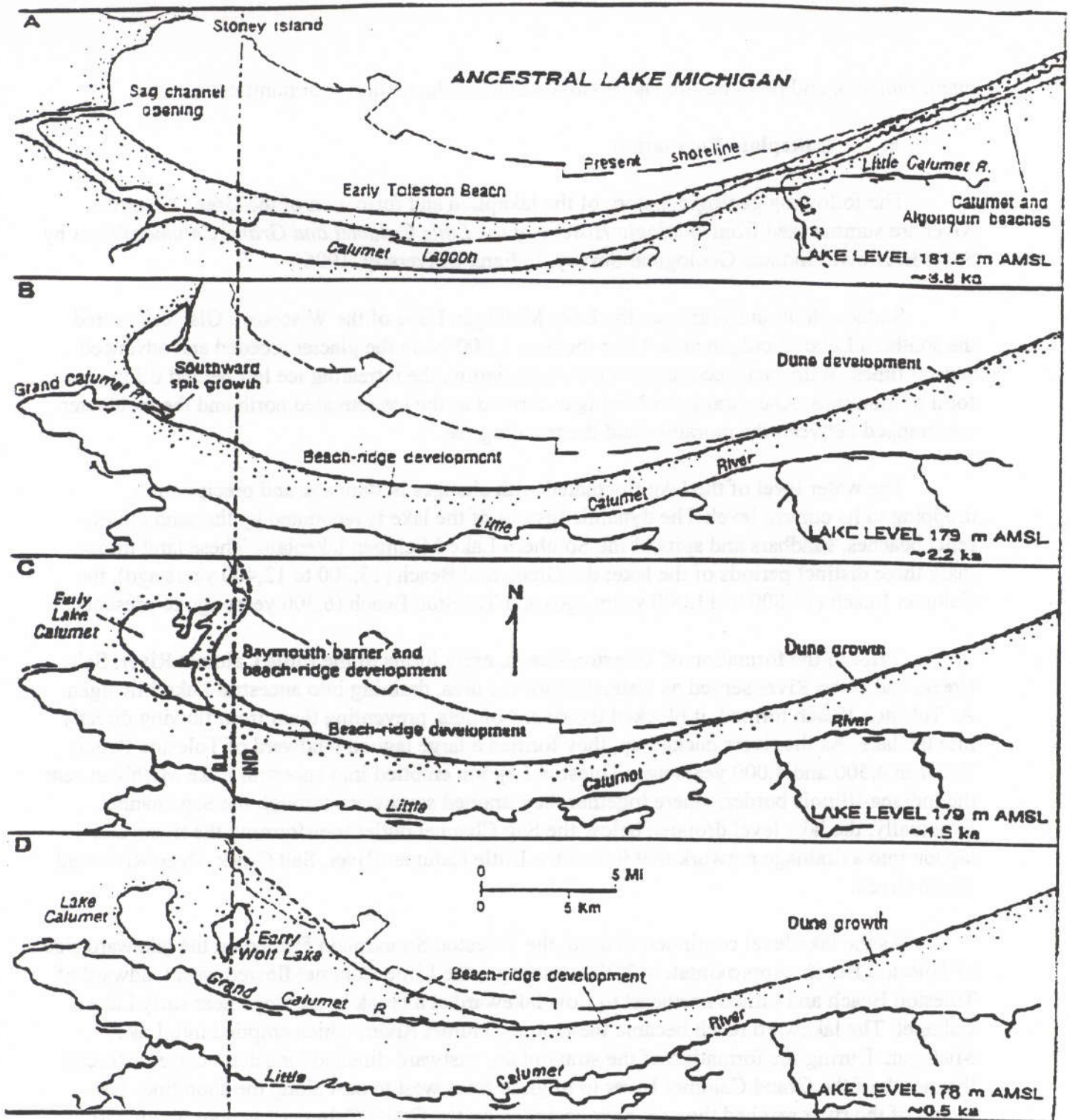


Figure 1. Paleogeographic reconstruction of the shoreline progradation of the Toleston Beach since about 3,800 years ago and the corresponding changes in drainage patterns along the Little and Grand Calumet Rivers (from Chrzastowski and Thompson, 1992).

Toleston Beach, at its east end, begins as a high dune and widens into the Toleston strandplain as it moves west. In the northwest section of the strandplain a series of shallow lakes were captured by spits as the lake receded. To the south and east the surface topography was dominated by a series of ancient linear beach ridges and intervening swales. Near the Indiana-Illinois border there were as many as one hundred of these ridges. Each individual ridge took from tens to hundreds of years to form as the level of Lake Michigan fluctuated. The ridges are built of layers of sand and gravel sediments deposited by shoreline wave activity and are capped with wind blown dune deposits.

Wetlands formed where the swales dip below the groundwater table. The well-drained sandy soils of the ridges grading into the marshy swales created a wide range of moisture conditions that were complicated by the natural fluctuations in the groundwater table including seasonal changes, short term fluctuations of Lake Michigan water level, and the long term retreat of the lake. This is reflected in the variety of natural communities found throughout the dune and swale region. From the dry sand savannas to the interdunal ponds, these communities are interwoven into a fine tapestry of living organisms responding to each temporal or spatial change in the landscape.

The Grand Calumet River formed as a natural land feature along with the dune and swale on the Toleston strandplain. Despite fragmentation, the river corridor and natural-area remnants share a common ecological heritage. The divisions between these areas are artificial impairments to the natural ecological processes. No matter how disturbed the landscape, the remnants are elements of a larger system. Understanding how that system functions and its potential for improvement provides context for habitat restoration projects along the river corridor. The long term viability of the native communities will depend on restoring ecological processes along the river and throughout the watershed.

B. Key Ecological Processes

1. *Natural Succession*

Natural succession, the process where one recognizable biotic community naturally replaces another, takes place over hundreds and thousands of years. As Lake Michigan receded, plants and animals from the surrounding landscape migrated in and colonized the newly formed ridges and swales. The various biotic communities that inhabit these areas mark the stages in the evolution of the lakeplain and reveal the natural succession through which sand and gravel beaches were transformed into living marshes, prairies and savannas. The ridge and swale system closest to the lake (north of the Grand Calumet River) has a higher water table, is more calcareous, and has fewer trees. Prior to logging, white and jack pine dominated the ridges and white cedar was found throughout the swales. The inland ridge and swale system (south of the Grand Calumet River) has a lower pH and is more heavily forested with black and white oaks (Bacone, 1979).

2. *Hydrology*

Ground water flow was crucial to maintaining the moisture regimes in the wetlands, lakes and rivers of the lakeplain. The subsurface of the lakeplain is underlaid with a layer of nearly impermeable clay topped by lacustrine sediments that form the Calumet Aquifer. This formation holds groundwater close to the surface, resulting in poor surface water drainage. Poor drainage and relatively flat topography resulted in marshes, shallow lakes, and sluggish rivers and creeks to form throughout the new landscape. Moisture conditions were complicated by the natural fluctuations in the groundwater table including seasonal changes, short term fluctuations of Lake Michigan water level, and the long term retreat of the lake.

3. *Species Diversity*

Species diversity was enhanced on the southern Lake Michigan lakeplain by successive waves of tundra, boreal, eastern deciduous forest and prairie systems migrating across the region with changes in climate. Boreal and tundra communities were established along the receding edge of the glacier. By the end of the Calumet Beach phase of the lake a forest, dominated by spruce and fir, followed the receding water north. A mild semi-arid period began that spanned several stages of the lake's evolution, allowing deciduous forest to migrate in from the south and east and eventually prairie from the west (Bacone 1979). Elements from these biomes that could survive the changing environmental conditions mixed freely together to form the unique natural communities of the lakeplain.

4. *Fire*

Fire has been an influence on the biotic communities of the lakeplain for at least 4,000 years, creating and maintaining the openness of prairie and savanna communities. During the formation of the Tolleston strandplain, human activity began to have a direct influence on the lakeplain landscape. Climatic conditions became more moist and favored the deciduous forest. The forest expanded across the landscape from the south and east pushing the prairie back west. The advance of the forest was checked by Native Americans, who used fire as a hunting tool. Fires swept across the prairies into the edge of the forest, creating openings for prairie species to establish amongst fire tolerant deciduous species (Bacone).

C. Stressors Causing Impairments to Key Ecological Processes

Intensive industrial and urban development have resulted in significant stress on the lakeplain ecosystem and are expressed as beneficial use impairments. Fragmentation and loss of physical habitat, fire suppression, altered hydrology, exotic species, shoreline alterations and contamination are stressors on the biological, chemical and physical structure of the ecosystem. The stressors do not act upon the processes singularly, but in combination, magnifying their influence on the landscape. The following matrix (Table 01) shows the impact of stressors causing beneficial use impairments on the key ecological processes.

Matrix of Stressors Causing Beneficial Use Impairments and Key Ecological Processes

Stressors Causing Beneficial Use Impairments	Key Ecological Processes			
	Succession	Hydrology	Species Diversity	Fire
Pollution and Nutrient Contamination	reduces species & community diversity limits natural community interaction allows for influx of exotics	alters chemical structure of habitat	alters chemical structure of habitat limits species interaction higher rates of extirpation allows for influx of exotics lower recolonization rates	
Loss of Physical Habitat/ Habitat Fragmentation	reduces species & community diversity limits natural community interaction allows for influx of exotics	disrupts surface water flow	alters physical structure of habitat limits species interaction higher rates of extirpation allows for influx of exotics lower recolonization rates	restricts size and range
Altered Hydrology	reduces species & community diversity limits natural community interaction allows for influx of exotics	disrupts groundwater flow disrupts surface water flow	alters physical structure of habitat limits species interaction higher rates of extirpation allows for influx of exotics	
Shoreline Alterations	eliminates early successional communities allows for influx of exotics	disrupts groundwater flow disrupts surface water flow	alters physical structure of habitat limits species interaction higher rates of extirpation allows for influx of exotics	
Exotic Species	replaces native species in succession patterns reduces species and community diversity limits natural community interaction	changes in biological structure can impact surface water patterns	alters biological structure of habitat outcompetes native species limits species interaction	alters fuel loading and composition
Fire Suppression	accelerates succession reduces species and community diversity limits natural community interaction may favor exotic species	changes in biological structure can impact surface water patterns	alters biological structure of habitat limits species interaction higher rates of extirpation may favor exotic species	reduction in frequency increase in intensity of wildfires

1. *Pollution and Nutrient Contamination*

Contamination impacts the chemical structure of habitat, affecting succession and species diversity. Sedimentation can alter the physical structure of aquatic habitat. Contamination can take the form of toxics, pathogens, and nutrients. Contamination alters the chemical environment and creates conditions that cannot support conservative species. Contamination causes greater rates of extinction, reduces available habitat, diminishes species interaction, and creates conditions that favor exotic species.

2. *Loss of Physical Habitat/Habitat Fragmentation*

Fragmentation and physical destruction of habitat destroy the physical structure of the landscape, affecting species diversity, succession, hydrology and fire. Physical changes in habitat conditions along the edges of fragments disrupt biotic communities and allow for the influx of exotic species. Small habitat patches generally have high rates of extinction, low rates of recolonization, and low levels of species diversity. Species that once interacted across the broader landscape are limited to small fragments. As a result, ecological interactions such as succession, pollination and predator/prey relationships are impaired. The ecological niches created by natural and human influences on the landscape go unfilled without the influx of new species. Habitat fragmentation restricts the size and range of fire on the landscape and restricts the ability of fire-sensitive species to recolonize burned areas.

3. *Altered Hydrology*

Altered hydrology impacts the physical and biological structure of the landscape and affects succession, natural hydrology and species diversity. Extensive draining and filling have reduced the total acreage of wetlands in the Area of Concern to about 30 percent of what existed prior to urban industrial development. Precipitation that once recharged the groundwater is now piped away as urban runoff, and rivers and streams have been channelized. These alterations disrupt surface/groundwater interactions, fragment aquatic communities, reduce available aquatic habitats, and allow for the influx of exotic species.

4. *Shoreline Alterations*

Shoreline alterations impact the physical structure of the landscape, affecting succession, hydrology and species diversity. Armoring and filling along the Lake Michigan shoreline impacts succession by inhibiting further dune formation. Two globally rare communities (panne and foredune) have been virtually eliminated from the Area of Concern because they are early successional shoreline communities. Shoreline alterations also reduce available habitat and disrupt surface and groundwater flow.

5. *Exotic Species*

Exotic species alter the biological structure of the landscape and affect succession and species diversity. Introduced species many times have no biological control in the natural system and out compete native species. Introduced species often form large monocultures that destroy and fragment natural habitat. Exotic species can alter succession patterns, limit species interactions, and lower recolonization rates.

6. *Fire Suppression*

Fire suppression alters the biological structure of the landscape, affecting succession and species diversity. Fire suppression also physically affects wildfire behavior by reducing the frequency and increasing the intensity. Areas left unburned build-up heavy combustible fuel loads that, in the event of a wildfire, can be dangerous to people, property, and the natural system. Without fire, savannas and prairies become choked with saplings and brush, shading out herbaceous species. When these areas are shaded out, species diversity is reduced, exotic species are favored, and the biological structure of the natural communities is destroyed.

III. Habitat

The landscape of the Calumet Region has changed dramatically over the past one hundred years. The Grand Calumet River typifies these changes. It was once described as being more like a bayou on Lake Michigan than a river (Moore 1959), but has since been channelized and redirected to flow into the Mississippi river basin. Depending on the level of the lake, the east branch also flows into Lake Michigan. Today roughly 90 percent of the river's water comes from industrial and municipal discharges. The sandy soils of the river bed have been overlain by sediments contaminated with the residue of urban industrial activities. Despite these changes, aspects of the natural systems are still evident along the river corridor and throughout the watershed. Identifying and understanding the significance of the native species and community types is an integral part of assessing the ecological state of the river corridor.

Currently, the most biologically diverse communities along the river corridor are restricted to a series of small tracts that have escaped physical disruption of the natural terrain. These sites include DuPont Dune & Swale, Clark and Pine East, the Grand Calumet Lagoons and Miller Woods unit of the National Lake Shore. There are somewhat disturbed areas, such as the NIPSCO Roxanna Substation, that support degraded native communities. And still others that are extremely degraded in most aspects but maintain specific ecological functions. Roxanna Marsh is the best example of the latter, it bears little resemblance to any native community type, yet it is a crucial stop over point for long range migratory waterfowl.

Migratory birds follow the elongate north-south lakeshore of Lake Michigan toward wintering grounds each fall. These migratory birds ultimately pass through the dune area at the southern tip of the lake. Brock (1986) called this avian convergence in the Area of Concern (and surrounding areas) the funnel effect which resulted in the area becoming a massive portal of migration toward wintering grounds throughout the Midwest. The lake provides rare habitat in the deep lake and beaches of the area. The deep lake attracts numerous diving ducks and the beaches provide the first resting place after long flights over the lake. Even though they are often degraded, remnant habitats in the shoreline area become extremely important areas for migrating birds. The Migrant Trap, Roxanna Pond (Marsh), Lake George Woods, and the Hammond Cinder Flats are exceptional examples of such areas.

A. Natural Heritage Data

This natural heritage information is summarized from *The Conservation of Biological Diversity in the Great Lakes Ecosystem: Issues and Opportunities*, by Crispin and Rankin. Seven natural systems have been identified that support biodiversity in the Great Lakes Basin. They are:

open lake, coastal shore, coastal marsh, lakeplain, tributary and connecting channel, inland terrestrial upland and inland wetland. The open lakes, coastal marsh, coastal shore and lakeplain are unique to the basin. Of these, coastal shore and lakeplain support a disproportionate amount of the basin's special biological diversity. Of the sixty-one Great Lakes' dependent, globally significant elements (G1 or G2), 26 percent are supported by coastal shore, while 21 percent are supported by lakeplain systems.

The Southern Lake Michigan region supports both lakeplain and coastal shore systems. The biological diversity of the coastal dunes that stretch along the southeast shoreline from Gary to southwest Michigan is underscored by the fact that the Indiana Dunes National Lakeshore has the third highest plant diversity of all national parks, despite having less than three percent of the total acreage of either of the top two (National Park Service, 1987). Data from the Natural Heritage Network identifies The Greater Calumet Wetlands Site as an area that also supports significant biological diversity on the Southern Lake Michigan lakeplain (Crispin and Rankin).

The Greater Calumet Wetlands Site stretches along the southern shore of Lake Michigan from the southeast side of Chicago to the west side of Gary and extends south to the southern edge of the lakeplain. This area contains several high quality remnants of the native landscape, harboring a wide range of both upland and wetland community types. A number of severely degraded wetlands serve as nesting and foraging habitat for regionally rare birds. There are eighteen natural community types within the site. Inventories include over seven hundred species of native plants, of which eighty-five are globally or state significant; over two hundred species of birds, including eighteen confirmed nesting species that are globally or state significant (The Nature Conservancy).

The Area of Concern is in the northeast section of the Greater Calumet Wetlands Site. It harbors a series of high quality remnants of the dune and swale complex that once covered the Grand Calumet River Watershed. Clark and Pine Nature Preserve, Gibson Woods Nature Preserve, Ivanhoe Dune and Swale Nature Preserve and Toleston Ridges Nature Preserve are examples of islands of biodiversity in the midst of an urban industrial landscape. These sites support a mosaic of interconnected natural communities that at times defy mapping. Seven of the community types are globally rare; panne, wet mesic sand prairie, mesic prairie, dry mesic sand prairie, dry mesic sand savanna, dry sand savanna and sedge meadow. The ridge and swale remnants support the most dense assemblage of rare plants and animals in Indiana with sixty-six state rare and endangered species currently identified at these sites (The Nature Conservancy). Clark and Pine Nature Preserve's forty acres support the highest concentration of rare and endangered species in the state of Indiana.

Several tracts that support significant habitat are adjacent to the Grand Calumet River. DuPont Dune and Swale and Clark and Pine East both include high quality remnants of dune and swale and have riparian wetlands with direct surface water connections to the river channel. The DuPont natural area contains four globally rare communities; wet-mesic sand prairie, dry sand savanna, dry-mesic sand prairie and sedge meadow. Roxanna Marsh and the Calumet Tern Site are both degraded wetlands that are noted as foraging and nesting habitat for regionally rare birds. At the extreme east end of the river are three Natural Heritage sites associated with the Grand Calumet River Lagoons; Miller Beach and Dunes, the U.S. Steel Site and sections of Marquette Park. All are a part of or adjacent to the larger Miller Woods Unit of the Indiana Dunes National Lakeshore, a nine hundred acre remnant of native lakeplain landscape.

Toleston Beach fans out from a single dune ridge in the east to about fifty dune capped beach ridges in the Miller area. The ridges have a linear form that parallels the lakeshore and are capped by moderate size dunes making them higher than those found farther west on the strandplain. Windblown sand has divided sections of the swales into separate ponds. High parabolic dunes occur lakeward of the lagoons (Brown 97). This area was the transition zone between the ridge and swale region to the west and the high dunes to the east. Prior to urban development, Miller Woods graded into the Greater Calumet Wetlands Site, now they are physically separated by the city of Gary.

The natural course of the Grand Calumet River was altered to accommodate building the U.S. Steel mill in Gary. The relocation of the river channel isolated the section of the river east of the U.S. Steel facility, as a result, the Grand Calumet Lagoons formed. The area surrounding the lagoons can be separated into two units; north of the lagoons is primarily foredune and dune complex, while south of the lagoons is a savanna complex (Wilhelm, 1990 p.47). Natural Heritage data for Miller Woods and The Grand Calumet Lagoons area is limited. The north unit supports two globally rare communities, panne and foredune. There is no Natural Heritage data available on community classification in the savanna complex to the south of the lagoons.

B. Floristic Quality Assessment

The integrity of a natural area is indicated by its ability to support native species. When natural processes are still intact, the native species dependent on them will continue to thrive. If, on the other hand, those processes are impaired or destroyed those dependent species will vanish. The flora of the Chicago region shows varying degrees of fidelity to specific habitat conditions as well as tolerance for disturbance. The overall health of a natural area is reflected in its diversity of conservative species, those adapted to a specific set of biotic and abiotic conditions (Swink and Wilhelm).

The Floristic Quality Assessment, as described by Swink and Wilhelm (1994) in *Plants of the Chicago Region*, assigns a coefficient of conservatism, C value, to all native plant species in the region. Plants are ranked from zero to ten, with ten being the most conservative species. The C values of plant inventories can be computed for two different floristic assessments. The first is the Native C value, which is the mean C value of plants at a site. The second is the Floristic Quality Index which reflects the richness of conservative species within a natural area. The following is a summary of Native C values and Floristic Quality Index ratings from *Plants of the Chicago Region*.

Based upon fifteen years of application of this assessment system to all types of land in the Chicago region, certain patterns have emerged. We have found that the mean C values in the preponderance of our open land range from 0 to 2. In light of the fact that 89% of our native flora has a C value of 4 or greater, and a mean C value of 7.3, it is evident that the principle elements of our native systems are uninvolved in the Chicago region landscape today.

The vast majority of land in the region registers I values [Floristic Quality Index] of less than 20 and essentially has no significance from a natural area perspective. Areas with I values higher than 35 possess sufficient conservatism and richness to be of profound importance from a regional perspective. Areas registering in the 50's and higher are extremely rare and of paramount importance; they represent less than 0.5% of the land area in the Chicago region.

Table 02 summarizes the floristic quality assessments that were done for all the large dune and swale remnants in the Greater Calumet Wetlands Site as part of the Illinois-Indiana Regional Airport Site Selection Report in 1991 (TAMS Technical paper #7). The assessments were updated in 1994. Table 03 summarizes the two units of the Miller Woods site that were surveyed in August of 1978 and August of 1989 (Wilhelm, 1990 p.19).

Table 02. Floristic Quality Assessments for Greater Calumet Wetlands Complex Ridge and Swale Sites

Greater Calumet Wetlands Complex Ridge and Swale Remnant Sites	Native Taxa	Floristic Quality Index	Native C Value
Brunswick Savanna	68	38.81	4.71
Clark & Pine Addition # 1	92	44.00	4.59
Clark & Pine Addition # 2	152	75.03	6.09
Clark & Pine Nature Preserve	277	128	7.7
Clark & Pine East	212	88.58	5.74
Clark Junction	245	101.96	6.51
Clark Junction East	187	76.93	5.63
Cline Ave. Dune & Swale	106	53.52	5.20
DuPont Dune & Swale	226	76.10	5.06
Gibson Woods Nature Preserve	297	103.00	6.0
Ivanhoe Dune & Swale	272	89.62	5.43
Lakeshore Prairie	151	72.02	5.86
Toleston Ridges	261	101.00	6.1
Toleston Woods	93	44.59	4.62

Table 03. Floristic Quality Assessments for Miller Section

Miller Woods and Dunes Sites	Native Taxa	Floristic Quality Index	Native C Value
Unit A Foredune and Dune Complex	210	97.00	6.70
Unit B Savanna Complex	179	78.00	5.81

C. The Grand Calumet River Corridor

The Army Corps of Engineers has identified several reaches of the Grand Calumet River that are associated with specific dredging projects. (Please see the map entitled "Grand Calumet Sediment Remediation Plan: Study Reaches" in the Sediment Clean Up and Restoration Alternatives Project). The land adjacent to four of those reaches supports significant pockets of

biodiversity. At the extreme east end of the river, Miller Woods and Dunes surround much of the Lagoons Reach. Clark and Pine East flanks both sides of the river at the west end of the U.S. Steel Reach. DuPont Dune and Swale runs along the north bank of the west half of the DuPont Reach. On the south bank of the river across from DuPont, smaller natural areas support native upland and wetland communities, including the Calumet Tern Site. At the east end of the reach are two small remnants of dune and swale and a large degraded wetland complex on the USS Lead property north of the river. The Roxanna Marsh Reach contains degraded wetlands that are important habitat for migratory waterfowl. The Airport Reach contains significant wetland areas that are important contributors to habitat along the river corridor.

1. *Miller Woods and Dunes*

The remnant natural areas surrounding the lagoons cover over nine hundred acres, including the Miller Woods and Dunes Unit of the Indiana Dunes National Lakeshore, the City of Gary's Marquette Park and private property owned by U.S. Steel Corporation and NIPSCO. The following information on the Miller section of the Indiana Dunes National Lakeshore is summarized in *Special Vegetation of the Indiana Dunes National Lakeshore* by Gerould Wilhelm (Wilhelm 1990). The dune complex north of the lagoons supports panne and foredune communities. The ridge and swale complex to the south of the lagoons is dominated by a savanna and marsh complex. The Miller area has been shown to supply habitat for at least seventy floristic elements considered rare or limited to a unique niche within the Indiana Dunes National Lakeshore.

Foredune communities occupy the windward exposure of the first line of dunes from the lake shore. Characteristic plants of the foredune include: *Ammophila breviligulata*, *Andropogon scoparius*, *Artemisia caudata*, *Calamovilfa longifolia*, *Cirsium pitcheri*, *Cornus stolonifera baileyi*, *Lathyrus japonicus glaber*, *Populus detoides*, *Rhus aromatica arenaria* and *Solidago racemosa gillamani*.

Panne communities in the Miller dunes inhabit a series of interdunal depressions that form on the lee sides of the first or second line of dunes. The depressions intersect the ground water table forming calcareous wetlands and ponds. Pannes are unique in floristic composition, containing species that grow nowhere else in the Chicago Region or State of Indiana. Plants of the panne community include: *Aster ptarmicoides*, *Carex garberi*, *Carex viridula*, *Gentiana crinata*, *Liparis loeselii*, *Lobelia kalmii*, *Rynchospora capillacea*, *Sabatia angularis*, *Scleria verticillata* and *Utricularia cornuta*.

The ridges and swales south of the lagoons support some of the highest quality black oak savanna in the Chicago Region. The more open sand prairie areas support: *Andropogon scoparius*, *Arabis lyrata*, *Asclepias amplexicaulis*, *Carex mulenburghii*, *Koeleria cristata*, *Krigia biflora*, *Linaria canadensis*, *Opuntia humifusa*, *Polygonum tenue* and *Viola pedata lineariloba*. The black oak savannas contain: *Aquilegia canadensis*, *Aralia nudicaulis*, *Aster linariifolius*, *Carex pennsylvanica*, *Diervilla lonicera*, *Liatris aspera*, *Lupinus perennis occidentalis*, *Maiathemum canadense interius*, *Tephrosia virginiana* and *Vaccinium angustifolium laevifolium*.

Over four hundred and thirty species of native plants have been documented in the Miller Woods and Dune section of the Indiana Dunes National Lakeshore. The area as a whole has a mean C value of 6.84 and a Floristic Quality Index rating of 142, identifying it as a high quality

natural area with significant habitat.

2. Clark and Pine East

The preserve is not uniform in quality throughout its borders. The entire tract is two hundred and fifty-three acres, which include about fifty acres of remnant ridge and swale. The ridge and swale areas support sand savanna and sand prairie on the upland ridges, and wet prairies, sedge meadows, emergent marsh and shrub swamps in the swales. There are approximately 100 acres of sand mined dune ridges that have revegetated with predominately native plant communities. The remaining acreage includes highly degraded swales, areas filled with fly-ash, and two large borrow pits from a sand mining operation. The Airport Reach contains significant wetland areas that are important contributors to habitat along the river corridor.

The sand mining operation scrapped away the dunes to the water table, creating habitat conditions similar to the natural pannes. Many panne associates are now found growing in these areas including: *Aster ptarmicoides*, *Carex viridula*, *Gentiana crinata*, *Hypericum kalmianum*, *Liparis loeselii*, *Potentilla fruticosa*, *Rynchospora capillacea* and *Sabatia angularis*.

The plant species list for the site contains two hundred and twelve native species and forty adventives, with a Floristic Quality Index of 78.23 and Native C Value of 5.03 with adventives. These numbers indicate Clark and Pine East is of extreme importance, as a natural area, to the Chicago Region.

3. DuPont Dune and Swale

There are approximately one hundred and seventy acres of remnant dune and swale included in DuPont's corporate land holdings around its East Chicago plant. Four globally rare communities have been identified at the DuPont natural area; wet-mesic sand prairie, dry-mesic sand prairie, dry sand savanna and sedge meadow.

Approximately fifty acres are a unique formation of dune and swale that have a natural surface water connection with the Grand Calumet River. Marshes along the river curve to the west and grade into linear swales. Near the river the marshes are generally filled with cattails (*Typha* sp.), common reed (*Phragmites australis*) and purple loosestrife (*Lythrum salicaria*). The swales support high quality wet prairie and sedge meadow communities. Species that are common throughout the swales include *Aster ptarmicoides*, *Calamagrostis canadensis*, *Carex stricta*, *Chelone glabra*, *Coreopsis tripteris*, *Eryngium yuccifolium*, *Eupatorium maculatum*, *Liatris spicata*, *Muhlenbergia glomerata*, *Pycnanthemum virginianum*, *Scirpus pungens*, and *Scirpus validus creber*. Cattails, common reed and purple loosestrife are well established in deeper parts of the swales. These features formed as the result of the mouth of the river migrating to the east as the Tolleston strandplain formed, and were once common along the north bank of the river. Now the ones at DuPont are among the few that have not been destroyed.

The plant species list as of 1993 contains two hundred and twenty-six native plant species and thirty-five adventives. It has a Floristic Quality Index rating of 70.8 and Native C value of 4.38 with adventives. These numbers indicate that the DuPont tract is of extreme value as a natural area within the Chicago region.

4. *Airport Sedge Meadow/Wet Prairie Wetlands*

A wetland assessment report for the Gary Regional Airport was completed in 1993; approximately one hundred and sixty-nine acres of jurisdictional wetlands were identified. The wetlands were placed into three general types: emergent marsh/open water; Sedge meadow/wet prairie wetland; and scrub-shrub/forested wetland. The sedge meadow/wet prairie wetlands provide potential habitat for wildlife ranging from cottontail rabbit to coyote and a large and diverse plant community including the States rare Kalms St. Johns-wort (*Hypericum kalmianum*) and over thirty species of sedges, grasses, forbs and small shrubs (Earth-Source, Inc. 1993). Wetlands located west and south of the airport (forty-four and eighty-eight acres, respectively) were considered sufficiently important in functions of habitat and water purification and storage to be included in U.S. EPA (1988) designation as prior identified wetlands unsuitable for filling.

5. *Degraded Habitat Areas*

Although much of the aquatic habitat remaining in the Area of Concern has been degraded, the remaining habitat provides feeding, nesting and resting areas for hundreds of birds each year. Ducks and other aquatic birds (Table 04) utilize open water and wetland habitat associated with the Indiana Harbor Ship Canal (including Lake George Branch), the east and west branches of the Grand Calumet River and various ponded areas (Roxanna Pond, Ralston Street Lagoons, Lake George, Wolf Lake, Bongji Ponds, Georgia Pacific Lagoons, Marquette Park Lagoons, and others) (Brock, 1986; US Fish & Wildlife Service, 1996a and 1996b). Recent records from the Breeding Bird Atlas project (Table 05) indicate that approximately seventy-two species of birds breed in the Area of Concern. At least thirty-six species of mammals have been recorded utilizing various habitats in the area (Table 06) (Whitaker, *et al.*, 1994). Numerous endangered, threatened, or of special concern animals also inhabit this area (Table 07).

Roxanna Marsh (Pond) is a 22.4 acre wetland located in the West Branch of the Grand Calumet River near the Hammond Sanitary District plant. The wetland is contiguous to the Grand Calumet River and for the most part is less than one foot in depth, depending on fluctuation of water level in the river. Wetland types include palustrine emergent, aquatic bed and open water. This marsh is extremely important as a feeding area for migrant birds and other wildlife species. Brock (1986) indicates that the area provides the most reliable shorebird habitat in the Dunes Area. Rare species seen at the marsh include: Marbled Godwit, Hudsonian Godwit, American Avocet, Stilt Sandpiper, Long-billed Dowitcher and Red-necked Phalarope (Brock, 1986). Because of the marsh's proximity and connectivity to the Grand Calumet River, the area is considered extremely degraded, having been subjected to excessive levels of contaminants that its primary wetland functions may be significantly impaired. U.S. EPA (1988) found that the functions of absorbing excessive nutrients (nitrogen and phosphorus) and removing particulate matter thus reducing turbidity in this portion of the Grand Calumet River were important enough to designate Roxanna Pond area as a prior identified wetland unsuitable for filling.

Table 04. Bird Species Known From the Indiana Harbor, Indiana Harbor Ship Canal, Lake George Branch, and Grand Calumet River Area, including the ECI Site. This includes migrants, wintering species, and nesting species. (Adopted from U.S. FWS 1996b).

Double-crested cormorant	<i>Phalacrocorax auritus</i>
Horned grebe	<i>Podiceps auritus</i>
Pied-billed grebe	<i>Podilymbus podiceps</i>
White pelican	<i>Pelecanus erythrorhynchos</i>
Mute swan	<i>Cygnus olor</i>
Canada goose	<i>Branta canadensis</i>
Mallard*	<i>Anas platyrhynchos</i>
Blue-winged teal*	<i>A. discors</i>
Redhead	<i>Aythya americana</i>
Canvasback	<i>A. valisineria</i>
Greater scaup	<i>A. marila</i>
Lesser scaup	<i>A. affinis</i>
Ring-necked duck	<i>A. collaris</i>
Bufflehead	<i>Bucephala albeola</i>
Common goldeneye	<i>B. clangula</i>
White-winged scoter	<i>Melanitta deglandi</i>
Oldsquaw	<i>Clangula hyemalis</i>
Common merganser	<i>Mergus merganser</i>
Red-breasted merganser	<i>M. serrator</i>
Hooded merganser	<i>Lophodytes cucullatus</i>
Short-eared owl	<i>Asio flammeus</i>
Turkey vulture	<i>Cathartes aura</i>
Osprey	<i>Pandion haliaetus</i>
Sharp-shinned hawk	<i>Accipiter striatus</i>
Red-tailed hawk*	<i>Buteo jamaicensis</i>
Red-shouldered hawk	<i>B. lineatus</i>
Rough-legged hawk	<i>B. lagopus</i>
Broad-winged hawk	<i>B. platypterus</i>
Peregrine falcon*	<i>Falco peregrinus</i>
Kestrel*	<i>F. sparverius</i>
Ring-necked pheasant*	<i>Phasianus colchicus</i>
Common egret	<i>Casmerodius albus</i>
Great blue heron	<i>Ardea herodias</i>
Green-backed heron*	<i>Butorides virescens</i>
Little blue heron	<i>Florida caerulea</i>
Black-crowned night heron*	<i>Nycticorax nycticorax</i>
Least bittern*	<i>Ixobrychus exilis</i>
American coot*	<i>Fulica americana</i>
Common moorhen*	<i>Gallinula chloropus</i>
Sora	<i>Porzana carolina</i>
Black-bellied plover	<i>Pluvialis squatarola</i>
Killdeer*	<i>Charadrius vociferus</i>
Semipalmated plover	<i>C. semipalmatus</i>
Solitary sandpiper	<i>Tringa solitaria</i>

Greater yellowlegs	<i>T. melanoleuca</i>
Lesser yellowlegs	<i>T. flavipes</i>
American avocet	<i>Recurvirostra americana</i>
Spotted sandpiper	<i>Actitis macularia</i>
Hudsonian godwit	<i>Limosa haemastica</i>
Marbled godwit	<i>L. fedoa</i>
Western sandpiper	<i>Calidris mauri</i>
Least sandpiper	<i>C. minutilla</i>
White-rumped sandpiper	<i>C. fuscicollis</i>
Pectoral sandpiper	<i>C. melaanotos</i>
Dunlin	<i>C. alpina</i>
Stilt sandpiper	<i>C. himantopus</i>
Short-billed dowitcher	<i>Limnodromus griseus</i>
Long-billed dowitcher	<i>L. scolopaceus</i>
Common snipe	<i>Gallinago gallinago</i>
American woodcock*	<i>Scolopax minor</i>
Wilson's phalarope	<i>Phalaropus tricolor</i>
Red-necked phalarope	<i>P. lobatus</i>
Ring-billed gull*	<i>Larus delawarensis</i>
Herring gull*	<i>L. argentatus</i>
Caspian tern	<i>Hydroprogne caspia</i>
Black tern*	<i>Chlidonias niger</i>
Rock dove*	<i>Columba livia</i>
Mourning dove*	<i>Zenaidura macroura</i>
Nighthawk*	<i>Chordeiles minor</i>
Whip-poor-will	<i>Caprimulgus vociferus</i>
Chimney swift*	<i>Chaetura pelagica</i>
Belted kingfisher*	<i>Megaceryle alcyon</i>
Flicker*	<i>Colaptes auratus</i>
Red-headed woodpecker	<i>Malanerpes erythrocephalus</i>
Eastern kingbird*	<i>Tyrannus tyrannus</i>
Willow flycatcher*	<i>Empidonax traillii</i>
Barn swallow*	<i>Hirundo rustica</i>
Tree swallow*	<i>Iridoprocne bicolor</i>
Bank swallow*	<i>Riparia riparia</i>
Rough-winged swallow	<i>Stelgidopteryx serripennis</i>
Blue jay*	<i>Cyanocitta cristata</i>
Crow*	<i>Corvus brachyrhynchos</i>
Black-capped chickadee*	<i>Parus atricapillus</i>
Tufted titmouse*	<i>P. bicolor</i>
Red-breasted nuthatch	<i>Sitta canadensis</i>
Brown creeper	<i>Certhia familiaris</i>
Marsh wren*	<i>Cistothorus palustris</i>
House wren*	<i>Troglodytes aedon</i>
Brown thrasher*	<i>Toxostoma rufum</i>
Catbird*	<i>Dumetella carolinensis</i>
Mockingbird	<i>Mimus polyglottos</i>
Robin*	<i>Turdus migratorius</i>

Eastern bluebird	<i>Sialia sialis</i>
Hermit thrush	<i>Hylocichla guttata</i>
Swainson's thrush	<i>H. ustulata</i>
Golden-crowned kinglet	<i>Regulus satropa</i>
Ruby-crowned kinglet	<i>R. calendula</i>
Yellow warbler*	<i>Dendroica petechia</i>
Black-throated green warbler	<i>D. virens</i>
Yellow-rumped warbler	<i>D. coronata</i>
Yellowthroat*	<i>Geothlypis trichas</i>
Warbling vireo*	<i>Vireo gilvus</i>
White-eyed vireo	<i>V. griseus</i>
Red-eyed vireo*	<i>V. olivacea</i>
Starling*	<i>Sturnus vulgaris</i>
House sparrow*	<i>Passer domesticus</i>
Eastern meadowlark*	<i>Sturnella magna</i>
Red-winged blackbird*	<i>Agelaius phoeniceus</i>
Yellow-headed blackbird*	<i>Xanthocephalus xanthocephalus</i>
Grackle*	<i>Quiscalus quiscula</i>
Brown-headed cowbird*	<i>Molothrus ater</i>
Northern oriole*	<i>Icterus galbula</i>
Indigo bunting*	<i>Passerina cyanea</i>
House finch*	<i>Carpodacus mexicanus</i>
Cardinal*	<i>Richmondia cardinalis</i>
Rose-breasted grosbeak	<i>Pheucticus ludovicianus</i>
American goldfinch*	<i>Spinus tristis</i>
Rufous-sided towhee*	<i>Pipilo erythrophthalmus</i>
Junco	<i>Junco hyemalis</i>
Field sparrow*	<i>Spizella pusilla</i>
Chipping sparrow	<i>S. passerina</i>
White-throated sparrow	<i>Zonotrichia albicollis</i>
Song sparrow*	<i>Melospiza melodia</i>
Swamp sparrow*	<i>M. georgiana</i>

*Known to nest

Based on sightings reported in the Peregrine Falcon Journal (1990-1995), personal observations by U.S. FWS biologists, Brock (1986), and Sabuco (1994).

Table 05. Breeding Bird Atlas records for priority breeding blocks (west-central 1/6 of topographic map) in or near the Grand Calumet River Indiana Harbor Ship Canal Near Shore Lake Michigan Area of Concern.

Topo Map/County	Portage/Porter	Gary/Lake	Highland/Lake	Whiting/Lake
Atlas Block No.	830	831	832	859
Priority Block No.	3	3	3	3

SPECIES

Pied-billed Grebe		1		
Green Heron	3	2		
Mute Swan				1
Canada Goose		2	1	2
Wood Duck	2	1	1	
Mallard	1	1	1	1
Blue-winged Teal			1	
Red-tailed Hawk	3	2		
American Kestrel		1		
Ring-necked Pheasant	2			
Northern Bobwhite	1			
Common Moorhen		1		
American Coot				2
Killdeer	2	1	1	1
Spotted Sandpiper		2		
Rock Dove	2	2	2	2
Mourning Dove	2	1	1	2
Eastern Screech-Owl		3		
Common Nighthawk	2	3		2
Chimney Swift	2	3	3	2
Ruby-throated Hummingbird		3		
Belted Kingfisher	2		2	2
Red-headed Woodpecker	2	2	2	
Red-bellied Woodpecker	2			
Downy Woodpecker	2	1	1	1
Hairy Woodpecker	2	2		

Topo Map/County	Portage/Porter	Gary/Lake	Highland/Lake	Whiting/Lake
Atlas Block No.	830	831	832	859
Priority Block No.	3	3	3	3

SPECIES

Northern Flicker	2	2	1	2
Eastern Wood-Pewee	2			
Alder Flycatcher				3
Willow Flycatcher	2	2		
Great Crested Flycatcher	2		2	2
Eastern Kingbird	2	1	1	
Purple Martin	3	1		1
Tree Swallow		1	3	1
N. Rough-winged Swallow		1		
Bank Swallow	3		1	
Barn Swallow	1	1	1	3
Blue Jay	1	1	2	1
American Crow	1	1		2
Black-capped Chickadee	2	3	1	
Tufted Titmouse	2	3		
White-breasted Nuthatch	2		2	
Carolina Wren	2			
House Wren	2	1	1	
Marsh Wren				2
Blue-gray Gnatcatcher			2	
Eastern Bluebird	1			
Veery	3			
Wood Thrush	2	2		
American Robin	1	1	1	1
Gray Catbird	2	2	1	2
Brown Thrasher	2			
Cedar Waxwing	2	2	2	
European Starling	1	1		1

	Portage/Porter	Gary/Lake	Highland/Lake	Whiting/Lake
Topo Map/County				
Atlas Block No.	830	831	832	859
Priority Block No.	3	3	3	3

SPECIES

Yellow-throated Vireo		3		3
Warbling Vireo	3	2	2	3
Red-eyed Vireo	2	2	2	
Yellow Warbler	2	2		3
Chestnut-sided Warbler			3	
Prothonotary Warbler			3	
Common Yellowthroat	2	2	2	3
Scarlet Tanager	2	3		
Northern Cardinal	2	1	1	1
Rose-breasted Grosbeak	2	3		
Indigo Bunting	1	1	1	3
Rufous-sided Towhee	2	2		3
Chipping Sparrow	1	1	1	2
Field Sparrow	3		1	
Lark Sparrow		1		
Song Sparrow	2	1	1	2
Swamp Sparrow		1		
Red-winged Blackbird	2	1	2	1
Eastern Meadowlark	2	3		
Common Grackle	1	1	2	1
Brown-headed Cowbird	1	1	1	2
Orchard Oriole			2	
Northern Oriole	2	1	2	
House Finch	1	2		
American Goldfinch	2	1		1
House Sparrow	2	1	1	1

* Breeding Codes: (1) confirmed, (2) probable, (3) possible.

Table 06. Mammals reported from Indiana Dunes National Lakeshore (modified from Whitaker, et al., 1994).

Virginia opossum	<i>Didelphis virginiana</i>
Least shrew	<i>Cryptotis parva</i>
Masked shrew	<i>Sorex cinereus</i>
Northern short-tailed shrew	<i>Blarina brevicauda</i>
Eastern mole	<i>Scalopus aquaticus</i>
Little brown myotis	<i>Myotis lucifugus</i>
Eastern red bat	<i>Lasiurus borealis</i>
Silver-haired bat	<i>Lasionycteris noctivagans</i>
Big brown bat	<i>Eptesicus fuscus</i>
Eastern cottontail	<i>Sylvilagus floridanus</i>
Eastern chipmunk	<i>Tamias striatus</i>
Woodchuck	<i>Marmota monax</i>
Franklin's ground squirrel	<i>Spermophilus franklinii</i>
Thirteen-lined ground squirrel	<i>Spermophilus tridecemlineatus</i>
Eastern gray squirrel	<i>Sciurus carolinensis</i>
Eastern fox squirrel	<i>Sciurus niger</i>
Red squirrel	<i>Tamiasciurus hudsonicus</i>
Southern flying squirrel	<i>Glaucomys volans</i>
American beaver	<i>Castor canadensis</i>
White-footed mouse	<i>Peromyscus leucopus</i>
Prairie deer mouse	<i>Peromyscus maniculatus bairdii</i>
Norway rat	<i>Ratus norvegicus</i>
House mouse	<i>Mus musculus</i>
Prairie vole	<i>Microtus ochrogaster</i>
Meadow vole	<i>Microtus pennsylvanicus</i>
Woodland vole	<i>Microtus pinetorum</i>
Common muskrat	<i>Ondatra zibethicus</i>
Southern bog lemming	<i>Synaptomys cooperi</i>
Meadow jumping mouse	<i>Zapus hudsonius</i>
Red fox	<i>Vulpes vulpes</i>
Common raccoon	<i>Procyon lotor</i>
Long-tailed weasel	<i>Mustela nivalis</i>
Mink	<i>Mustela vison</i>
American badger	<i>Taxidea taxus</i>
Striped skunk	<i>Mephitis mephitis</i>
White-tailed deer	<i>Odocoileus virginianus</i>

Table 07. Animals recorded in the Grand Calumet River, Indiana Ship Harbor Canal and Near Shore Lake Michigan Area of Concern that are listed as endangered, threatened or of special concern. Animals on watch lists have also been included. (Data from Indiana Department of Natural Resources)

MAMMALS

Franklin's ground squirrel	<i>Spermophilus franklinii</i>	E*
Star-nosed mole	<i>Condylura cristata</i>	SC
Least weasel	<i>Mustela nivalis</i>	SC

BIRDS

American bittern	<i>Botaurus lentiginosus</i>	E
Great egret	<i>Casmerodius albus</i>	E
Black-crowned night-heron	<i>Nycticorax nycticorax</i>	E
Yellow-crowned night-heron	<i>Nyctanassa violaceus</i>	E
Peregrine falcon	<i>Falco peregrinus</i>	E-F
King rail	<i>Rallus elegans</i>	E
Piping plover	<i>Charadrius melodus</i>	E-F
Black tern	<i>Chlidonias niger</i>	E
Least bittern	<i>Ixobrychus exilis</i>	SC
Red-shouldered hawk	<i>Buteo lineatus</i>	SC
Virginia rail	<i>Rallus limicola</i>	SC
Marsh wren	<i>Cistothorus palustris</i>	SC
Yellow-headed blackbird	<i>Xanthocephalus xanthocephalus</i>	T?
Cooper's hawk	<i>Accipiter cooperii</i>	WL
Sedge wren	<i>Cistothorus platensis</i>	T
Brown creeper	<i>Certhia americana</i>	WL
Least flycatcher	<i>Empidonax minimus</i>	SC
Golden winged warbler	<i>vermivo chrysoptera</i>	E

REPTILES

Spotted turtle	<i>Clemmys guttata</i>	T
Western smooth green snake	<i>Opheodrys vernalis</i>	T
Blanding's turtle	<i>Emydoidea blandingi</i>	SC
Western ribbon snake	<i>Thamnophis proximus</i>	SC
Eastern massasauga	<i>Sistrurus catenatus</i>	T
Slender glass lizard	<i>Ophisaurus attenuatus</i>	?

AMPHIBIANS

Mudpuppy	<i>Necturus maculosus</i>	SC
Blue-spotted salamander	<i>Ambystoma laterale</i>	SC
Northern leopard frog	<i>Rana pipiens</i>	SC

Table 07. (Continued)

FISH

Lake sturgeon	<i>Acipenser fulvescens</i>	E
Popeye shiner	<i>Notropis ariommus</i>	E

BUTTERFLIES

Ottoo skipper	<i>Hesperia ottoe</i>	E
Karner blue	<i>Lycaeidus melissa samuelis</i>	E-F
Dusted skipper	<i>Atrytonopsis hianna</i>	E
Olympia marblewing	<i>Glaucoopsyche lygdamus couperi</i>	E
Byssus (Bunchgrass) skipper	<i>Problema byssus</i>	SC
Columbine borer	<i>Papaipema leucostigma</i>	WL
Bracken borer moth	<i>Papaipema pterisii</i>	WL

* E = State Endangered; E-F = State/Federal Endangered; T = State Threatened; SC = Special Concern; WL = Watch List

IV. Surface Water in the Grand Calumet River and the Indiana Harbor Ship Canal**A. Water Quality Monitoring**

According to the Indiana 305(b) Report 1992-93 (IDEM, 1994), the waters of the Grand Calumet River and the Indiana Harbor Ship Canal continue to have persistent water quality problems. The sampling data indicate that concentrations of cyanide and *E. coli* continue to be of concern throughout much of the system.

Cyanide concentrations exceeded the acute criterion for this substance at three (3) of seven sampling stations from seventeen to thirty-three percent (17-33%) of the time. Two D.O. (dissolved oxygen) violations were found at the Grand Calumet River/Indiana Harbor Canal stations and a 1990 fish community sampling assessment indicates that D.O. levels may be of concern. Un-ionized ammonia criteria were not violated at any station at the acute level. The *E. coli* bacteriological criterion was exceeded up to eighty-six percent (86%) of the time at each of the monitoring stations.

Monitoring results for the period 1994-95 showed similar water quality violations for cyanide and *E. coli*. Un-ionized ammonia did not meet the chronic criteria in 28 percent of surface water samples collected (IDEM, 1996). The status of designated use support lists both the East and West branches of the Grand Calumet River, and the Indiana Harbor Ship Canal as nonsupporting for both aquatic life and recreational use. Probable causes include oil and grease, lead, PCB, pesticides, mercury, ammonia, and combined sewer overflows (IDEM, 1994 and IDEM, 1996). While problems in the Grand Calumet River have existed for many years, some past pollutant problems have been resolved, and the concentrations of many substances have been reduced even though water quality standards violations still occur. Water quality of Lake Michigan does vary (in the Indiana portion). Concentrations of substances in the near shore zone reflect the effects of wastewater and tributary contributions from the watershed and are nearly always higher near shore than in the "open water" lake samples (IDEM, 1996).

B. Sediment Monitoring and Characterization

Sediment in the bottom of a river or lake provides a habitat for numerous aquatic organisms and is a major repository for many of the more persistent chemicals that are introduced into surface waters. In the aquatic environment, most man-made chemicals and waste materials, including toxic organic and inorganic chemicals, eventually accumulate in the sediment (Sobiech *et al.*, 1994). Mounting evidence of environmental degradation exists in areas where U.S. EPA Water Quality Criteria (WQC; Stephan *et al.*, 1985) are not exceeded, yet organisms in or near sediments are adversely affected (Chapman, 1989). Concentrations of contaminants in the sediment may be several orders of magnitude higher than in the overlying water; however, bulk sediment concentrations have not been strongly correlated to bioavailability (Burton, 1991). The biological viability of the Grand Calumet River and Indiana Harbor Ship Canal has been severely degraded due in part to numerous spills, municipal and industrial wastewater discharges, and combined sewer overflows (Sobiech *et al.*, 1994). These actions have caused a dramatic deterioration of the water quality and significantly impaired the sediments of this aquatic ecosystem.

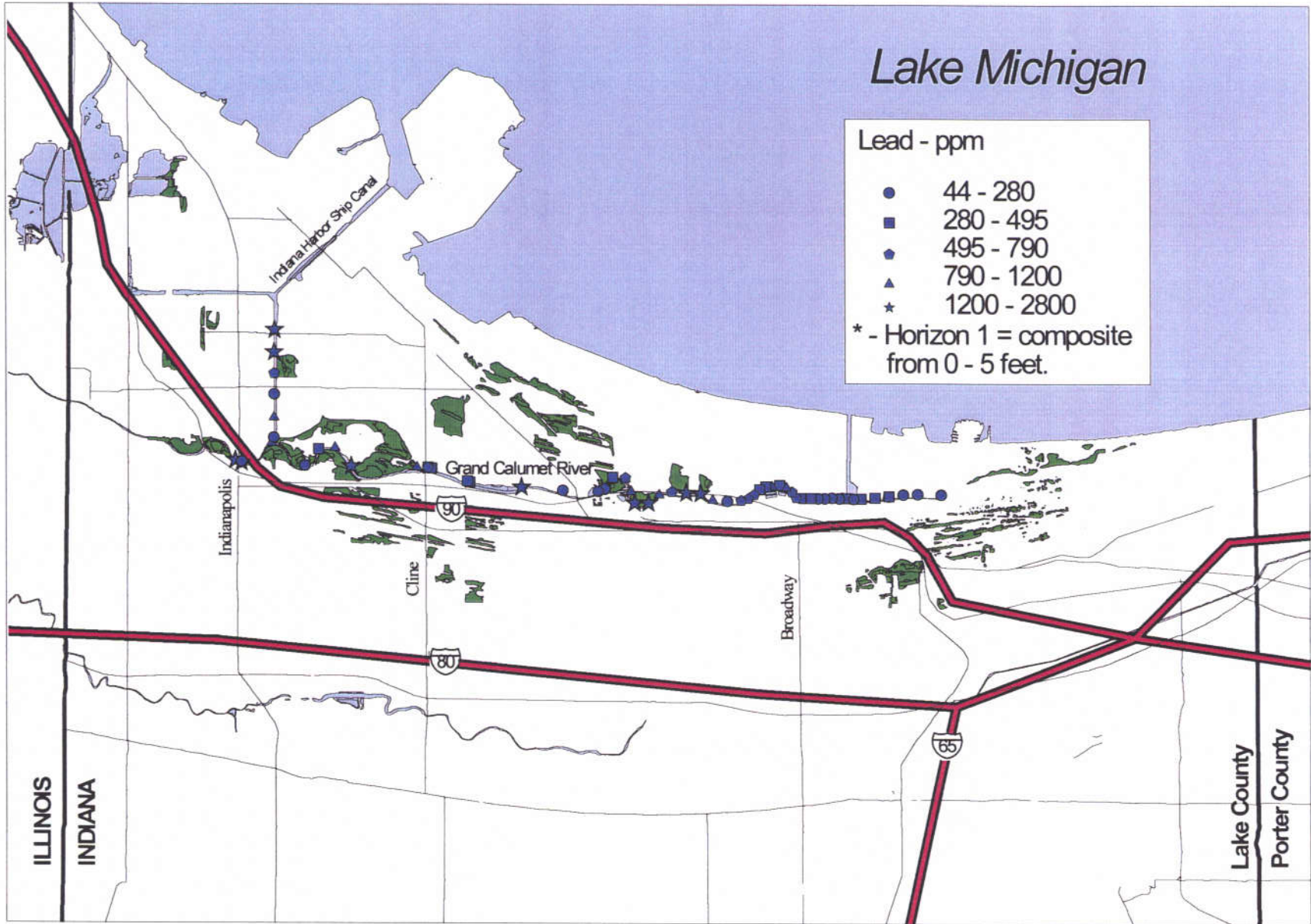
Sediment characterization studies have detected a wide array of chemical compounds that include: conventional pollutants, metals, and organic chemicals such as PCBs. The concentration of any one of the following contaminants could cause adverse ecological effects. Characterization of Grand Calumet River and Indiana Harbor Ship Canal sediments, conducted by Hoke *et al.* (1993), analyzed for one hundred and four organic chemicals and detected sixty-three compounds. Concentrations of the various compounds present in the sediments varied greatly. Chemicals such as *m*-chlorophenol, 2,6-dichlorophenol, 2,4,6-trichlorophenol, 2,3,5,6-tetrachlorophenol, 3,4-dichloroaniline, 3,3-dichlorobenzidine, *p,p'*-DDD, tetrachloroethylene, 1,2,3-trichlorobenzene, 1,1,1-trichloroethane, di-*n*-butyl phthalate, 1-chloro-2-nitrobenzene, and 2,4-dinitrotoluene were generally present in low ug/kg (part per billion) range. Compounds exhibiting the greatest sediment concentrations were the various polycyclic aromatic hydrocarbons (PAHs), total polychlorinated biphenyls (PCBs, such as Aroclor 1248), *p,p'*-DDE, toxaphene, *p*-chlorotoluene, ethylbenzene, and *p*-dichlorobenzene. These compounds were generally present in the 2-20 mg/kg (ppm) range although several of the PAHs were present at concentrations as great as 100 mg/kg.

Detectable concentrations of most metals analyzed were present in all study sites' sediments. Iron, magnesium, and manganese were generally present in high mg/kg to low gm/kg (grams per kilogram) (or parts per thousand) concentrations in solid phase sediments. Of the metals of toxicological concern in aquatic systems, zinc, lead, and chromium were present at concentrations as great as 5.23, 3.94, and 1.22 gm/kg (or parts per thousand), respectively. Copper, nickel, and cadmium concentrations were generally below 500 mg/kg (or parts per million). Compounds detected at concentrations present have the potential of causing adverse ecological effects.

Results from the U.S. Steel Corporation 1991 Sediment Characterization Study showed similar results. A wide variety of organics and metals were detected. Due to the wide assortment of contaminants detected, five contaminants were selected from this study in an attempt to illustrate the level of contamination detected. These contaminants are displayed with their corresponding levels and spatial distributions (Figures i - v).

Figure i: Lead Horizon 1*

29



2 0 2 4 Miles



Source of Data: U.S. Steel Corporation 1991 Sediment Characterization Study
 Map Date: October 1997

Figure ii: Fluoranthene Horizon 1*

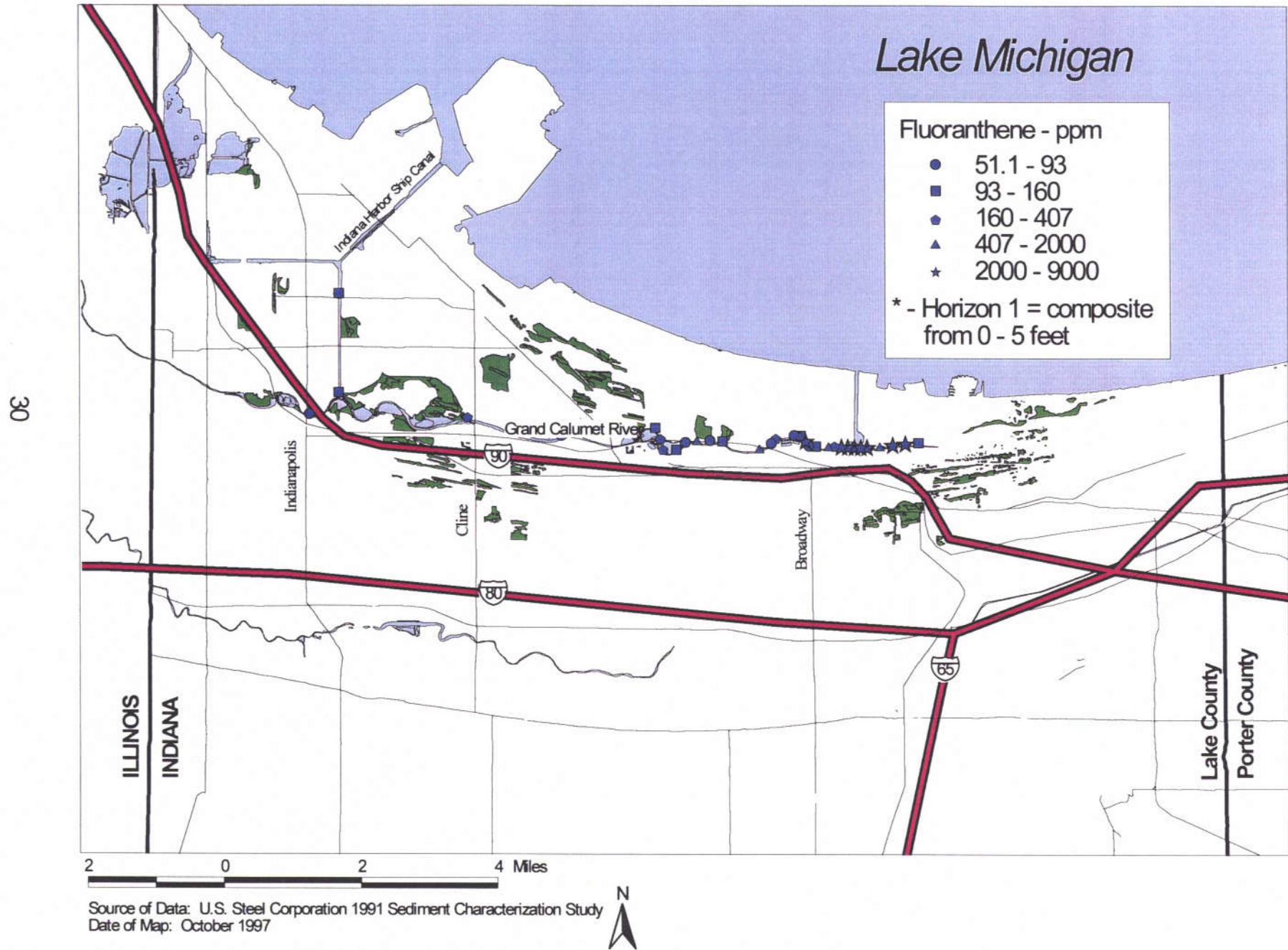
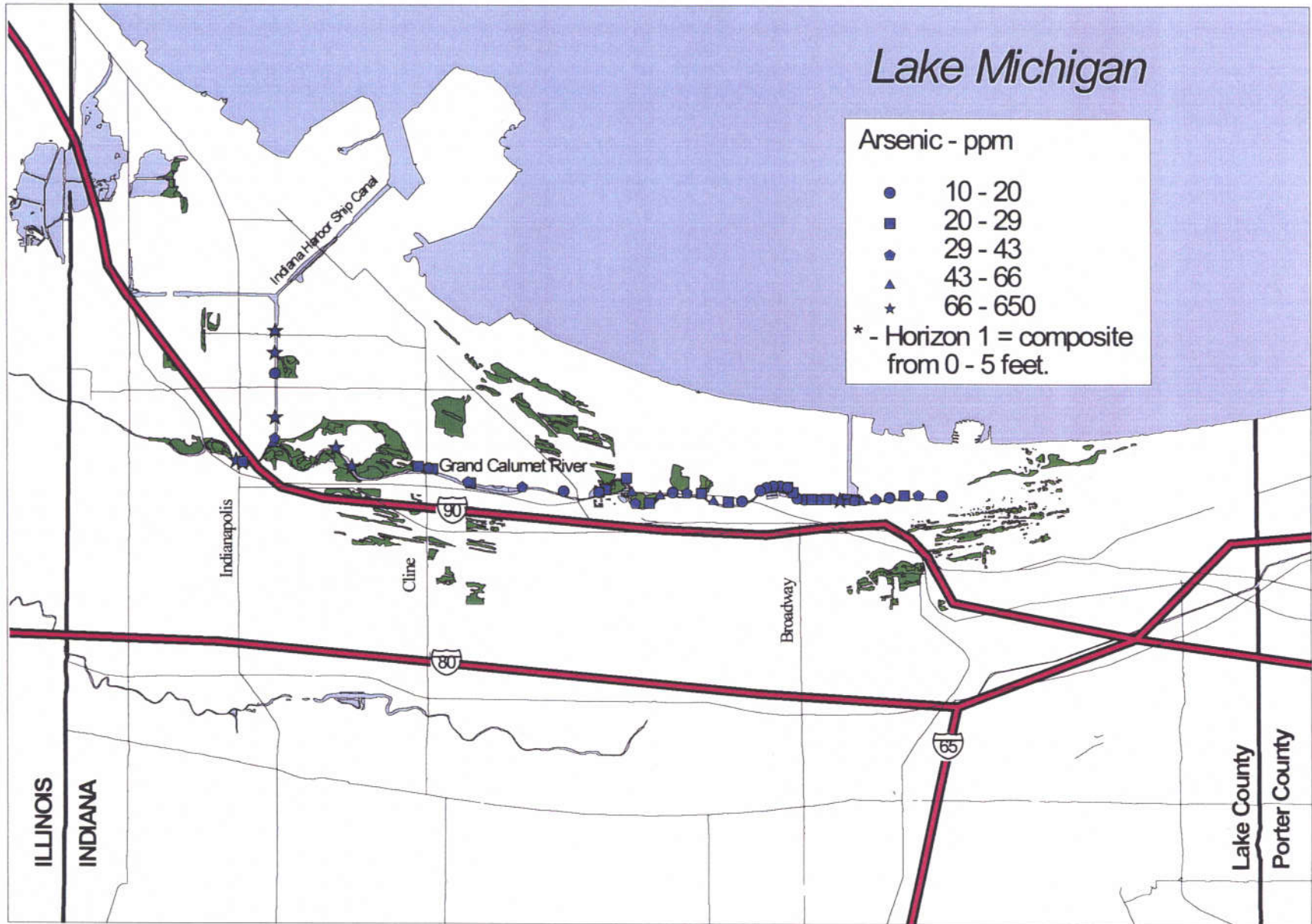


Figure iii: Arsenic Horizon 1*

31



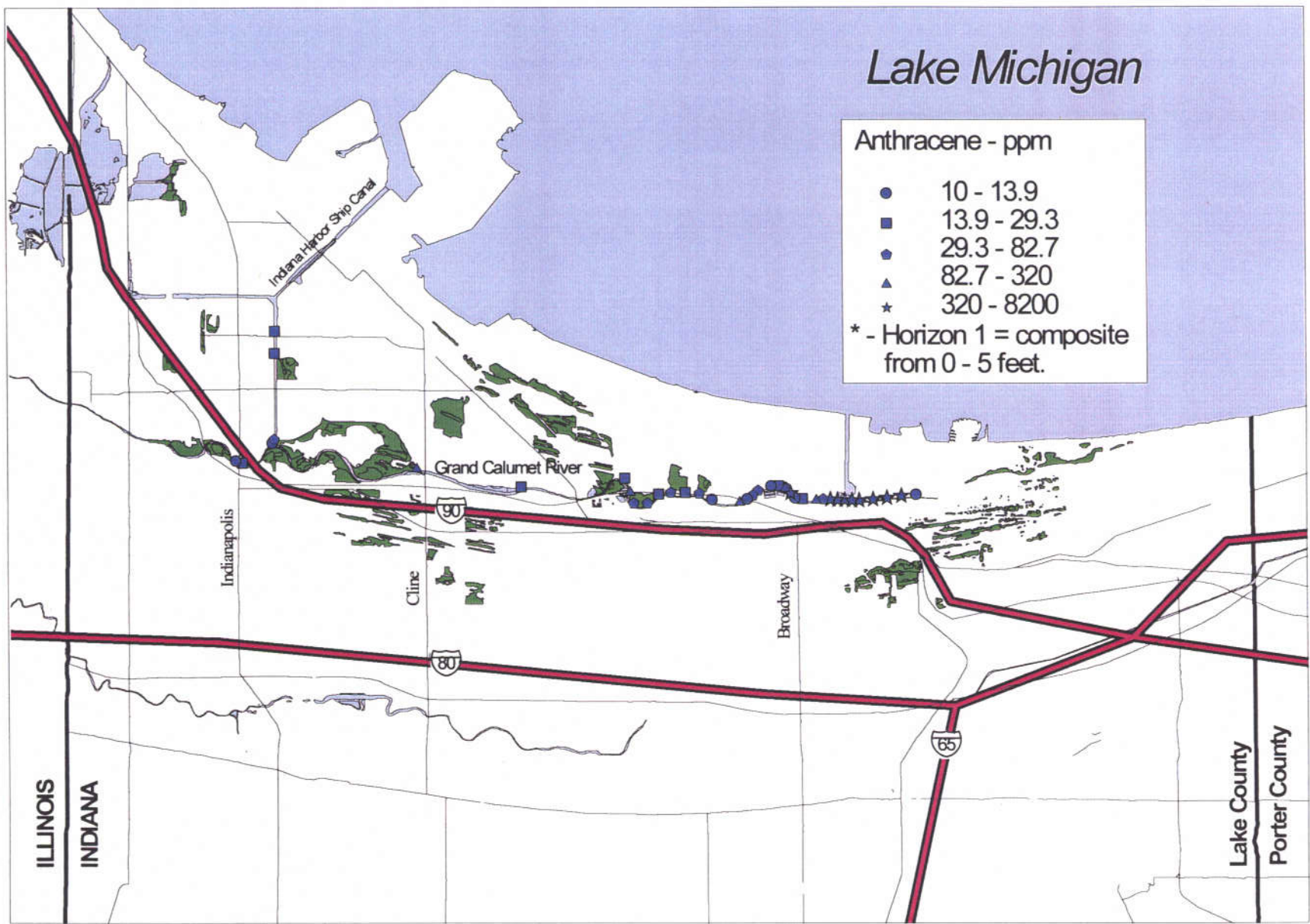
2 0 2 4 Miles



Source of Data: U.S. Steel Corporation 1991 Sediment Characterization Study
 Map Date: October 1997

Figure iv: Anthracene Horizon 1*

32



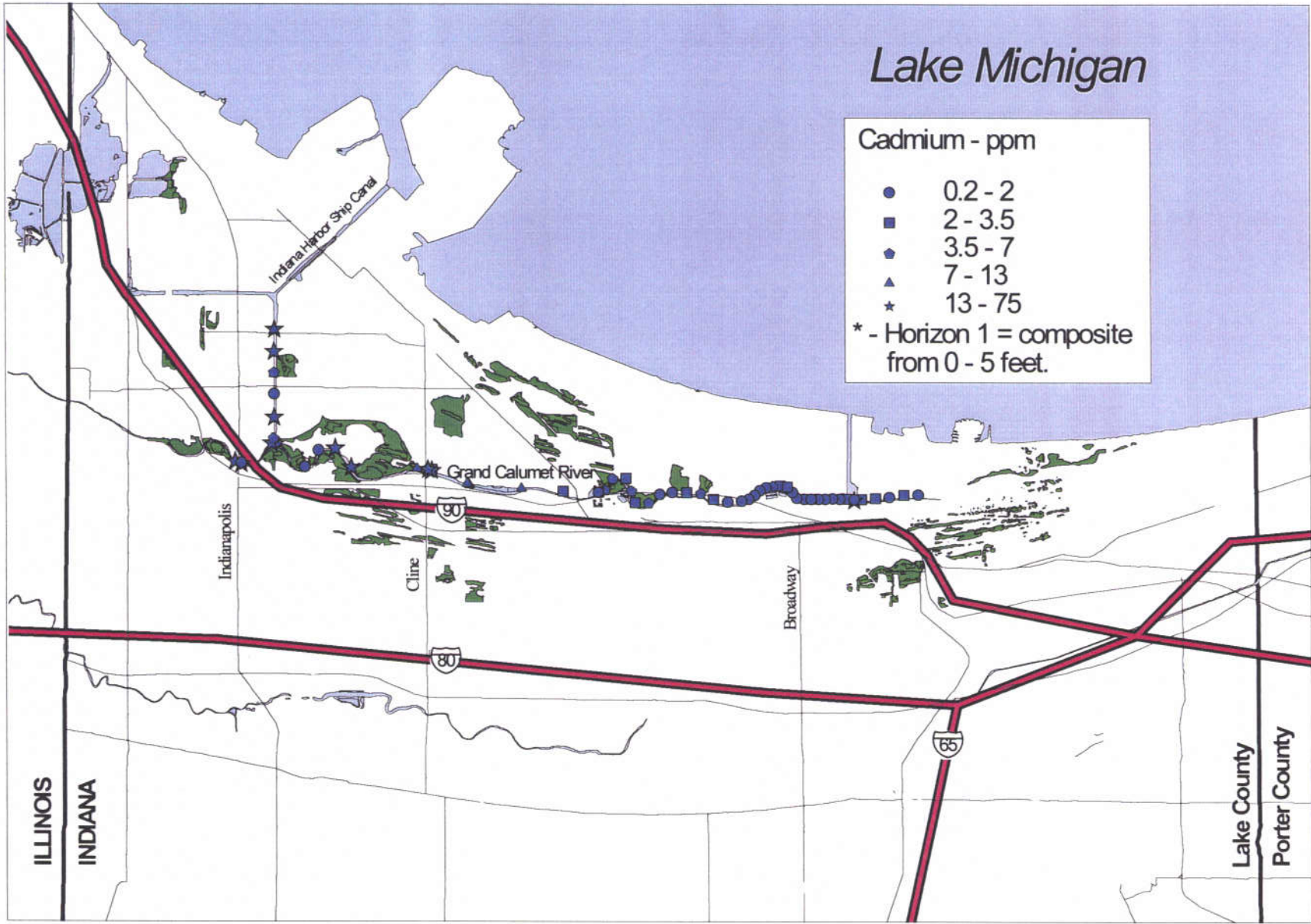
2 0 2 4 Miles



Source of Data: U.S. Steel Corporation 1991 Sediment Characterization Study
 Map Date: October 1997

Figure v: Cadmium Horizon 1*

33



2 0 2 4 Miles



Source of Data: U.S. Steel Corporation 1991 Sediment Characterization Study
Map Date: October 1997

The most recent sediment contaminant monitoring results (1994) on the Grand Calumet River and Indiana Harbor Ship Canal by IDEM Office of Water Management also exhibited a variety of PAHs, PCB as Aroclor 1248, and metals. Regular collections of surficial aquatic sediment from the channel have occurred at Bridge Street, Cline Avenue, Kennedy Avenue, Indianapolis Boulevard, and at Dickey Road on the Indiana Harbor Ship Canal. The PAHs of highest concentration in the surficial sediment samples were chrysene, pyrene, fluoranthene, phenanthrene, and benzo (*a*) pyrene. Metals of concern had the following concentration ranges (mg/kg dry weight):

	<u>Low</u>		<u>High</u>	<u>State mean</u>	<u>95th percentile</u>
cadmium	3.0	to	29.2	0.37	7.09
copper	105	to	879	20.2	120
lead	230	to	4350	24.1	197
mercury	0.220	to	12.4	0.057	0.34
nickel	1.7	to	418	13.2	64.7
zinc	1080	to	4860	84.0	460
arsenic	20.5	to	101	6.43	22.2
chromium	185	to	696	16.1	97.9

(Wente, 1994).

These concentration ranges are generally on the order of ten times higher than the mean sediment concentration for Indiana assuming no spatial variability with high ranges ranking well above the ninety-fifth percentile.

C. Sediment Toxicity Analysis

Sediment toxicity was also analyzed in the 1994 U.S. FWS study (Pre-Remedial Biological and Water Quality Assessment of the East Branch Grand Calumet River Gary, Indiana). Sediment toxicity is determined by exposing test organisms that are commonly found in sediments (i.e. *Hyalella azteca*, *Chironomus riparius* and *Chironomus tentans*) to sediment collected from the test area indicating whether pollutants exist in toxic amounts or toxic conditions exist. Sediment samples for toxicity testing were collected from various locations along the East Branch of the Grand Calumet River. Additionally, sediments were collected from Long Lake, Indiana Dunes National Lakeshore (IDNL), to serve as a reference location. Results from the sediment toxicity testing revealed that statistically significant *H. azteca* mortality occurred in all East Branch sediments, relative to the reference sample collected from IDNL (Table 08).

Percent mortality observed for each sediment sample at the termination of the 10-day static renewal acute toxicity tests with *Hyalella azteca*.

Sediment I.D.	Percent Mortality				
	Rep A	Rep B	Rep C	Rep D	Rep E
<i>Test Dates: July 6-16, 1994</i>					
GCR-28	95	100	100	100	100
GCR-32	100	100	100	100	100
GCR-34	80	85	80	85	90
GCR-35	100	100	100	100	100
GCR-36	100	100	100	100	100
IDNL	0	5	0	10	0
<i>Test Dates: July 8-18, 1994</i>					
GCR-06	100	100	100	100	100
GCR-11	65	75	90	60	72
GCR-18	100	100	80	100	100
GCR-21	45	50	50	45	70
GCR-24	100	100	100	100	100
IDNL	0	0	0	5	0

- a - Statistically different as compared to the reference control (IDNL, test dates July 6-16, 1994).
- b - Statistically different as compared to the reference control (IDNL, test dates July 8-18, 1994).

(reproduced from Springborn Laboratories, Inc. 1994. Toxicity evaluation of the sediment collected from the East Branch of the Grand Calumet River in Gary, Indiana.)

Table 08.

Sediment toxicity was also confirmed from a study conducted with *Chironomus tentans*, (Hoke *et al.*, 1993), which analyzed sediment collected from ten locations along the Grand Calumet River [spanning from the East Branch to the Indiana/Illinois border] and three locations in the Indiana Harbor Ship Canal. In this study, toxicity is demonstrated by an inhibition in weight gain of the test species (*C. tentans*) exposed to the sediment. The results of this study demonstrated an average inhibition in growth of 91.9 percent. Compared to a control, this indicates a significant increase in toxicity.

D. Biological Community Monitoring

Numerous studies have characterized the quality (or biological integrity) of the fish communities as well as aquatic insect communities of the Grand Calumet River and Indiana Harbor Ship Canal (U.S. EPA, 1985; Simon *et al.*, 1988; Bright, 1988; Sobiech *et al.*, 1994). Fish and insect community monitoring gives a collective measurement of all stresses imposed on the ecological integrity of the system. The biological community imprints into its compositional, structural, and functional organization all stresses, not only reflecting the stresses at the immediate site sampled but the collective ecological stresses of all aspects of the system upstream. An Index of Biotic Integrity (IBI) is used to assess the ecological integrity of the fish community. It is based on scored attributes of the community including its compositional, structural, and functional makeup. The IBI is compared to a calibrated reference on best attainable conditions. Changes in the biological community will be reflected in the indicators and monitoring strategies developed. See Chapter Seven.

IDEM, along with U.S. EPA Region V, conducted fish community surveys during the mid 1980s. Fish sampling locations for Grand Calumet River and Indiana Harbor Ship Canal consisted of five hundred meter river reaches sampled along the near-shore margins of both banks. All fish netted were identified to species, measured for length range, weighed, and enumerated in the field. Simon *et al.* (1988) showed that water quality in the Grand Calumet River had improved from 1985 to 1988. Forty-three fish collections were made in the basin from 1985 to 1988, resulting in a cumulative total of twenty-one fish species documented. The east branch and the Indiana Harbor Ship Canal had IBI ratings of "very poor" to "poor" during the period. The IBI ratings for the west branch were "very poor" with no fish being collected in same areas during 1987 and 1988. A "very poor" rating in an IBI describes the community as having few fish present, mostly introduced or tolerant forms; hybrids common; diseases, parasites, fin damage, and other anomalies regular. A "poor" rating describes the community as dominated by omnivores, tolerant forms, and habitat generalists; few top carnivores; growth rates and condition factors commonly depressed; hybrids and diseased fish often present (Simon *et al.*, 1991; Sobiech *et al.*, 1994). The high proportion of omnivorous fish in the Grand Calumet River is symptomatic of declining environmental quality (Simon, 1991).

Golden shiner, goldfish, and common carp generally dominate the fish community of the Grand Calumet River and Indiana Harbor Ship Canal making up over 80 percent of the community (Simon *et al.*, 1988). All three of these species are considered very tolerant of stressed conditions (Simon, 1991). Goldfish and common carp are not species native to the river. The overall quality of the Grand Calumet River is "very poor" even though a high proportion of cattail marsh wetland lies along the basin margins (Simon, 1991). Simon (1991) states that:

Overall, habitat is not the limiting factor in the improvement of this basin since enough refuges exist

to facilitate the colonization of impacted areas after the perturbations have been removed. The high degree of industrialization along the River's banks is the principal cause of toxic influence impacting the aquatic community.

The most recent fish community study, by Sobiech *et al.* (1994) focused on the East Branch of the Grand Calumet River. In this study, all sites sampled had an IBI rating of "very poor." Again a high proportion of omnivorous fish were observed. There was also a lack of simple lithophilic spawners demonstrating the absence of clean gravel or cobble substrate necessary for reproduction. Hybrids were common and DELT (deformities, eroded fins, lesions, and tumors) anomalies were frequent (Sobiech *et al.*, 1994). Simon (1991) observed DELT anomalies from 3.4 to 12.5 percent of the total fish community. Normal DELT anomaly occurrence would be expected to be no more than 1-2 percent of the community.

IDEM has conducted biennial sampling for aquatic macroinvertebrates in the Indiana Harbor Ship Canal at the Dickey Road bridge for a number of years. IDEM also conducted several studies on the Grand Calumet River in the mid-to-late 1980s. Aquatic macroinvertebrates are sampled using artificial substrate samplers suspended into the water column from a bridge (Fullner, R.S., 1971). The sampler is retrieved after six to eight weeks and all organisms preserved. The insects, snails, worms, etc. are then identified, enumerated, and the community integrity assessed. Bright evaluated collections from the east and west branches of the Grand Calumet River, Indiana Harbor Ship Canal, and the Lake George Canal. "No intolerant species were present at any of the sites." However, he noted that the presence of many facultative organisms (esp. dragonflies, certain midges, and snails) indicated that severe oxygen depletions do not occur, but that the benthic fauna were stressed by toxic chemicals. Bright also noted the absence or rarity of groups generally tolerant of mild organic pollution that are quite sensitive to toxic chemicals. Bright also saw an association between the amounts of cyanide and PAHs (polycyclic aromatic hydrocarbons) in the sediments and the amount of biological community depression. The most biologically depressed site in this study was at Bridge Street in the East Branch.

The study by Sobiech *et al.* (1994), also included the assessment of aquatic macroinvertebrate communities using artificial substrate samplers. They used an Invertebrate Community Index (ICI) score which is similar to an IBI and is based on observed attributes of the macroinvertebrate community (Ohio EPA, 1989). A Family Biotic Index (FBI; Hilsenhoff, 1988), which provides a measure of the effects of organic degradation on an invertebrate community based on the pollution tolerance of the invertebrates collected, was also calculated for each sampling location.

The Sobiech *et al.* (1994) study concluded that the overall invertebrate taxa composition of the East Branch was poor. Low numbers of individuals, low organism density, and low taxa diversity were observed at all sites during the survey. No sensitive taxon of invertebrates were collected from the East Branch. The East Branch's invertebrate community was dominated by tolerant individuals (95.5 percent). The FBI score for the sites reflects the presence of fairly poor to very poor pollution-tolerant invertebrate communities and indicate those pollutional degree ranges from substantial to severe in the East Branch. The poor taxa composition of the East Branch is reflective of the degraded environmental conditions. Degraded environmental conditions resulting from continual toxic loading to the East Branch have adversely affected its invertebrate trophic composition.

Additionally, the Assessment and Remediation of Contaminated Sediments (ARCS) Program conducted a study of the Indiana Harbor Ship Canal. The results from this indicated a very stunted benthic invertebrate community. The invertebrate community, dominated by the Oligochaeta family Tubificidae (worms), is indicative of a benthic invertebrate community subjected to heavy organic pollution (Brinkhurst *et al.*, 1972; Brinkhurst and Cook, 1974; Cook and Johnson, 1974; Burt *et al.*, 1991). All of the Tubificidae genera present in the Indiana Harbor are known to be very tolerant of organic pollutants (Kennedy, 1965; Brinkhurst *et al.*, 1972). *Limnodrilus hoffmeisteri*, one of the most pollution tolerant Oligochaeta species, was the most abundant species at all stations sampled (ARCS, 1993).

E. Fish Tissue (and other biological matrices) Monitoring

Fish tissue monitoring is a widely used method of monitoring and assessing environmental contaminants and their bioavailability. It is known that concentrations of some contaminants may be greater in tissues than in water because of bioconcentration, bioaccumulation, and/or biomagnification. Tissue contaminant monitoring is a tool that measures contaminants that can not be otherwise measured in water or air. Tissue contaminant monitoring, when part of an integrated multimedia monitoring program, gives insight into exposure levels and allows IDEM to better develop its understanding into the complexities of contaminant distribution, fate, and effects.

The Biological Studies Section of the Office of Water Management at IDEM has been collecting fish tissue from the Grand Calumet River and Indiana Harbor Ship Canal since 1986. The IDEM collected fish tissue from both the Grand Calumet River and Indiana Harbor Ship Canal prior to 1986. The most recent fish tissue contaminant results are from 1994. Lake Michigan open waters fish are also regularly collected and analyzed for contaminants. Both salmonid and non-salmonid Lake Michigan samples are analyzed. The Lake Michigan samples are collected by IDNR's Division of Fish and Wildlife personnel, and processed by IDEM Biological Studies personnel and analyzed by a contract laboratory. Some samples are sent to the U.S. Food and Drug Administration Lab in Minneapolis, Minnesota for analysis. All resulting data (to various degrees) are used to support the issuance of fish consumption advisories for both the Grand Calumet River and Indiana Harbor Ship Canal and lakewide interstate fish consumption advisories.

Of the fish tissue samples analyzed from the Grand Calumet River and Indiana Harbor Ship Canal in 1994, 95 percent had total PCB concentrations that exceeded 2.0 parts per million (ppm). In fact common carp total PCB levels averaged 10.3 ppm on a whole fish basis ranging from 0.8 to 27 ppm. All fish tissue samples collected from four locations in the Grand Calumet River showed a continued high level of contamination (IDEM, 1994; IDEM, 1996). Historically, most samples analyzed by IDEM have had total PCB concentrations in excess of 2.0 ppm. Contaminant analyses in crayfish as well as snapping turtle tissue have historically found PCB at levels ranging from 0.13-1.2 ppm (IDEM, unpublished data. However, this data has undergone quality assurance and quality control and is public data). The Grand Calumet River and Indiana Harbor Ship Canal has long been known for its PCB contaminated sediments.

The Grand Calumet River and Indiana Harbor Ship Canal fish still rank as the most contaminated fish in the state of Indiana. More kinds of contaminants are detected in Grand Calumet River and Indiana Harbor Ship Canal fish tissue than anywhere else in the state. Other

contaminants of concern detected include the organochlorine-based pesticides aldrin, total DDT, chlordane, lindane, dieldrin, and hexachlorobenzene. A number of polycyclic aromatic hydrocarbons including 1-methyl naphthalene, 2-methyl naphthalene, acenaphthene, fluorene, anthracene, phenanthrene, fluoranthene, pyrene, and indeno (1,2,3-c,d) pyrene, are detected in fish tissue (IDEM unpublished data). Other semivolatile and volatile organic compounds detected in fish tissue samples have been benzene, dibenzofuran, tetrachloroethylene, trichloroethylene, di-n-butylphthalate, 1,1,1-trichloroethane, and trichloromethane.

F. Fish Consumption Advisory

In 1995 a risk-based approach was adopted by Indiana State Department of Health (ISDH) for evaluating PCB contamination in fish tissue. This approach was based on the protocols developed by the Great Lakes Sport Fish Consumption Advisory Task Force (Anderson *et al.*, 1993). In 1986 this Task Force was created and ultimately charged with developing a uniform sport fish consumption advisory protocol applicable to all Great Lakes and their immediate tributaries. The advisory goals were to: 1) maintain the health benefit of fish consumption; 2) minimize the potential for angler toxic chemical exposure; 3) use credible and understandable science; and 4) present the information in a manner conducive to maximal voluntary compliance.

The Task Force spent considerable time reviewing and discussing the risk of adverse health effects from consumption of contaminated sport fish. They chose to focus initial advisory protocol on PCB, the chemical contaminant most frequently encountered in Great Lakes fish which necessitated a fish consumption advisory. Their advisory approach utilizes a weight-of-evidence derived individual health protection value (HPV) of 0.05ug/kg/day for PCB residue ingested from fish tissue. The HPV is intended to encompass acceptable reproductive and developmental risks as well as cancer. Mercury contamination in fish tissue has also been evaluated using a similar type reference dose value (RDV) to encompass acceptable reproductive and developmental risks (ISDH *et al.*, 1996). Mercury is detected ubiquitously in fish tissue samples from Indiana waters. Mercury based fish consumption advisories using this new approach were included in the 1996 Indiana Fish Consumption Advisory.

The fish consumption advisory for Lake Michigan and its immediate tributaries is the result of effort from all of the Great Lakes states for a consistent and uniform fish consumption advisory as well as additional data collected by IDEM. The Indiana Lake Michigan advisory extends for two hundred and forty-one square miles which is the southern most waters of the lake. The current fish consumption advisory for Lake Michigan and its tributaries is included in Table 09.

Table 09. Fish Consumption Advisory for Lake Michigan and Tributaries (ISDH *et al.*, 1997).

<u>Location</u>	<u>Species</u>	<u>Fish size</u>	<u>Group</u>
Grand Calumet River and Indiana Harbor Ship Canal in Lake County			All
All	5* @		
Lake County	Goldfish	4+	5*
	Golden Shiner	3-6	5*
Lake, LaPorte, & Porter counties	Black Crappie	7-8" 8+"	3* 4*
	Brook Trout	All	3*
	Brown Trout	up to 18" 18-27" 27+"	3* 4* 5*
	Common Carp	All	5* @
	Catfish	All	5*
	Chinook Salmon	up to 26" 26"+	3* 4*
	Coho Salmon	17-28" 28"+	3* 4*
	Lake Trout	up to 21" 21-26" 26"+	3* 4* 5*
	Largemouth Bass	4-7" 7+"	3* 4*
	Longnose Sucker	14-23" 23"+	4* @ 5*
	Northern Pike	10-14" 14+"	3* 4*
	Pink Salmon	All	3*
	Rainbow Trout	up to 22" 22"+	3* 4*
	Walleye	17-26" 26"+	3* 4*
	Whitefish	up to 23" 23"+	3* 4*
	White Sucker	14-23" 23"+	3* 4*

* = Advisory driven by PCB contamination.; @ = Advisory driven also by mercury contamination.

The new advisory approach divides restrictions into five consumption advisory groupings: Group 1- unrestricted consumption (one meal per month for women who are pregnant or breastfeeding, women who plan to have children, and children under the age of 15), Group 2- one meal per week (**one meal per month for women who are pregnant or breastfeeding, women who plan to have children, and children under the age of 15**), Group 3- one meal per month (**women who are pregnant or breastfeeding, women who plan to have children, and children under the age of 15 do not eat**), Group 4- one meal per two months (**women who are pregnant or breastfeeding, women who plan to have children, and children under the age of 15 do not eat**), Group 5- **NO CONSUMPTION (DO NOT EAT)**. It is very important that pregnant women, nursing mothers, women who may become pregnant in the next several years, and all children under the age of 15 follow the recommendations in this advisory. Spacing fish

meals out for the recommended groupings prevents the contaminants from building up to harmful levels in the body.

V. Ground Water Flows and Data

The Area of Concern is characterized by a complex and shallow ground water flow that is intrinsically connected to the surface water. Contaminants can enter the ground water through soil and surface water interactions with the ground water. The uppermost bedrock area has been disrupted by numerous excavations for water reclamation and storm drainage tunnels. Based on ground water data analysis, small amounts of contamination detected in the uppermost bedrock aquifer could be attributed to leakage from surface or shallow ground water from improperly sealed wells or borings and not due to transport through geologic material (Kay *et al.*, 1996).

A study done by the USGS in 1988-89 (Fenelon and Watson, 1993) described the ground water quality as being poorest at the steel and petrochemical facilities, moderate near light industrial and commercial areas, and best in residential and park areas. One study estimated that ground water may contribute to more than ten percent of the total chemical load of ammonia, chromium, and cyanide to the Grand Calumet River (Kay *et al.*, 1996). For a more complete discussion of ground water quality in the Area of Concern, see appendix A of the Sediment Cleanup and Restoration Alternatives Project, 1997.

The disposal of large quantities of municipal and industrial wastes affects ground water quality at several industrial and waste disposal sites. This decreases the viability of the lakes and wetlands. In addition, crushed and hot poured slag has also been used as fill to create large areas of "made" land along the shores of Lake Michigan, Wolf Lake, and Lake George (Kay *et al.*, 1996). A study of the location and effects of the slag and other anthropogenic fill sites in the Area of Concern has been made by the USGS and U.S. EPA. These two agencies released this document entitled, "Characterization of Fill Deposits in the Calumet Region of Northwest Indiana and Northeast Illinois".

Geotechnical and environmental investigations at specific industrial and waste disposal sites have been completed. Results indicate environmental problems at several sites, many of which are adjacent. These site-specific investigations generally provide a detailed understanding of the geohydrology at a specific site, but not of the hydrogeologic relation between adjacent sites and between a site and the area as a whole (Kay *et al.*, 1996).

VI. Air Quality

The relationship between air emissions and impaired uses is not clearly established because air quality has historically not been evaluated using biological indicators but rather measurements of ambient air concentrations of pollutants. Ambient air monitoring data indicate Lake and Porter counties have the most severely polluted air in Indiana. While the relationship between air emissions and the impaired uses is not clearly established, many pollutants affecting the Area of Concern, especially bioaccumulative heavy metals such as mercury, originate from air emissions. Also, because air pollutants can be transported over long-distances, a significant portion of the air quality impact on this area may originate outside the Area of Concern.

IDEM does not currently use biomonitoring to assess the effects of air pollutants on

biological organisms. However, certain plant and animal species are highly susceptible to pollutants introduced to the ecosystem through air emissions. Biomonitoring is recognized as a possible method by which to better assess the effects of air deposition in the Area of Concern.

The Wisconsin Department of Natural Resources has conducted studies on the effects of tropospheric ozone on the growth of Trembling Aspen (*Populus tremuloides*) and has found it to be an excellent bioindicator. Aspen trees in areas with high ambient ozone levels grew more slowly than trees in areas with lower ozone levels. Milkweed is another plant commonly used as a bioindicator. Studies in Wisconsin indicate an increase in visible foliar injury (stems and leaves) to milkweed plants in areas with higher ozone levels.

Lichens have the capacity to accumulate mercury in their tissues up to several thousand times ambient mercury levels. Because of that capability, they are another type of organism that serve as an ideal bioindicator. Wisconsin has conducted several lichen distribution studies since the early 1990s.

Great Lakes studies cited in Stage I have found deformities in migratory birds. The Area of Concern has many migratory species, although it is not known if these birds were contaminated in this area. Additionally, wildlife has greatly diminished during this century. The U.S. FWS plans to conduct more research on the subject of wildlife in the Area of Concern in the near future.

VII. Conclusion

The ecological resources of the area include eighteen natural community types, over seven hundred species of plants, and over two hundred species of birds. Seven of the community types, eighty-five of the plant species and eighteen of the nesting bird species are globally or state significant. Important natural processes which contributed to the development of the region's diversity have been altered by human development. Ecological succession and hydrologic interconnections have been disrupted by stressors such as habitat fragmentation, fire suppression, hydrologic modification, exotic species, shoreline alteration and environmental contamination. As a result of these stressors, critical habitat areas exist in varying states of degradation, from minimally disturbed to severely degraded. Some of these critical habitat areas include the Miller Woods and Dunes area, the Clark and Pine East preserve, the DuPont Dune and Swale area, the Gary Airport Sedge Meadow area, and Roxanna Marsh.

Water quality in the Grand Calumet River and Indiana Harbor Ship Canal system continues to be of concern. Concentrations of many contaminants in the water system have been reduced, however there are still water quality violations. Cyanide, unionized ammonia, and *E. coli* levels are most frequently found to exceed water quality standards. Other water quality problems include oil and grease, lead, PCBs, pesticides, and mercury. Contaminated sediments throughout the Grand Calumet River and Indiana Harbor Ship Canal system are significant contributors to the degradation of both water quality and aquatic habitat. Sediments are heavily contaminated with organic chemicals including pesticides, PAHs, PCBs and with heavy metals. Tests have shown these sediments to be toxic to aquatic organisms. Ground water in the area is also contaminated. Highest contamination levels are found in the metal and petroleum industrial areas. Because ground and surface water in the Area of Concern are hydrologically linked, ground water contamination and surface water quality problems are closely related. Further, air

quality in the Area of Concern contributes to water quality problems. Some bioaccumulative pollutants, such as mercury, are primarily delivered to water through air deposition.

Aquatic species and macroinvertebrate communities in the system show low biodiversity. Species composition is typical of degraded environmental conditions with only pollution tolerant species present. Species which are present have multiple indications of exposure to contaminants, including higher incidence of disease and low growth rates. Studies indicate that toxic contamination, rather than habitat loss, is most likely the limiting factor contributing to these degraded communities. Many of the contaminants prevalent in the system are bioaccumulating. The high concentrations of toxic chemicals such as PCBs and mercury in fish tissues have resulted in IDNR recommendations that no fish from the Grand Calumet River and Indiana Harbor Ship Canal system are safe for human consumption.

Environmental conditions in the Area of Concern exist in a wide range of extremes. There are multiple heavily contaminated National Priorities List sites side by side with natural areas of significant biological diversity. The Area of Concern contains ecological resources of global significance which are threatened by the concurrent environmental degradation. Water quality fails to meet its designated standards and is a problem which is contributed to by contaminated sediments, contaminated groundwater, and air deposition. Diverse terrestrial and wetland communities contrast with degraded aquatic communities. Fish able to survive in the system are so heavily contaminated that they are unfit for human consumption.

The significant amount of stress in the Area of Concern has caused much of the degradation of the ecosystem, resulting in the loss of habitat, increased sedimentation, lack of or excessive nutrient loadings, etc. The stress can occur from either biological, physical, or chemical factors. The six leading contributors to the high level of stress are almost all derived from human activity.

Contamination is related to all fourteen of the beneficial uses of the Area of Concern. It seriously alters fish and wildlife populations, drinking water standards, aesthetics, deformities, agricultural and industrial work, etc. Contamination contains a variety of factors which affect the environment. Contaminated sediment from municipal and industrial point discharge, combined sewer overflow, and urban runoff all contribute to the decreasing efficiency of the ecosystem. Also, non-point source pollution, land development, erosion, runoff, and air emissions (directed at the National Ambient Air Quality Standards --NAAQS) limit the beneficial uses in the Area of Concern. Other major stressors include fragmentation and loss of physical habitat, altered hydrology, shoreline alterations, introduction of exotic species, and fire suppression. All of these inducers of stress add to the reduction of the fourteen beneficial uses and the increased degradation of the environment.

CHAPTER THREE

SOURCES OF ENVIRONMENTAL STRESS

I. Introduction

There are a number of different causes of stress on the environment in the Grand Calumet River and Indiana Harbor Ship Canal Area of Concern. These sources of environmental stress have caused the destruction of many stable communities of organisms. Stress can be physical, such as sedimentation, loss of beach nourishment or loss of access to habitat. It can be biological, such as pathogen or parasite infestation, or lack of predators or prey. Stress can be from chemical factors such as too many or too few nutrients. Almost all sources of ecosystem stress are the result of human activity. The six sources of stress include:

- Pollutant and nutrient contamination
- Fragmentation and loss of physical habitat
- Altered hydrology
- Shoreline alterations
- Exotic species introduction
- Fire suppression

This chapter looks at the six major sources of stress to the ecosystem in the Area of Concern. Identification of these sources of stress is one of the first steps in restoring and maintaining the Area of Concern ecosystem. Many of the sources of stress, such as those causing changes in ground water levels and flow, cannot be remediated, but should be accounted for in the design of remedial actions. The following figure (figure viii), Matrix of Beneficial Use Impairments and Stressors Causing Beneficial Use Impairments, identifies these sources of stress in relation to the beneficial uses they impair.

Matrix of Beneficial Use Impairments and Stressors Causing Beneficial Use Impairments

Beneficial Use Impairments	Stressors Causing Beneficial Use Impairments					
	Contamination	Fragmentation and loss of physical habitat	Altered Hydrology	Shoreline Alterations	Exotic Species	Fire Suppression
Restrictions on Fish and Wildlife Consumption	*					
Tainting of Fish and Wildlife Flavor	*					
Degraded Fish and Wildlife Populations	*	loss of breeding/foraging habitat limits species interaction	loss of breeding/foraging habitat	changes physical structure of habitat	loss of breeding/foraging habitat outcompetes native species	loss of breeding/foraging habitat
Fish Tumors and other Deformities	*	lack of suitable habitat forces increased exposure to contaminants				
Bird or Animal Deformities and/or Reproductive Problems	*	lack of suitable habitat forces increased exposure to contaminants				
Degradation of Benthos	*	lack of suitable habitat	changes physical structure of habitat	changes physical structure of habitat	changes biological structure of habitat outcompetes native species	
Restriction on Dredging Activities	*	protection of high quality habitat complicates sediment removal	changes physical structure of habitat			
Eutrophication or undesirable Algae	*		disrupts surface / groundwater flow			
Restrictions on Drinking Water Consumption or Taste and/or Odor Problems	*					
Beach Closings	*					
Degradation of Aesthetics	*	The beneficial use impairment focuses on negative aesthetic qualities such as discolored water. Restoring natural communities along the river will improve the overall aesthetics of the Area of Concern.				
Added Costs to Agriculture or Industry	*				Zebra Mussels can clog water intakes and discharges	
Degradation of Phytoplankton and Zooplankton Populations	*	lack of suitable habitat	changes in physical habitat structure	changes physical structure of habitat	changes biological structure of habitat outcompetes native species	changes in biological structure of habitat
Loss of Fish and Wildlife Habitat	*	loss of breeding/foraging habitat limits species interaction	changes in physical habitat structure	changes physical structure of habitat eliminates nearshore aquatic and early successional habitat	changes biological structure of habitat outcompetes native species	changes in biological structure of habitat

*The relationship between contaminants and beneficial use impairments are detailed in the front matter.

II. Contamination

Contamination contributes to all fourteen beneficial use impairments. It is the primary stressor causing restrictions on fish and wildlife consumption, tainting of fish and wildlife flavor, fish tumors and other deformities. It also leads to bird or animal deformities or reproductive problems, restriction on dredging activities, restrictions on drinking water consumption or taste or odor problems. It can also lead to beach closings, degradation of aesthetics, and added cost to agriculture or industry. It works in combination with other stressors to cause degraded fish and wildlife populations, degradation of benthos, eutrophication or other undesirable algae, degradation of phytoplankton and zooplankton populations, and loss of fish and wildlife habitat.

A. Contaminated Sediment

There are three major sources that account for the sediment entering the Grand Calumet River and Indiana Harbor Ship Canal. They include: municipal and industrial point discharges, combined sewer overflows (CSOs), and urban runoff. IDEM has issued permits for thirty-nine outfalls on the Grand Calumet River and Indiana Harbor Ship Canal which serve municipal sewage treatment plants, semi-integrated steel manufacturing, chemical producers, and others. In addition to these controlled point sources, the sanitary districts of Gary, Hammond, and East Chicago maintain combined sewer systems that overflow to the Grand Calumet River and Indiana Harbor Ship Canal, even during light storm events.

There are differing views on the amount of sediment entering the system. Two separate studies calculating the annual loadings of sediment to the Grand Calumet River and Indiana Harbor Ship Canal demonstrate a substantial difference in loadings. The first study, conducted by the U.S. Army Corps of Engineers in its Comprehensive Management Plan for dredging the Indiana Harbor Ship Canal, estimates the total annual loading to be 152,000 cubic yards (CY). The second study was conducted by Mark W. Tenney, ScD., P.E. on behalf of the Grand Calumet Task Force. This evaluation estimates the annual total loading from sediment to the Grand Calumet River and Indiana Harbor Ship Canal to be from 15,000 - 26,000 CY. One possible explanation for the difference in values could be differing methodologies. Another reason could be that the original U.S. Army Corps of Engineers study was conducted in the early 1980's, and better management practices could account for the reduction in total loadings estimated in the later Tenney study.

The sediment loading estimate prepared by the U.S. Army Corps of Engineers was part of a larger effort to compute the deposition rate within the federal portion of the Indiana Harbor Ship Canal and to compute the discharge of sediments to Lake Michigan. The loading estimate was used as a confirmation of a deposition rate that was first computed by noting the changes in surveyed volumes over a period of time. In an attempt to discern the total discharge of sediments in this waterway, the U.S. Army Corps of Engineers is collecting data throughout 1996 and 1997

from gauging stations along the Grand Calumet River and Indiana Harbor Ship Canal. Sediment discharges could vary from the sediment loading rates in two important ways. First, the sediment discharge is a function of the sediment loading, but it is also a function of the deposition or erosion of sediments within or along the harbor or canal. Second, the discharge of sediments out of the Indiana Harbor Ship Canal primarily occurs during storm events, and therefore the daily monitoring of suspended sediments may not, in the short term, be consistent with long term averages. Given the sediment discharge data, however, along with future updated surveys, it may be possible to predict the sediment loadings, the deposition rates, and the discharges to Lake Michigan.

Based on monthly discharge reports located at IDEM from August 1993 through July 1995, nineteen National Pollutant Discharge Elimination System permittees in the Grand Calumet River and Indiana Harbor Ship Canal area discharged an average total flow of approximately eight hundred and thirty-three million gallons per day (MGD) or 1,291 cubic feet per second (cfs). In a dry weather period, this amount of effluent flow represents the entire flow in the river system. The estimated soil and sediment loss due to stormwater runoff to the Grand Calumet River and Indiana Harbor Ship Canal is 20,000,000 pounds annually (U.S. Army Corps of Engineers Grand Calumet River Basin BMP Demonstration, 1995).

Most of the Grand Calumet River and Indiana Harbor Ship Canal system has reached a steady-state condition, meaning there is a balance of sediment deposition and scour/transport. (Indiana Harbor and Canal Maintenance Dredging and Disposal Activities, Draft Environmental Impact Statement, U.S. Army Corps of Engineers) The result of this condition is a loading of 100,000 to 200,000 CY of sediment to Lake Michigan from the mouth of the Indiana Harbor annually. The annual sediment load to the lake contains an estimated 67,000 pounds of chromium, 100,000 pounds of lead, and four hundred and twenty pounds of PCB's (U.S. Army Corps of Engineers).

Industrial and municipal outfalls, including combined sewer systems, are a primary source of pollution of the Grand Calumet River and Indiana Harbor Ship Canal sediments. Sediments become contaminated before their deposition in the navigation channel (U.S. Army Corps of Engineers). Characterization of sediments in thirteen miles of the Grand Calumet River and Indiana Harbor Ship Canal conducted by the U.S. Steel Corporation, pursuant to a Consent Decree with the U.S. EPA, identified sediment contamination consistent with wastes from industries that either have discharged directly to the river, or have discharged indirectly to the river through local sewage treatment plants and combined sewer overflows. Many of these sources are located upstream of the Indiana Harbor Ship Canal.

B. Point Source Discharges

The majority of industries in the Northwest Indiana area discharge into the Grand Calumet River and the Indiana Harbor Ship Canal. Municipal and industrial wastewater and industrial cooling and process water are monitored and regulated by National Pollutant Discharge Elimination System (NPDES) permits. However, storm water runoff, combined sewer overflows, spills, and other discharges from nonpoint sources are more difficult to quantify and control.

Stage I of the Remedial Action Plan identified water quality concerns in the river system from several toxic substances that are believed to emanate from numerous sources such as industrial and municipal point sources, nonpoint water sources, air deposition, and the resuspension of sediments. Stage I also identified water quality problems on the river system caused by CSOs from each of the three sanitary districts on the river system. The CSOs cause degradation of the water quality of the river system. IDEM contracted for a limited amount of wet weather, whole effluent toxicity testing of CSO outfalls on the river to determine the toxicity of these discharges during storm events. There was some concern with the results due to the unusually large rain events that occurred prior to the sampling phase of the toxicity tests. On the whole, the results of these tests were considered inconclusive. Further testing will be necessary to clearly establish the effect CSO discharges have on the river system.

C. Nonpoint Source Contributions

Nonpoint source water pollution in the Area of Concern is caused by runoff from urban, industrial and rural sources, and agricultural sources. Other forms of nonpoint source pollution affecting use impairments are sedimentation from the erosion of riparian and other unprotected areas; surface and ground water contamination from excessive use of pesticides and fertilizers; nutrient loadings from improper land application of sludge, wastewater, animal waste, and failing on-site sewage disposal systems. Wet and dry air deposition of atmospheric pollutants also cause nonpoint source pollution. The resuspension of sediments also contribute to diminishing water quality. For a thorough discussion of the effects of sediment resuspension, see the Sediment Cleanup and Restoration Alternatives Project, 1997, published by the U.S. Army Corps of Engineers.

D. Land Development, Erosion and Runoff

The Area of Concern is heavily industrialized. Current industries include three steel mills, two oil refinery/re-refineries, a chemical plant, and a boiler/industrial furnace (BIF). A potential source of pollution in the Area of Concern comes from the mismanagement of hazardous waste being generated, treated, stored and disposed. There are four active hazardous waste Treatment, Storage, and Disposal (TSD) facilities and seven TSD facilities undergoing the closure process. In addition, there are forty-eight operating hazardous waste Large Quantity Generators (LQG)

within the Area of Concern, and a total of four hundred and fifty-nine Small Quantity Generators within Lake County. (This represents the total number of small quantity generators in Lake County, including those sites that may be outside the Area of Concern).

One by-product of this highly industrialized area is waste. A number of sites became contaminated prior to the effective date of the Resource Conservation and Recovery Act (RCRA) program. There are four Superfund sites within the Area of Concern. One site proposed for the NPL, USS Lead, is currently undergoing RCRA corrective action. The Area of Concern also contains four active State Cleanup sites, and ten Corrective Action sites. In addition, the heavy industrialization of the area has resulted in widespread contamination of the soil by hazardous substances and petroleum through accidental spills and releases. IDEM currently maintains a spill database to track these spills.

Leaking underground storage tanks are also a point of concern. As of May 1996, there were one thousand eighty-two facilities in Lake County that have underground storage tanks. As of June 1996, approximately four hundred leaking underground storage tank (LUST) sites have been identified in Lake County. There are two hundred and thirty-six Low Priority LUST sites, one hundred and twenty-eight Medium Priority LUST sites, and thirty-two High Priority LUST sites. Of the four hundred LUST cases, fourteen have completed cleanups and ten are not officially recorded as cleanups but have been discontinued. This leaves three hundred and seventy-six active cases with forty-nine having progressed beyond the investigation phase in which corrective action plans have been submitted for their cleanup. The majority of staff resources are used in the remediation of high priority cases. IDEM has one full-time staff member working out of the Northwest Regional Office who is dedicated to the cleanup of the Lake County LUST sites.

E. Air Emission and Deposition

There are many sources of atmospheric deposition in this region including semi-integrated and fully integrated steel mills, companies supporting steel production, a petroleum refining and marketing operation, utilities, other manufacturing, and the mobile sources associated with dense population and the area's proximity to Chicago. Atmospheric deposition contributes to at least eleven of the fourteen identified impaired uses.

Based on ambient air monitoring data, Lake and Porter Counties have been designated as non-attainment for ozone (O₃) National Ambient Air Quality Standards (NAAQS). The northern portion of Lake county has been designated as nonattainment for particulate matter (PM₁₀) and sulfur dioxide (SO₂) NAAQS. As a result, a significant portion of IDEM activity is focused in these two counties. All efforts and programs that reduce emissions of air pollutants in the area will contribute to restoration of the beneficial uses that are now impaired. This section details specific measures to reduce air emissions in Lake and Porter Counties. Over time, reductions of

air pollutants will help restore the impaired beneficial uses.

The primary indicators of air quality are the NAAQS which U.S. EPA has established for six criteria pollutants: sulfur dioxide (SO₂), nitrogen dioxide (NO₂), ozone (O₃), lead (Pb), particulate matter ten microns in diameter (PM₁₀) or less, and carbon monoxide (CO). (Table 11). Primary NAAQS have been established to protect public health while secondary standards have been established to protect public welfare and property. Pollutant levels above the primary standards can result in adverse health effects, especially for those segments of the population that are particularly susceptible such as young children, the elderly, or those with respiratory illnesses.

Table 11. National Ambient Air Quality Standards (NAAQS)				
Pollutant	Primary (Health Related)		Secondary (Welfare Related)	
	Type of Average	Standard	Type of Average	Standard
CO	8-hour	9 ppm (10 mg/m ³)		Same as Primary
	1-hour	35 ppm (40 mg /m ³)		Same as Primary
Pb	Maximum Quarterly Average	1.5 ug/m ³		Same as Primary
NO ₂	Annual Arithmetic Mean	0.053 ppm (100 Ug/m ³)		Same as Primary
O ₃	Maximum Daily 1-hour Average	0.12 ppm		Same as Primary
PM ₁₀	Annual Arithmetic Mean	50 ug/m ³		Same as Primary
	24-hour	150 ug/m ³		Same as Primary
SO ₂	Annual Arithmetic Mean	80 ug/m ³ (0.03 ppm)	3- hour	1300 ug/m ³ (0.50 ppm)
	24-hour	365 ug/m ³ (0.14 ppm)		Same as Primary

Attainment of the NAAQS is determined using ambient air monitoring data. Modeling is used in the development of a State Implementation Plan (SIP) to show that attainment is likely to be achieved with measures included in the SIP. IDEM operates a network of ambient air quality monitors for all criteria pollutants and many toxic compounds. In some cases, industries also operate ambient air quality monitors. The data from this monitoring network provides an indication of air quality trends.

Typically, air quality monitoring in Indiana has focused on monitoring ambient levels of the criteria pollutants to determine compliance with NAAQS. However, IDEM has also monitored ambient air concentrations of certain toxics and heavy metals at the Hammond monitoring site since 1988. Currently, no state or federal rules establish acceptable ambient air

concentrations of toxic pollutants or heavy metals (the one exception is lead, for which a NAAQS has been established). The Hammond toxics monitoring site was originally established as part of an urban air monitoring program, funded by U.S. EPA, and maintained by IDEM since completion of the program in the late 1980s. Data collected at the site are reported to the U.S. EPA's Aerometric Information Retrieval System (AIRs) data repository and provides historical information on ambient air concentrations of toxic pollutants and metals. Since the site was originally established, the number of organic compounds analyzed has increased from eighteen to eighty-two.

U.S. EPA mandated that states establish photochemical assessment monitoring, type-II sites (PAMS-II) in counties designated as severely nonattainment for ozone. The Office of Air Management (OAM) established a PAMS-II monitoring site at Gary ITRI. Throughout the ozone season, PAMS-II monitoring provides hourly determinations of ozone precursors and carbonyl compounds. Fifty-six organic compounds, including alkanes, alkenes, and some aromatic hydrocarbons are monitored.

IDEM also uses special purpose monitoring in areas that have no permanent monitoring sites. Special purpose monitoring provides data that can be used to assess ambient air quality impacts of specific sources, especially in cases where a violation is suspected, or to verify modeling studies.

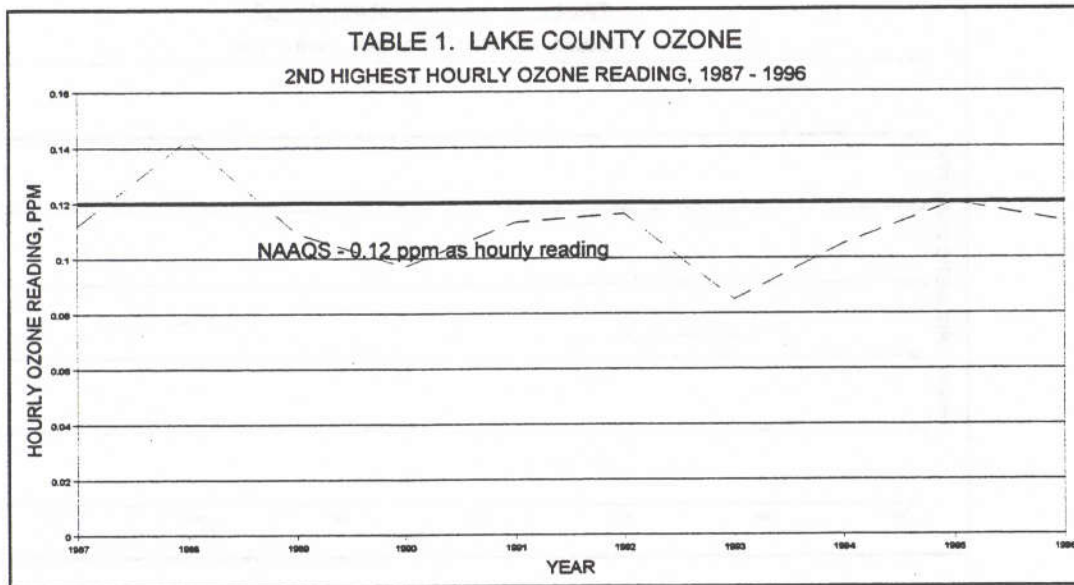
One category of regulated pollutants is criteria pollutants. Criteria pollutants are those pollutants for which NAAQS have been established, along with precursors. The criteria pollutants include ozone, particulate matter, sulfur dioxide, nitrogen dioxide (a subset of nitrogen oxides), carbon monoxide, and lead. These criteria pollutants contribute to the atmospheric deposition in this region.

1. *Ozone*

Ozone is not directly emitted into the atmosphere, but rather is formed when volatile organic compounds (VOCs) react with nitrogen oxides and carbon monoxide in the presence of sunlight. Ground level ozone is often referred to as photochemical smog. VOC, NO_x, and CO along with high temperature, direct sunlight, and low wind speed play a key role in the formation of ozone. Ozone is normally of concern during the hot summer months which are typically referred to as the ozone season.

Lake County and the Chicago Metropolitan area share ozone problems due to heavy motor vehicle traffic, large population, industrial base, and the unique meteorological conditions caused by Lake Michigan. Lake County is included within the Chicago-Northwest Indiana severe nonattainment area for ozone. The Clean Air Act requires states to develop a State Implementation Plan containing comprehensive measures to eliminate the health threat from

ozone in severe nonattainment areas by 2007. Additional information on ozone reduction measures being employed in the Area of Concern is included in Chapter Five. Table 1 on the following page provides a graph of the second highest hourly ozone reading at each ozone monitoring site located in Lake County for each year between 1987 and 1996.

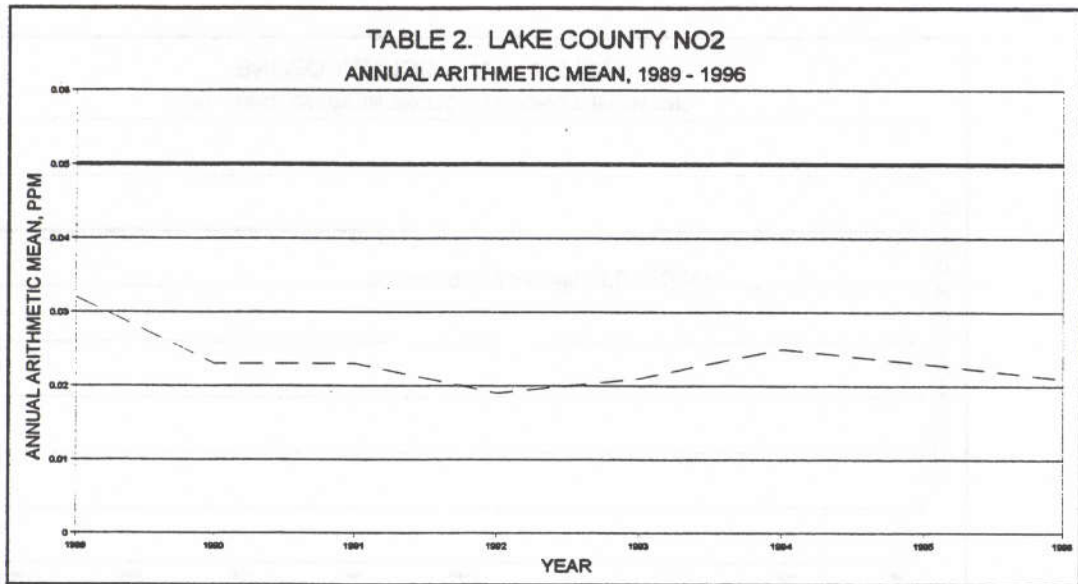


There was one exceedence of the ozone standard (0.12 ppm) within the Area of Concern during the summer of 1996: 0.131 ppm at the Hammond CAAP. On July 18, 1997, the U.S. EPA promulgated revisions to the NAAQS for ozone based on findings that exposures to concentrations lower than that established by the one-hour standard for longer periods of time (six to eight hours) were linked to adverse health effects. U.S. EPA established a standard of 0.08 ppm averaged over an eight hour time period. The Clean Air Act requirements for areas that are nonattainment of the one hour standard (0.12 ppm) remain in place. Development and implementation of measures to attain the one hour standard will further progress in meeting the new standard. U.S. EPA is currently developing implementation guidance for the new standard.

2. Nitrogen Oxides

Nitrogen oxides (NO_x) are formed from high temperature fossil fuel combustion. Primary sources include utility and industrial boilers, and motor vehicles. Nitric oxide is the principal pollutant emitted, but a substantial portion is converted to nitrogen dioxide (NO₂) in a chemical reaction promoted by sunlight. The NAAQS is established for NO₂ because of its direct health

effects, however, NO_x plays a significant role in acid rain and ozone formation. Depending on the specific circumstances, NO_x can either promote or inhibit ozone formation. See Table 2 below.



Acid rain provisions in the CAA require nitrogen oxides reductions from large utility boilers. Title IV of the CAA includes provisions which establish strict emissions standards on source emitting nitrogen oxide in order to reduce acid rain. The control of nitrogen oxides from stationary sources is complicated and difficult. In addition to these requirements, new, utility and industrial boilers are required to meet NO_x emission requirements in the New Source Performance Standards (NSPS) based on the date of construction.

The Clean Air Act Amendments also require states to adopt rules that will reduce NO_x emissions, similar to the VOC measures, in ozone nonattainment areas. However, because of the particular chemistry of ozone formation, NO_x reduction, in some cases, can actually increase ozone levels in the immediate area. The CAAA permits states to request a waiver of the NO_x

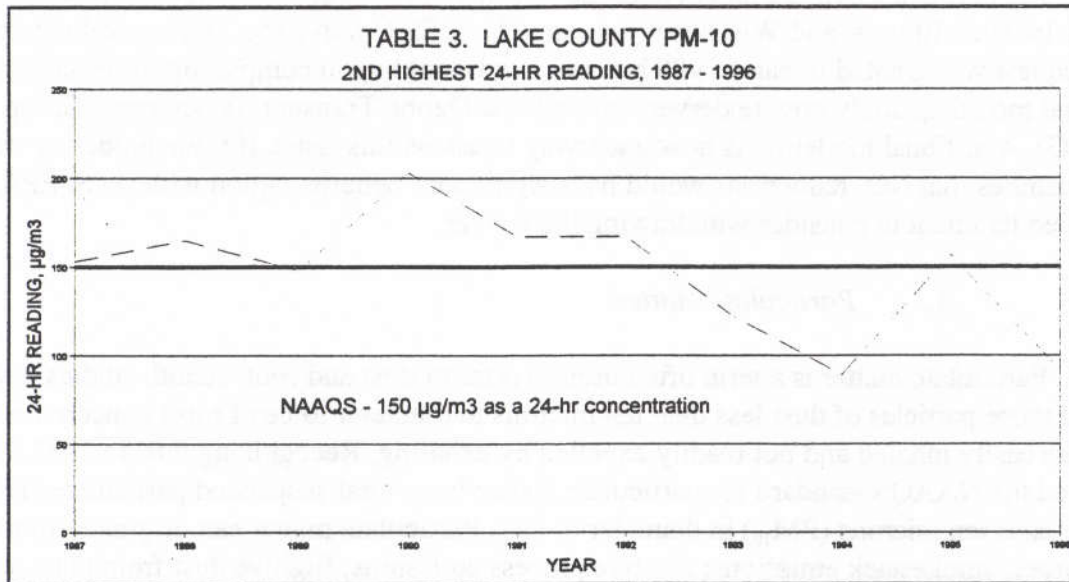
requirements if air quality modeling demonstrates that this would be the result pursuant to Title I. The modeling performed by the Lake Michigan Air Directors' Consortium (LADCO) for the Chicago-NW Indiana nonattainment area showed that NO_x reductions would increase peak ozone levels. Indiana, Illinois, and Wisconsin requested U.S. EPA waive the NO_x control requirements. The request was granted in early 1996 but was conditional upon completion of the larger scale regional modeling study now underway through the Ozone Transport Assessment Group (OTAG). Additional modeling is now underway to assess this issue. If these modeling studies demonstrates that NO_x reductions would have significant benefits region wide, U.S. EPA has indicated its intent to consider withdrawing the waiver.

3. *Particulate Matter*

Particulate matter is a term often used to refer to dust and soot. Health studies have shown those particles of dust less than ten microns in diameter to be of most concern because they are easily inhaled and not readily expelled by exhaling. Recognizing this, in 1987, U.S. EPA changed the NAAQS standard for particulate matter from total suspended particulate (TSP) to particulates ten microns (PM₁₀) in diameter or less. Particulate matter can originate from a variety of sources: smokestack emissions; fugitive process emissions; fugitive dust from plant sites; public roadways; and mobile sources.

Particulate emissions have historically been a significant concern in Lake County. In the 1970s and 1980s, ambient levels of TSP exceeded health standards frequently and by significant margins. In 1993, IDEM completed a rulemaking that established new emission limitations for sources in Lake County to meet the NAAQS for PM₁₀. These rules are part of Indiana's PM₁₀ State Implementation Plan (SIP). The PM₁₀ SIP also requires the collection and continual update of source emissions data and ambient air monitoring data. IDEM analyzes data on an ongoing basis to identify issues of concern, and then develops rules and policies to maintain the PM₁₀ NAAQS.

The PM₁₀ SIP also includes a control strategy that focuses on Lake County which has the most serious particulate pollution in the state. This strategy includes process specific emission limitations for major stationary sources which have resulted in significant emission reductions (e.g., shutdown of the Inland Steel coke batteries), fugitive dust control plans, and other measures meant to ensure continuous compliance and improved enforceability. The U.S. EPA's recent approval of the PM₁₀ SIP makes it federally enforceable. The PM₁₀ levels in Lake County have dropped significantly due to new particulate rules and efforts of Lake County industry. Table 3 provides a graph of the second highest PM₁₀ readings at each PM₁₀ monitoring site located in Lake County for each year between 1987 and 1996.



On July 18, 1997, U.S. EPA promulgated revisions to the NAAQS for particulate matter based on findings of studies linking exposures to ambient fine particulate matter to adverse health effects. U.S. EPA established a 24-hour and annual standard for particulate matter 2.5 microns in diameter or less. Because limited information is available on sources and ambient concentrations of PM_{2.5}, monitoring and planning will be required before control measures to address these standards would be required. IDEM is establishing monitoring sites for PM_{2.5}.

4. *Sulfur Dioxide*

As part of this State Implementation Plan, IDEM has developed process specific emission limitations for major stationary sources located in Lake County. These rules include fuel use restrictions, require the use of lower sulfur fuels; and set emission limits for steel mills, refineries, and other facilities in Lake County. Title IV of the CAA includes provisions which establish strict emissions standards on sources emitting sulfur dioxide in order to reduce acid rain. By January 1, 1995, during the first phase of the program, the one hundred and ten largest sulfur-emitting electric utility plants were required to meet more strict standards for annual sulfur dioxide emissions. Continuous emission monitoring (CEMS) is required on all Phase I and Phase II boilers to demonstrate continual compliance. Phase II of the program will require, by January 1, 2000, sulfur dioxide reductions on Phase I boilers and initial reductions on Phase II boilers. In Lake County, two major stationary boilers are subject to Phase II requirements. While still classified as a nonattainment area, IDEM has not monitored an exceedence of the sulfur dioxide

(SO₂) NAAQS in Lake County since 1985.

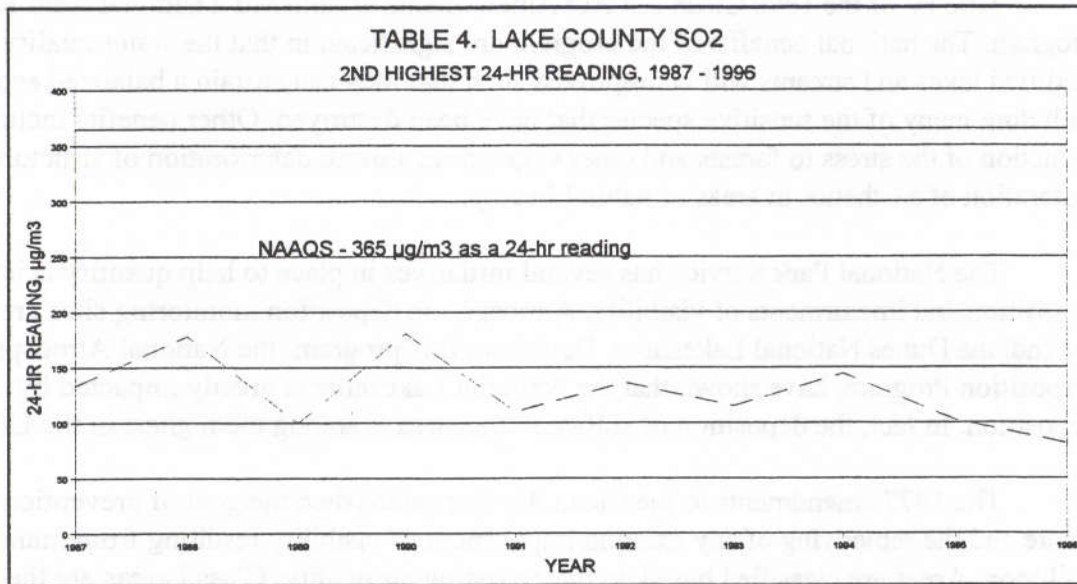


Table 4 (above) provides a graph of the second highest 24-hour SO₂ monitoring site located in Lake County for each year between 1987 and 1996.

Acid deposition, or acid rain as it is commonly known, results when emissions of SO₂ and NO_x react in the atmosphere with water, oxygen, and oxidants to form various acidic compounds. These compounds can be deposited in either dry form (gas and particulate) or wet form (rain, snow, and fog). Winds can transport these compounds long distances before they are deposited. Electric utilities and other fossil fuel combustion sources account for about seventy percent of the annual SO₂ and thirty percent of the NO_x emissions in the United States. Mobile sources are also a significant contributor of NO_x emissions.

Acid rain causes acidification of lakes and streams, and accelerates the decay of structures such as buildings and bridges, and damages paint on automobiles and houses resulting in increased maintenance costs. Additionally, SO₂ and NO_x and their particulate forms, sulfates and nitrates, contribute to visibility degradation and impact public health. Many bodies of water in the upper Midwest, including those within the Area of Concern, have been affected by acidification. Acidification results in a lowering of the pH level in the water which affects many sensitive species. While acidification is often considered a chronic problem, there can be periods of episodic acidification which are brief periods of low pH levels that result from snow melt or heavy rains. Episodic acidification may result in acute impacts on sensitive species which causes

large scale fish kills.

Title IV of the 1990 Clean Air Act Amendments established a national Acid Rain Program. The national benefits of the program are significant in that the water quality in many acidified lakes and streams will be improved such that they can sustain a balanced ecosystem including many of the sensitive species that have been destroyed. Other benefits include a reduction of the stress to forests and other vegetation, slowed deterioration of structures, and the restoration of aesthetics in areas of natural beauty.

The National Park Service has several initiatives in place to help quantify acidic deposition and impairments of visibility. Atmospheric deposition monitoring sites are located in the Indiana Dunes National Lakeshore. Data from this program, the National Atmospheric Deposition Program, have shown that the National Lakeshore is greatly impacted by acidic deposition. In fact, the deposition of sulfate in this area is among the highest in the United States.

The 1977 amendments to the Clean Air Act established the goal of prevention of any future and the remedying of any existing impairment of visibility resulting from manmade air pollution. Areas are classified based on their existing air quality: Class I areas are the most pristine with practically any change in air quality is considered significant; Class II areas have some industry and are expected to experience some deterioration in air quality that is normal with growth; and Class III areas are heavily industrialized with deterioration up to air quality standards not considered significant.

Class I areas typically include areas such as the national parks in the western United States like the Grand Canyon. The National Park Service has instituted several visibility monitoring programs and management activities to protect visibility. Surveys of visitors to national parks indicate a high value is placed on improving visibility and restoring the natural aesthetics of these vistas.

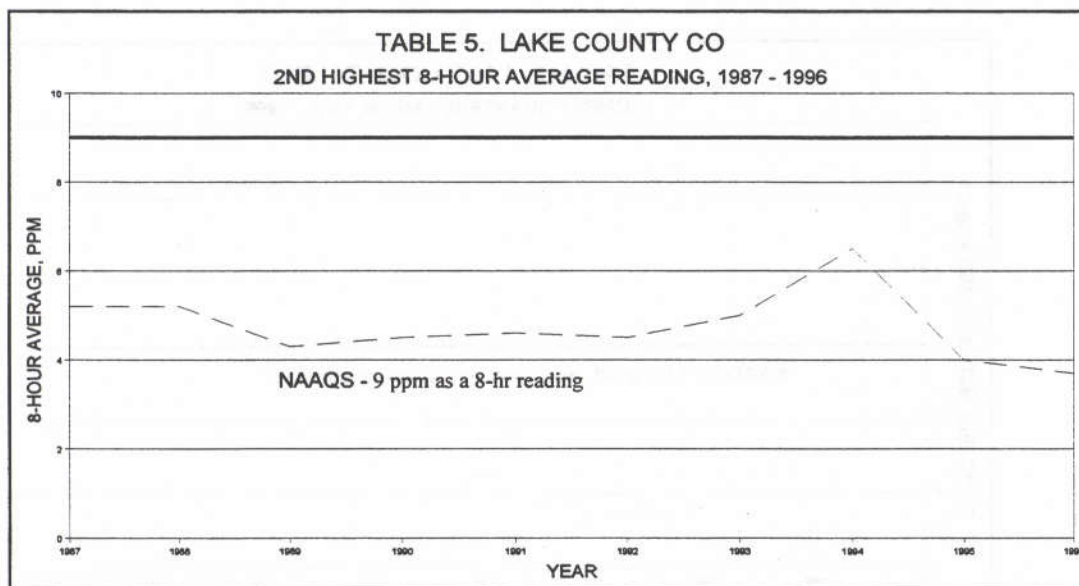
Indiana Dunes National Lakeshore is exempt from the Class I visibility protection requirements because it is located in a Class II area. It is subject to the same air quality requirements as the surrounding area. There are no federal visibility standards for Lake or Porter Counties.

5. *Carbon Monoxide*

Carbon monoxide (CO) is produced by the incomplete combustion of carbon fuels. It is emitted by incomplete combustion of fossil fuel including motor vehicles use and industrial processes. While CO plays a minor role in ozone formation, emissions of CO are more directly

related to ambient concentrations of CO in the atmosphere. Because carbon monoxide represents a loss of fuel, there are economic incentives for stationary sources to reduce emissions. In some industrial processes, such as those used in iron and steel plants and petroleum refineries, carbon monoxide is collected and used in waste-heat recovery systems. IDEM has set process specific emission limits for petroleum refineries, ferrous metal smelters, and municipal waste incinerators. Control of CO from motor vehicles is more complicated because the CO reductions must be balanced with often conflicting considerations such as fuel economy, engine performance and reduction of other pollutants. The Inspection/Maintenance Program requires vehicles to be tested for CO in addition to hydrocarbons. Often a tune-up will help reduce vehicle emissions.

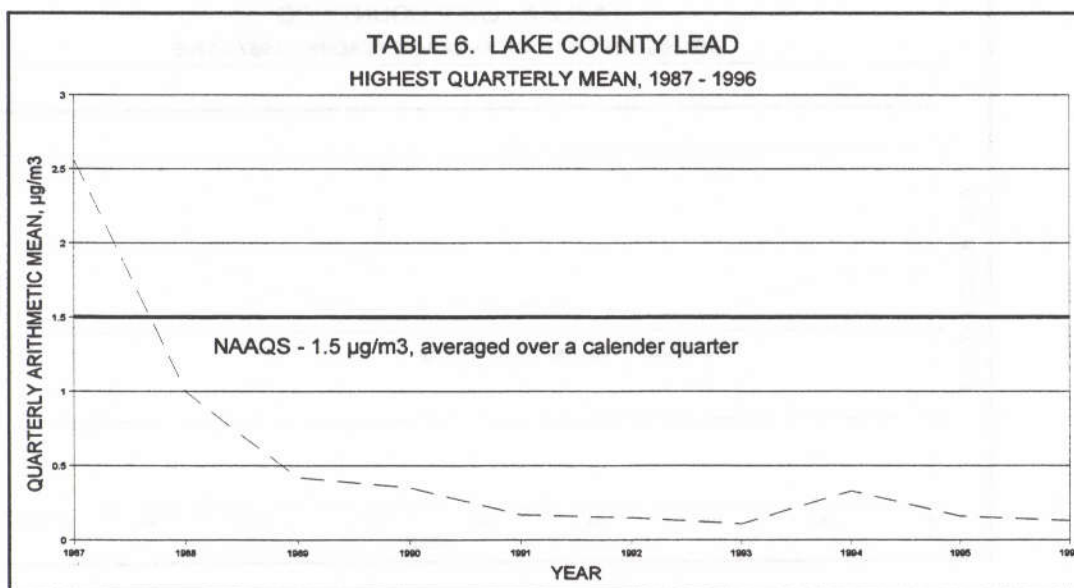
IDEM has not monitored an exceedence of the CO NAAQS in Lake County in over ten years. Table 5 provides a graph of the second highest CO readings at each CO monitoring site located in Lake County for each year between 1987 and 1996.



6. Lead

Lead is the only heavy metal for which an NAAQS has been established. The primary health concern of lead is the systemic effects it may have on the central nervous system. Often associated with learning problems in children, environmental exposure can also affect elderly and pregnant adults in Lake County.

The federal phase out of lead in gasoline also helped to significantly reduce emissions of lead. Several process changes at major industrial sources in Lake County have led to a reduction of lead concentrations in the atmosphere measured within the Area of Concern. IDEM has established process specific emission limitations for the three major industrial sources of lead located within the area concern: Hammond Lead Products-HLP Plant, Hammond Lead Products - Halstab Division, and U.S.S. Lead Refinery. In addition to the process specific emission limitations, the sources were also required to upgrade their ventilation and filtration systems and operate their buildings under negative pressure to reduce fugitive emissions. Additional measures are required to control fugitive emissions from storage piles. The Hammond Lead plants have also put into place operational controls and work practices beyond those required in the rules to further reduce lead emissions. Since the rules were adopted, U.S.S. Lead Refinery in East Chicago has shut down resulting in a decrease in ambient air levels of lead. IDEM has not monitored an exceedence of the Pb NAAQS since 1986. Table 6 provides a graph of the second highest Pb readings at a lead monitoring site located in Lake County for each year between 1987 and 1996.



7. *Open Burning*

Smoke from open burning is not only an irritant but contains harmful particulate and volatile organic pollutants. Due to high regional ozone levels, residential open burning is not allowed in Lake or Porter County. There are instances, however, when burning may balance

environmental benefits without adverse impacts on air quality. One such instance is the burning of vegetation for wildlife habitat maintenance, forest and natural area management, and fire fighting or prevention. Prescribed fires can benefit Indiana's woodlands and reduce the threat of wildfire.

Federally-managed woodlands, such as the Indiana Dunes National Lakeshore, commonly use prescribed fires to manage wildlife habitats. Special consideration and planning are necessary to ensure the prescribed fires have minimal affect on public health and welfare. Under Indiana's rules, only government agencies are allowed exemptions to use prescribed fires. They are required to prepare formal plans before burning takes place. IDEM may grant a variance for other types of burning provided certain criteria are met.

III. Fragmentation and Loss of Physical Habitat

Fragmentation and loss of physical habitat are directly related to degraded fish and wildlife population, degradation of benthos, degradation of phytoplankton and zooplankton populations and loss of fish and wildlife habitat. They are contributing factors to fish tumors and other deformities, bird or animal deformities and/or reproductive problems. While protecting sensitive habitat areas, such as Roxanna Marsh and DuPont, will not necessarily restrict dredging activities, it will make removing contaminated sediments more complicated.

At one time, the Indiana portion of the strandplain covered over 30,000 acres. Only 2,000 acres of ridge and swale still exist in the state. Aerial photographs taken over the last 60 years document the physical transformation of the region from a natural system to an urban industrial complex. The first complete set of aerial photographs of the Calumet region date back to 1938. Undisturbed sections of ridge and swale topography are easily recognized by their distinctive linear pattern. The photographs show that the strandplain had already been divided into three distinct units and that shoreline alterations that would eventually isolate the strandplain from Lake Michigan had already begun. The city of Gary separated the Miller Woods area in the east from the central ridge and swale section. The central ridge and swale section was divided from the Wolf Lake/George Lake area by the cities of Hammond, East Chicago and Whiting. Although these areas were isolated, there were still fairly large blocks of natural terrain in the Miller Woods and central ridge and swale areas. See Figure 1, Map of Tolleston beach ridges and dunes in Northwest Indiana.

Half of the approximately 2000 acres of the remaining natural landscape are found in the Miller Woods area. They are fairly contiguous and include the Miller Woods unit of the Indiana Dunes National Lakeshore, the City of Gary's Marquette Park and private property. Over 430 species of native plants have been documented in the Miller Woods unit of which at least 70 are

considered rare or are limited to a unique niche within the Indiana Dunes National Lakeshore (Wilhelm 1990). The dune complex north of the lagoons supports panne and foredune communities. The ridge and swale complex to the south of the lagoons support some of the highest quality black oak savanna in the Chicago Region (Wilhelm 1990)

The other remaining 1000 acres of natural landscape are scattered throughout the central ridge and swale area. The natural area fragments occur as isolated pockets ranging in size from five to 170 acres. The construction and expansion of the Gary airport isolated the lakeside remnants near Clarke & Pine from those in west Gary, Hammond and East Chicago. Industrial expansion, residential development and landfills contributed to the overall loss of habitat. Despite fragmentation these remnants still support dense assemblages of native plants and animals, including 66 state rare and endangered species.

Clarke and Pine Nature Preserve, Gibson Woods Nature Preserve, Ivanhoe Dune and Swale Nature Preserve and Toleston Ridges Nature Preserve are examples of these islands of biodiversity set in the midst of the urban industrial landscape. These sites support a mosaic of interconnected natural communities that defy mapping. Seven of the community types are globally rare; panne, wet mesic sand prairie, mesic prairie, dry mesic sand prairie, dry mesic sand savanna, dry sand savanna and sedge meadow (TNC). Clarke and Pine Nature Preserve's forty acres support the highest concentration of rare and endangered species in the state of Indiana.

The Wolf Lake/George Lake area has suffered the greatest loss of habitat. Of the five shallow lakes that occupied the northwest section of the strandplain, Berry Lake, George Lake and a portion of Wolf Lake were in Indiana. Berry Lake was filled and converted to industrial property in the early part of this century. The practice of draining and filling the lakes and marshes and converting them to industrial use reduced George Lake to 200 acres, less than half of its original size. A large portion of the southern end of Wolf Lake was also filled. Only a handful of small fragments, less than ten acres apiece, remain of the marshes that surrounded these lakes.

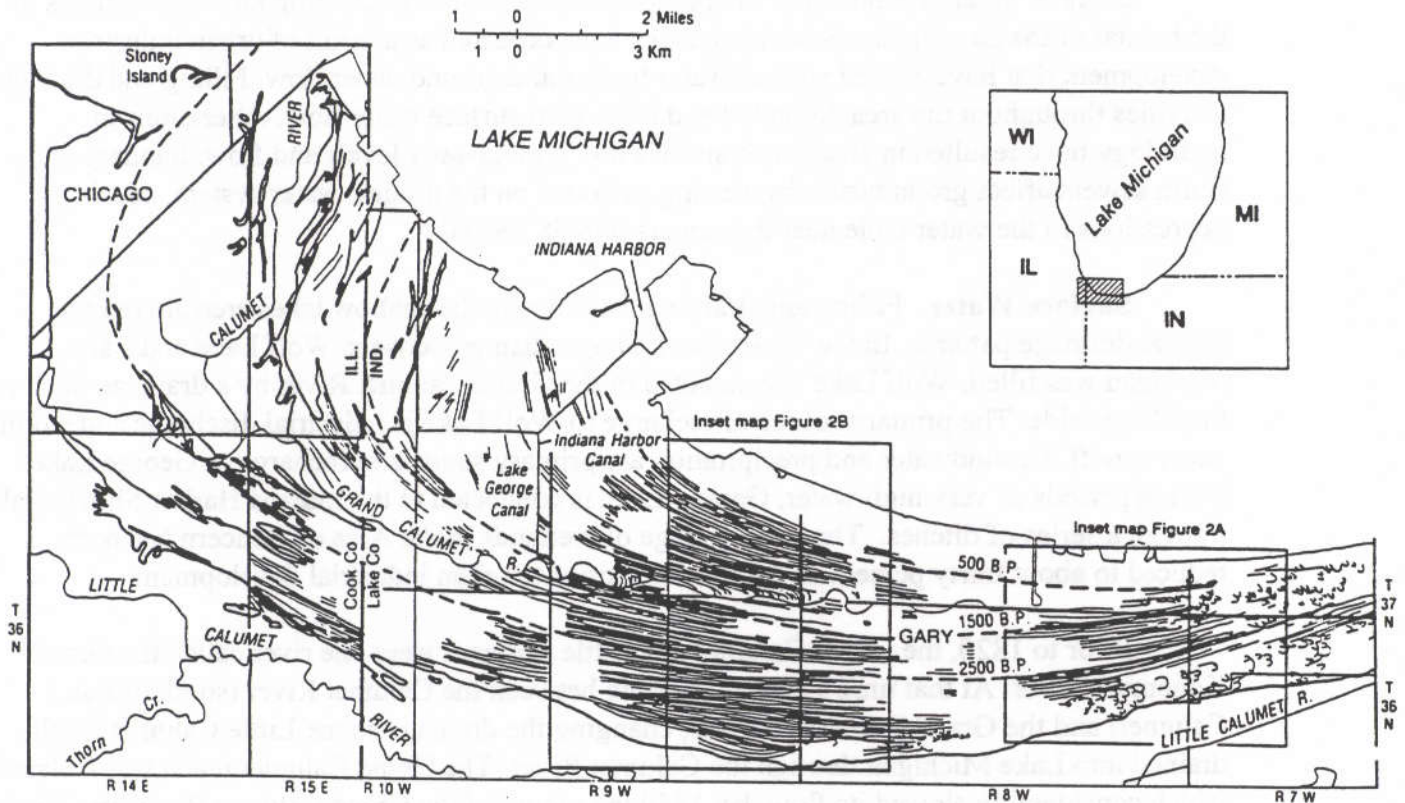


Figure 2. Map of Toleston (Nipissing age) beach ridges and dunes in northwest Indiana. The apex of individual beach and dune ridges were traced from 1938 air photos. By 1938, large tracks of land had been filled, mined or otherwise modified. Thus, many beach ridges and some dunes appear to be segregated or missing (white areas within the Toleston strandplain and dunes) from this map (from Thompson, 1992).

IV. Altered Hydrology

Altered hydrology directly contributes to degraded fish and wildlife populations, degradation of benthos, eutrophication or undesirable algae, degradation of phytoplankton and zooplankton populations, and loss of fish and wildlife habitat.

Surface water/ground water interactions are crucial to maintaining moisture regimes in the habitat of the strandplain. Several changes have occurred as a result of urban industrial development that have altered surface water bodies and ground water flow. Filling and drainage activities throughout the area disrupted and redirected surface water flow. Alterations in hydrology have resulted in changes to surface and groundwater levels and flow. Sanitary and storm sewers affect groundwater by serving as drains on the ground-water system, causing depressions in the water table near the sewers (USGS 1993).

Surface Water. Filling and draining activities in the shallow lakes area altered the natural drainage patterns. In the 1940s the drainage channel between Wolf Lake and Lake Michigan was filled. Wolf Lake is connected to the Grand Calumet River by a drainage ditch on the Illinois side. The primary source of recharge to Wolf Lake is industrial discharge and storm water runoff. Groundwater and precipitation are primary sources of recharge to George Lake. During periods of very high water, George Lake is connected to the Indiana Harbor Ship Canal through a series of ditches. The total acreage of wetlands in the Area of Concern has been reduced to about thirty percent of what existed prior to urban industrial development.

Prior to 1820, the Grand Calumet and Little Calumet were one river called the Grand Konomick River. At that time a channel opened between the Calumet River (south of Lake Calumet) and the Grand Konomick River, changing the drainage so the Little Calumet reach drained into Lake Michigan through the Calumet River. The Grand Calumet reach was isolated which considerably slowed its flow. By 1850 the mouth of the Grand Calumet River was blocked by beach and dune deposits and the river channel was choked with aquatic vegetation.

In the late 1800's the Corps of Engineers removed 37,743 cubic yards of material from the Grand Calumet River near Hammond to facilitate navigation for the Hammond packing plant. Dredging of this portion of the river was abandoned in 1895 because the channel filled with industrial waste and sewage faster than it could be removed by dredging. Construction of the Indiana Harbor Ship Canal began in 1903. The reach south of Columbus Drive was excavated by private interests between 1908 and 1912 to a depth of 15 feet.

Portions of the Grand Calumet Channel have been relocated during construction and expansion of the U.S. Steel plant and the I-90 toll road. A two-mile reach of the river was moved

1000 feet southward between 1906 and 1917. The lagoons were formerly connected to the river via open channel; however, the channel was filled and replaced with a culvert sometime after 1951. Between 1953 and 1959, two reaches of the river between Clark and Grant Streets in Gary were relocated for construction of the I-90 toll road.

In addition to relocation of the river channel, several sections of the river have been dredged either to facilitate commercial navigation or to enhance the discharge capacity of the river. U.S. Steel periodically dredged the river along its property through 1967. The dredged sediment, mostly untreated industrial and municipal waste, was side cast along the channel or placed in an area between Bridge Street and Taft Street north of the river. The western portion of the East Branch, between Bridge Street and the Indiana Harbor Ship Canal, may never have been dredged.

These developments changed the direction of the river flow. The former mouth of the river, the Grand Calumet Lagoons, is now the headwaters. The East Branch of the Grand Calumet River flows west from the lagoons to the junction with the Indiana Harbor Ship Canal, then north to Lake Michigan. Flow in the West Branch is more complex; it flows in two directions. Roxana Marsh lies near the flow divide. East of Roxana Marsh, the river flows east to the confluence with the Indiana Harbor Ship Canal, then north to Lake Michigan. West of Roxana Marsh, the river flows west into Illinois, forming a confluence with the Calumet River. Lake Michigan surface level is a significant factor in the flow direction and velocity of the Grand Calumet River, not only in the Indiana Harbor Ship Canal, but in the east and west branches as well.

Ground Water. The complex surface water/groundwater interactions are complicated by sheet piling that has been driven throughout the region. Sheet piling in the Gary Harbor and along reaches of the Grand Calumet River, Lake Calumet (in Illinois), the Indiana Harbor Ship Canal and Lake Michigan form a barrier to the flow of surface water and groundwater. Large gradients between surface and groundwater can be built up as a result (USGS 1996).

The study of shallow ground water in the Area of Concern has focused mainly on the transport of contaminants. The impacts of changes in groundwater flow on the natural systems is unknown. The pattern of ground water flow has been altered locally by surface structures and changes in run-off patterns. While the impacts of changes in groundwater flow on the remaining biotic communities has not been quantified, it is evident in the composition of biotic communities. Again, urban industrial development has had an impact on groundwater flow, recharge and discharge.

V. Shoreline Alterations

Shoreline alterations directly contribute to degraded fish and wildlife populations, degradation of benthos, degradation of phytoplankton and zooplankton populations, and loss of fish and wildlife habitat.

The state gave the first permits to fill into Lake Michigan in 1907. Since that time, most of the lakeshore has been altered by fill, armoring, breakwaters, and the creation of harbors, marinas and recreational parks. Shoreline alterations throughout the entire southern Lake Michigan area have severely disrupted the transport of sand along the shore and inhibited new beach and dune formation. Virtually all of the natural nearshore aquatic and terrestrial habitat has been severely degraded or eliminated from the Area of Concern. The Miller Woods Unit of the Indiana Dunes National Lakeshore is the only remnant natural area to border the lakeshore. Sites such as the "migrant bird trap" or the municipal and county parks offer specific limited habitat value.

VI. Exotic Species Introduction

Exotic species directly contribute to degraded fish and wildlife populations, eutrophication and undesirable algae, degradation of phytoplankton and zooplankton populations, and loss of fish and wildlife habitat. It is a contributing factor to degradation of benthos.

In the Chicago region there are approximately 2500 species of plants, of which, 900 have been introduced since European settlement. Of the 900 introduced species, 150 dominate 95 percent of the landscape. (Swink and Wilhelm 1994). In the Area of Concern there are a handful of exotic plants that are having a major impact on the biological structure of habitat. Plant species commonly associated with urban residential development dominate most of the vegetated landscape. Natural habitat has been replaced with manicured landscaping. A handful of exotic species, typha (cattails), purple loosestrife, phragmites, buckthorn and sweet clover, are having a major impact on the remaining natural habitat.

Typha migrated into the Great Lakes Region after European settlement and reached southern Lake Michigan around 1880. Typha is far more widespread locally than it was at the turn of the century, and is now common in marshes throughout the Calumet region (*Ibid*). Purple loosestrife, a Eurasian species, was introduced into the area as a cultivar and escaped to overtake many wetland areas. Each purple loosestrife plant produces as many as 250,000 seeds, that are dispersed through flowing water. Phragmites is opportunistic in disturbed areas and establishes large monocultures that quickly take over more diverse wetland communities. It primarily

reproduces by sending off long stolons, but can spread by seed. Common buckthorn is a Eurasian shrub that spreads by bird-dispersed seeds and invades native communities. It replaces native shrubs and is especially prevalent in areas that are fire-suppressed. While the other exotics discussed above are primarily wetland species, sweet clover, a biennial herbaceous plant, invades the upland sand prairies and savannas.

VII. Fire Suppression

The fires that were an integral part of the southern Lake Michigan lakeplain ecosystem became a threat to private property as permanent settlements developed in the region. As residential and industrial development expanded, the frequency and range of fires decreased. In some areas, this has caused the elimination of much of the herbaceous layer that served as fuel for the fires. In other cases, it caused fuel build-ups that made occasional wildfires more intense. Fragmentation has made it difficult for fire sensitive species to recolonize after fires have occurred.

The National Park Service, IDNR, Lake County Parks and Recreation, and The Nature Conservancy all use prescribed burns as a management tool for natural areas in the Area of Concern. Controlled burns are carried out under prescriptions that detail ecological objectives, appropriate weather conditions to control the fire and smoke, and emergency procedures. Records are kept of all fires including post-burn evaluations. Because of air quality concerns, open burning is not allowed in Lake County. Therefore, controlled burning for ecological purposes requires permits from the appropriate state and local agencies.

VIII. Conclusion

Significant stress in the Area of Concern has caused much of the degradation of the ecosystem, resulting in the loss of habitat, increased sedimentation and lack or excessive nutrient loadings. The stress can occur from either biological, physical, or chemical factors. The six leading contributors to the high level of stress are derived from human activity. Contamination seriously alters fish and wildlife populations, drinking water standards, aesthetics, deformities, agricultural and industrial work. Contamination contains a variety of factors which affect the environment. Contaminated sediment from municipal and industrial point discharge, combined sewer overflow, and urban runoff all contribute to the decreasing efficiency of the ecosystem. Also, non-point source pollution, land development, erosion, runoff, and air emissions limit the beneficial uses in the Area of Concern. Other major stressors include fragmentation and loss of physical habitat, altered hydrology, shoreline alterations and introduction of exotic species. All of these sources of stress impair fourteen beneficial uses degrade the environment.

CHAPTER FOUR PARTICIPATION IN THE REMEDIAL ACTION PLAN PROCESS

The public has numerous opportunities to participate in the Remedial Action Plan process and the activities necessary to achieve restoration of the impaired beneficial uses. Individuals may attend public meetings, comment on public documents such as the Environmental Performance Partnership Agreement, draft permits, and rulemakings. Many ongoing activities provide the public with opportunities to participate in decisions that will affect the restoration, protection, and uses of the river in the years to come. Thousands of area residents are committing their time and energy to restore the Grand Calumet River and the Area of Concern. The people of Northwest Indiana must be involved to a greater extent to ensure input in changes in progress or plans for the river and surrounding area. The public must be given every chance to express its opinion about those changes and to influence the decisions affecting it.

Success in addressing pollution and contamination issues serves as a catalyst to engage not-for-profit groups, the general public, industry, municipalities, academia, and regulatory agencies in ecosystem restoration. IDEM recognizes that multi-stakeholder involvement is critical to attaining the goals of the Remedial Action Plan. The history of involvement by multiple stakeholders is an important link from the beginning of the Remedial Action Plan process to current actions supporting the Remedial Action Plan, and also in future actions necessary to restore the impaired beneficial uses.

I. The Remedial Action Plan and its Origins

By the 1950's, the Grand Calumet River had become severely degraded due to decades of industrial and municipal discharges. Citizens, environmental groups, and government agencies concerned with the impact of the river on the health of the community and on the health of Lake Michigan began seeking ways to bring attention to the problems and potential of the river. The first major effort to clean up the pollution in the area was the Calumet Enforcement Conference, mandated by the Federal Water Pollution Control Act of 1965. The law called for enforcement conferences for major water bodies to help achieve water quality standards. In addition to a Lake Michigan Enforcement Conference, a special Calumet conference was created because most of the lake's pollution came from the concentration of industry at its southern tip.

In 1981, the Lake Michigan Federation organized local residents and formed the Grand Calumet Task Force and obtained funding to work with residents to develop a master plan for restoring the Grand Calumet River. These actions first drew the support of the U.S. EPA. Subsequently, these two undertakings provided the International Joint Commission with the idea of requesting Remedial Action Plans for places where the objectives of the Great Lakes Water Quality Agreement between the United States and Canada were not being achieved. These areas

Chapter Four "Participation in the Remedial Action Plan Process"

were eventually designated as Areas of Concern.

The International Joint Commission recognized that restoring each Area of Concern would require the involvement of local residents, industries, and regulatory bodies. In 1987, the International Joint Commission amended the Agreement to require Remedial Action Plans in all 43 Areas of Concern in the Great Lakes Basin. It also set specific requirements for Remedial Action Plans. A primary goal of these requirements is public support and input in development and implementation of Remedial Action Plans.

II. Current Activities Supporting the Remedial Action Plan

Widespread participation and support is critical to the success of this Remedial Action Plan. Public participation has two components: multi-stakeholder involvement and community involvement. Multi-stakeholder involvement will help identify which issues stakeholders find most critical. Community participation occurs primarily in two settings: multi-stakeholder discussions and public meetings. Multi-stakeholder discussions are usually formal groups with representatives from different interest groups or stakeholders (i.e., business, government, environmental groups, neighborhood and civic organizations, members of the general public) who meet on a regular basis to discuss specific topics. The CARE Committee is a multi-stakeholder group that meets monthly to discuss the Remedial Action Plan. Other multi-stakeholder groups involved in issues that may affect the Remedial Action Plan include the Grand Calumet Area Partnership, the Northwest Indiana Brownfield Redevelopment Project, the Sustainable Development Task Force of the Northwest Indiana Regional Planning Commission and the Grand Calumet River Corridor Planning Project.

A. Natural Resource Protection Efforts

The long history of local efforts to preserve the native landscape and conserve natural resources in the southern Lake Michigan region is well documented in J. Ronald Engel's book "Sacred Sands." Attempts at designing a comprehensive conservation plan for the area date back to 1912. The first publicly owned land in the dune region was Lake Front Park in Gary, now known as Marquette Park. The land was donated by U.S. Steel Corporation to the City of Gary to preserve a section of the lakeshore for public use (Engels 83). However, until recently, systematic conservation and preservation have not been integrated into land use patterns in the Area of Concern.

In 1976 most of the Miller Woods Unit of the Indiana Dunes National Lakeshore was included in the authorized boundaries of the Indiana Dunes National Park. At about the same time, the first attempt to develop a Coastal Zone Management Plan for Indiana produced a list of high quality natural areas in Lake County. The Coastal Zone Management study, which developed a growing awareness of the value of Northwest Indiana's biological heritage, led to

Chapter Four "Participation in the Remedial Action Plan Process"

the purchase and dedication of a handful of these sites as nature preserves. Prior to that time, these tracts were areas that had escaped urban industrial development only by chance. The protection of Gibson Woods, Toleston Ridges, Clark & Pine, and Ivanhoe Dune and Swale was accomplished through the work of local citizens, The Nature Conservancy, IDNR Division of Nature Preserves and Lake County Parks and Recreation Department. The inclusion of Miller Woods into the National Lakeshore and the dedication of these nature preserves was the first successful effort at systematic conservation of natural resources in the Area of Concern.

Clark and Pine East is a 253 acre tract the state acquired in the negotiated amendment to the MIDCO Superfund consent decree. Despite questions of contamination, state and federal agencies were able to develop an agreement that protected this critical habitat. The preservation of this site is a model for the kind of creativity and cooperation among government agencies necessary for natural resource protection in the Area of Concern.

The Shirley Hienze Environmental Fund (SHEF) is a local land trust dedicated to preserving natural areas in the dunes region. As of 1997, SHEF purchased several lots in the area south of Ivanhoe Dune and Swale Nature Preserve that includes approximately 70 acres of remnant ridge and swale. SHEF also purchased approximately 40 acres of remnant ridge and swale adjacent to the Grand Calumet River in Hammond.

Stewardship of private lands is a crucial issue facing preservation of biological diversity in the Area of Concern. Less than half of the native landscape that remains in the central ridge and swale area is formally preserved and managed for habitat value. The Nature Conservancy is working with DuPont to develop and implement a management plan for the 170 acres of remnant ridge and swale that are a part of their corporate land holdings in East Chicago. Northern Indiana Public Service Company is working with The Nature Conservancy, IDNR, the Indiana Dunes National Lakeshore and U.S. Fish and Wildlife Service to manage selected properties as productive habitat.

The Save the Dunes Council of Northwest Indiana, one of the oldest grassroots conservation organizations in the country, was founded in 1952. The objectives of the Save the Dunes Council Inc. are to maintain and restore the integrity and quality of the natural environment of the Indiana Dunes country. The prime concern of the Council is the vitality and use of the Indiana Dunes National Lakeshore, and adjacent or nearby ecosystems of similar natural worth, located near the Indiana shore of Lake Michigan. The hard work of Save the Dunes Council members led to the establishment of the Indiana Dunes National Lakeshore in 1966. The group continues to work on a wide variety of issues concerning the Dunes and the environmental quality of the area. The efforts of the Save the Dunes Council are supported entirely by membership dues, donations and volunteer time.

Chapter Four "Participation in the Remedial Action Plan Process"

B. Business and Industry Participation

Northwest Indiana's leading companies are committed to environmental stewardship and proactive environmental performance and make significant investments in environmental programs and pollution control. Business and industry leaders recognize that environmental stewardship can be a strategic advantage. During the last decade, corporate commitment to the environment has expanded from compliance-focused programs to integrated systems that manage costs, reduce risk and produce superior environmental results. Corporate mission statements include commitments to environmental protection. These mission statements also elevate environmental responsibility to a high priority. Environmental management is a critical factor in maintaining responsible and constructive corporate development. A number of companies have established citizens advisory committees to provide feedback on environmental issues and programs.

Business and industry are pursuing innovative solutions beyond mandated programs through corporate teamwork and community, governmental, and business partnerships. Voluntary and innovative programs allow companies to creatively address environmental concerns outside the realm of mandated programs. Partnerships with government agencies, businesses, and environmental organizations extend the scope of individual corporate environmental commitment.

C. Public Meetings

Special public meetings are often held to discuss issues of concern to particular communities. For example, IDEM and the U.S. EPA often hold public meetings on proposed permits. Meetings may also be sponsored by several different stakeholder groups, such as the U.S. Steel and the Grand Calumet Task Force sponsored meetings in conjunction with the environmental agencies to inform the public about proposed plans to dredge the river and ship canal. There are also many smaller organizational meetings that occur regularly throughout the region: school and church groups, neighborhood and block clubs, business and trade groups, fraternal societies, the Dunes-Calumet Audubon Society and the Friends of Gibson Woods.

D. Participation Within Agency Processes

IDEM and other regulatory agencies continue to encourage the public to identify potential problems and to call them to the attention of local, state or federal officials. The toll free IDEM telephone number is 1(800)451-6027. IDEM also encourages public participation throughout many of its decision making processes. Opportunities for public participation are built into IDEM programs. For example, permits proposed by IDEM are public noticed for comments. The public notice is published in the newspaper with the largest circulation in the area. Notice is also mailed to a list of people who request information on particular types of permits issued. During

this public notice period, all interested parties may comment on the legal and technical validity of the permit and its conditions and requirements. When IDEM issues a final permit, the public may appeal the issuance.

Additionally, all rule promulgation is published in the Indiana Register and voted upon by air, water, or waste citizen boards in open public hearings. During a rule promulgation, the public has the opportunity to submit comments to a point of contact within the Agency, and also may participate in the Board Hearings. IDEM must respond in the Indiana Register to comments made during the official comment periods and during the public hearings. For more significant rulemakings, IDEM forms advisory groups to receive input from all interested parties throughout the rulemaking process, both before and after the rule has been drafted.

A wide range of advisory groups have also been established to assist various IDEM programs. The Office of Air Management enlists advisory group help in developing rules and programs to implement the provisions of the Clean Air Act Amendments of 1990. A Clean Air Act Advisory Committee has been formed with several subcommittees established to focus on key issues in Northwest Indiana. During the Great Lakes Initiative rulemaking, IDEM exceeded federal requirements for public participation by forming an advisory workgroup and holding public meetings throughout the state, including several in Northwest Indiana. In these workgroups, the involved parties, including members of industry, environmental groups, and citizens at large, discussed specific issues which related to the rules being promulgated.

Although the public participation process is evolving, improvement is needed. The public is encouraged to participate in regulatory processes early. Many public meetings are held in Northwest Indiana, including some which are not required by law. Further, IDEM's Compliance and Technical Assistance Program (CTAP) assists Indiana businesses in achieving compliance and to promote cooperation between IDEM and the regulated community. CTAP includes several offices within IDEM and is principally operated out of the Office of Pollution Prevention and Technical Assistance. The Office of Air Management works with CTAP to provide education and outreach on new air rules and programs such as Title V and the National Emission Standards for Hazardous Air Pollutants.

Additionally, through the development of a computer-based Geographic Information System (GIS), public information on activities and projects in the Area of Concern will be more readily available.

E. Interagency Participation Processes

In October 1997 IDEM and the U.S. EPA finalized their second Environmental Performance Partnership Agreement. This Agreement mandates that IDEM coordinate its activities across its own programs as well as with other state and federal agencies, industry and

Chapter Four "Participation in the Remedial Action Plan Process"

the public. During the agreement period, IDEM and U.S. EPA will coordinate activities to avoid overlap and duplication in addressing new issues and concerns as they arise. This coordination will allow a greater exchange of information with the public and the regulated community.

IDEM also coordinates with other regulatory partners through other mechanisms. For example, IDEM is a natural resource trustee. In this capacity, IDEM works with the IDNR and the U.S. Department of Interior to promote the protection and restoration of critical habitat in the Area of Concern.

III. Conclusion

Each Remedial Action Plan Stage II is required by the International Joint Commission to include specific Remedial Action Plan goals and quantifiable objectives, and their relationship to use impairments. The Remedial Action Plan's goal of restoring the fourteen beneficial uses includes public participation, interagency participation, and business and industry participation.

Public participation is an important component of the Remedial Action Plan process. Citizens, environmental groups and government agencies, concerned about the impact of the polluted Grand Calumet River, sought ways to bring attention to the problems of the Grand Calumet River. This concern led to the formation of the Grand Calumet Task Force. The Remedial Action Plan was formed through the creation of the Task Force. Until recently, little attention was paid to conservation in land use planning in the Area of Concern. A combined effort between the public, state and local agencies has led to the purchase and dedication of land as nature preserves. IDEM and other regulatory agencies continue to encourage the public to identify potential problems and to call them to the attention of local, state or federal officials.

Participation is also encouraged through many of IDEM's decision processes. This participation and support is critical for the success of the Remedial Action Plan. There are two components within public participation: multi-stakeholder involvement and community involvement. Multi-stakeholders help identify issues that stakeholders find important. Community involvement occurs through multi-stakeholder discussions and public meetings.

IDEM also coordinates with other regulatory partners through the Environmental Performance Partnership Agreement. Since IDEM is a natural resource trustee, it works with IDNR to promote the protection and restoration of critical habitat in the Area of Concern. IDEM recognizes that the active participation and commitment of other agencies, community groups, environmental organizations and industry are critical to attaining the goals of the Remedial Action Plan. In return, business and industry are recognizing that environmental management is advantageous. Environmental management is among the highest corporate priorities and is a critical factor in maintaining responsible and constructive corporate development.

CHAPTER FIVE ACTIONS TO ATTAIN GOALS

I. Actions in Progress

A number of actions are currently underway in the Area of Concern that could lead to restoring and maintaining the beneficial uses. Through multi-stakeholder involvement, industry, regulatory agencies, not-for-profit groups and citizens work together to identify critical issues to reach the ultimate goal of delisting the impaired beneficial uses. Some voluntary actions are initiated by Remedial Action Plan subgroups or through Remedial Action Plan processes while others are initiated through other mechanisms but still support Remedial Action Plan goals. In addition to voluntary actions, federal, state and local agencies may initiate actions or institute procedures pursuant to regulations that support the Remedial Action Plan goals. Finally, administrative orders, agreed orders, or consent decrees also support Remedial Action Plan goals. Although often unilateral, these administrative or civil actions may be accomplished with multi-stakeholder involvement.

A. Voluntary Actions Initiated Through the Remedial Action Plan

1. The Cooperative Partnership Effort

A program for multi-stakeholder involvement in the Remedial Action Plan is an evolving cooperative effort to cleanup and restore the Grand Calumet River (the Partnership). The community recognizes that, given the immensity of the sediment contamination problem, the limited resources for cleanup and restoration may be applied more effectively by a community-based, consensus-driven, public/private partnership. This partnership will promote clean up and restoration of segments of the Grand Calumet River and Indiana Harbor Ship Canal. The mission of the Partnership is to:

- Balance the goals and objectives of the participants.
- Provide a forum for coordinated planning and implementation.
- Provide a communication network that links individual efforts.

This partnership was proposed through the auspices of CARE. The Partnership was proposed to avoid fragmentation by enabling industry, municipalities, citizen groups, educational institutions, and state and federal agencies to work cooperatively with pooled resources. Partners may contribute funds or resources for design, dredging, disposal, restoration, sampling, and administration. Similarly, partners may contribute land for disposal and habitat restoration. Working cooperatively, the partners will plan and carry out sediment cleanup and restoration projects. The eventual success of the partnership approach will be determined by the partners' commitment to its effectiveness and by their continued commitment to environmental

compliance.

The Partnership is a forum where participants can update each other monthly on progress of area initiatives. Through these updates, parties will accomplish the Partnership mission. The CARE Committee distinguishes itself from the Partnership in that it is a public advisory group whose current role is to work with IDEM to restore beneficial use impairments.

2. *Sediment Cleanup Restoration Alternatives Project (SCRAP)*

In the summer of 1995 members of the Sediments Committee and the Compliance/Enforcement Committee met to discuss the objectives of the Northwest Indiana Environmental Initiative Action Plan. In this plan, IDEM and the U.S. EPA committed "to continue the development of individual strategies targeting specific pollutants and broad strategies bringing together responsible parties to address key geographic areas." (Northwest Indiana Action Plan, 1995). Given the potential for several sediment remediation projects on the Grand Calumet River and Indiana Harbor Ship Canal and the uncoordinated implementation of consent decrees, both agencies recognized the need for a basin wide planning document. It was agreed that this document would identify:

- total volume of contaminated sediments,
- ecological risk associated with those contaminants,
- impacts dredging activities might have on the hydrography of the basin,
- remediation alternatives for each reach of the river and the impacts each alternative will have on restoring the beneficial uses,
- cost and feasibility of each alternative,
- project sequencing, and
- disposal options.

This analysis has been designated as the Sediment Cleanup and Restoration Alternatives Project. (See Figure vii, Flow Chart of the Sediment Cleanup and Restoration Alternatives Project Process, next page). Under the Water Resources Development Act, the U.S. Army Corps of Engineers may contract with the state to perform this work. Every dollar IDEM spends on the project (up to a certain cap) will be matched by U.S. Army Corps of Engineers planning and technical assistance dollars.

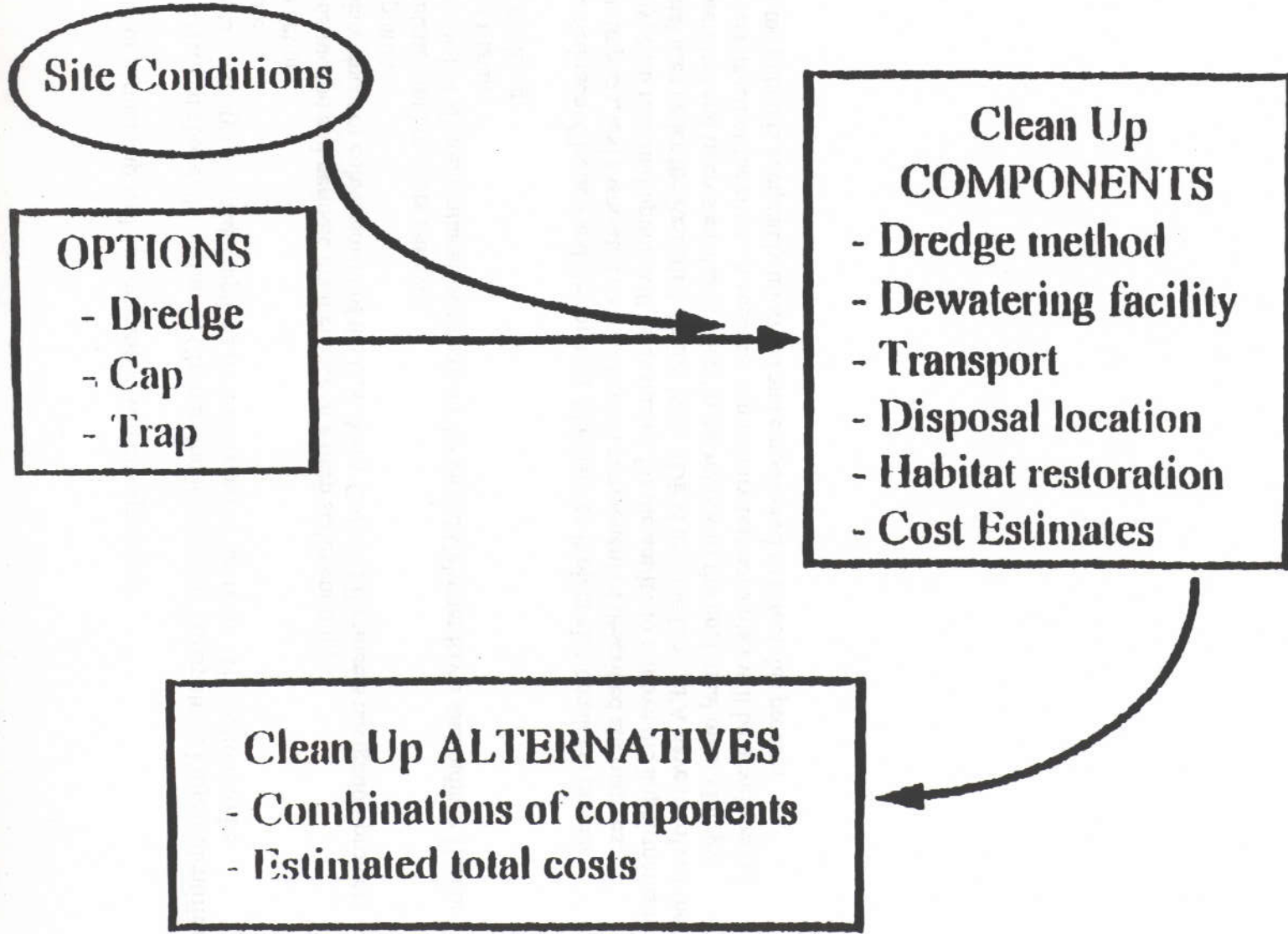
IDEM and the U.S. Army Corps of Engineers have provided funding and technical and planning assistance totaling \$1 million in developing the Sediment Cleanup and Restoration Alternatives Project. The U.S. EPA has committed more than \$208,000 to develop a Geographic Information System in support of this project. The remedial and restoration alternatives presented in the Sediment Cleanup and Restoration Alternatives Project will serve as guidance for the participants in the Sediment Remediation Partnership effort. Implementation of remedial activities in the Grand Calumet River and Indiana Harbor Ship Canal will be coordinated with the Sediment Cleanup and Restoration Alternatives Project. Remediation conducted through

enforcement or partnership will be compatible with this approach.

As described above, the Sediment Cleanup and Restoration Alternatives Project identifies and evaluates a variety of remedial options for each reach of the river. The options to be evaluated are:

- no action
- construction and periodic maintenance of a deep sediment trap;
- enlargement or enhancement of the U.S. Army Corps of Engineers navigation project;
- capping;
- contaminant hot spots removal;
- removal of all contaminated sediment on the Grand Calumet River and Indiana Harbor Ship Canal;
- or dredging.

The Sediment Cleanup and Restoration Alternatives Project also considers project sequencing, impacts, and associated costs with each component of described alternatives. Additionally, each remedial option will be evaluated for the ability to remove the impairments to the beneficial uses under the Remedial Action Plan. IDEM and the U.S. EPA have involved the CARE Committee and interested stakeholders in the review of the analytical methodology applied to each reach of the river. A separate community relations plan will be developed to ensure that the public is adequately informed and empowered to affect this process.



Flowchart Figure 3: The Sediment Cleanup and Restoration Alternatives Project

3. *The Native Revegetation of Steel Slag Project*

IDEM created this effort in cooperation with the U.S. Department of Agriculture and National Resource Conservation Service's District Conservationist. The City of Hammond is administering this funded project to develop a replicable, inexpensive procedure that can be pursued by land managers to revegetate the 16,000 acres of steel slag till sites in the Calumet Region. The participants in this project include the Morton Arboretum, the U.S. Department of Agriculture Plant Materials Center, the Friends of Gibson Woods, and The Nature Conservancy. The Land Remediation Committee is working with Lake County on the Bairstow Property and Industrial Fuels and Asphalt Superfund site.

4. *The Remedial Action Plan Geographic Information System (GIS) System*

The Remedial Action Plan GIS has been developed in this stage to be used to collect current and historic data, to review this data for gaps and quality, and to provide direction to the CARE Committee, and various Remedial Action Plan teams, as partners on the course to fill these gaps. Once a comprehensive compilation of data coverages is established, the Remedial Action Plan GIS tools will be used extensively in the implementation of the Stage III portion of the Remedial Action Plan, as well as continuing to track Stage II activities. This tracking will provide for information to the CARE Committee and the Remedial Action Plan Coordinating Committee for updates to the Stage II documents, as needed. For more information on the Remedial Action Plan GIS, see Chapter 8.

B. Additional Voluntary Actions Supporting Remedial Action Plan Goals

1. *The Grand Calumet River/Indiana Harbor Ship Canal Corridor Vision and Planning Project*

The goal of this project is: to plan for the revitalization and restoration of the Grand Calumet River and Indiana Harbor Ship Canal Corridor of Northwest Indiana and to promote an effective balance of community and economic development, commercial and industrial uses, recreational opportunities, historical and cultural preservation, nature conservation, water quality improvement, and environmental education, through a partnership visioning and funding process. The Project is an eighteen to twenty-four month consensus building planning initiative capitalizing on the momentum of ongoing multi-stakeholder efforts. The community-based collaborative process to be used will identify the future vision for the corridor including land uses along the river and ship canal and linkages to adjoining neighborhoods. Together the project will strive to create a sustainable urban ecosystem that improves the quality of life while maintaining the unique social, cultural, and natural resources of the region. This Project will mimic other local and regional efforts where community organizations, residents, government agencies, and private companies have worked together to seek solutions to local problems. At the end of the planning period, a vision concept plan with an action agenda for implementation will be created.

The Grand Cal Task formed the Corridor Vision Project Steering Committee with representatives from public interest groups, industry, city planning departments, and various government agencies. Over the past year, the Steering Committee has met to conceptualize a process that will respond to the needs of its diverse participants. The Steering Committee will continue to lead and have decision-making authority for the project. The Grand Cal Task Force, a nonprofit, tax-exempt organization, serves as the fiscal agent for the Project and chairs the Steering Committee. Representatives of the following groups, corporations and agencies are members of the Steering Committee:

- Cities of East Chicago, Gary and Hammond
- AMOCO
- DuPont
- Inland Steel
- NIPSCO
- U.S. Steel Gary Works
- EPA, Great Lakes Program Office
- Indiana Department of Environmental Management
- Indiana Department of Natural Resources
- Lake County Parks and Recreation Department
- Northwest Indiana Regional Planning Commission
- USDA, Natural Resource Conservation Service
- Illinois/Indiana Sea Grant
- Calumet Ecological Park Association
- Grand Calumet Task Force
- The Nature Conservancy
- Save the Dunes Council
- The National Park Service

The Steering Committee has determined that the corridor boundary will be established through community participation. For initial planning purposes the Lake Shore of Gary and East Chicago is the northern boundary, the Lake County line forms the east and west boundaries, and the Little Calumet River is the southern boundary. The boundary will be refined through the public consensus building process.

2. *Public Outreach and Education*

Community involvement serves many functions. It provides opportunities to educate the public about the Remedial Action Plan and solicit public comment for the document. Multiple educational programs encourage members of the public and regulated community to view the various sources of pollution and use impairments resulting from these pollutants as part of one ecosystem or watershed. IDEM, the Conservation Technology Information Center and the Indiana University School of Public and Environmental Affairs respectively coordinate the Coordinated Resource Management Process, Know Your Watershed Campaign, and the

Volunteer Monitoring Program. Consideration of all sources of pollutants as part of one integrated system represents a change from the traditional approach of regarding each stream as a separate entity. Projects must contain a public outreach component and partners seek other organizational partners within the watershed(s) to form watershed partnerships. Workshops and conferences on best management practices and their effectiveness and design criteria, prevention programs, innovative practices, funding opportunities, and local implementation programs are encouraged.

Some smaller scale activities in the Area of Concern through existing projects sponsored by state and local entities include:

- publication of new releases and newsletters,
- development of maps,
- organization of tours of the area and public meetings for project comment and analysis,
- reviewing of alternatives based on public concern,
- coordination efforts among project partners,
- completion and distribution of plans to interested parties,
- implementation of the plans as proposed in each project, and
- participation of individuals in the volunteer monitoring program.

Other activities include the placement of signs indicating Remedial Action Plan project sites and participation in Grand Calumet River Days, a week of river based activities designed to increase public awareness of and concern for the river. Ongoing efforts such as public meetings on the U.S. Steel dredging project, an annual canoe trip and other activities continue to increase public awareness of the area's environmental problems, and to improve the image of the Area of Concern.

The Grand Calumet Task Force sponsors several annual events to involve and educate the public on river restoration and water pollution issues. A canoe trip on the Grand Calumet River has become a popular event with as many as seventy canoes making the seven mile trip from Gary to East Chicago. Several river side clean ups, natural area hikes, the Great Lakes Beach Sweep, and an Adopt-A-River program are sponsored in river communities, usually in conjunction with other organizations and agencies.

The broad scope of the Remedial Action Plan makes it imperative that proponents of the plan take advantage of all these approaches to inform people about the potential changes in store for the river and the surrounding area and to receive input from all facets of the community about how these changes should be accomplished. As the plan reaches the implementation stage, different phases of implementation will be vital to its success. Individuals who wish to become involved in the Remedial Action Plan process on a more regular basis should be given the opportunity to do so. In some cases, this might require providing technical assistance or funding to significantly impacted groups in Northwest Indiana. This funding may promote a feeling of ownership of the Remedial Action Plan.

Simply getting on agendas or holding special meetings to explain the Remedial Action Plan will not be enough to get the broad public support necessary to implement the Remedial Action Plan successfully. The Remedial Action Plan process must include a commitment to create the management structure needed to inform people about the issues they care about, to respond to their concerns, and to enlist their support in finding solutions.

3. *Citizen Advisory Groups*

Some businesses in the Area of Concern have also developed mechanisms to solicit public input. For example, Amoco formed a Citizen's Advisory Committee in a voluntary effort to create a dialogue with the community. The committee was first formed in 1991 to address underground oil issues but has since been expanded to include all environmental issues at the refinery. Members include representatives from local neighborhoods, local businesses, community leaders, IDEM, refinery union members and refinery management. The public is encouraged to attend the quarterly meetings and ask Amoco staff members questions after the meeting. This effort has improved communications between the community and Amoco, and has provided Amoco direction on numerous community issues.

4. *The Southern Lake Michigan Conservation Initiative*

The Nature Conservancy (TNC) runs this program to recruit and train volunteer stewards to restore the natural areas in the Calumet Region, including the area of concern. The Lake County staff person is Paul Labus, who Co-chairs the CARE Habitat Subcommittee. Area of Concern residents are now participating as stewards at Area of Concern sites. The sites include: Gibson Woods Nature Preserve, Clark & Pine Nature Preserve, DuPont's Natural Area, and AMOCO's Lost Marsh. At the current rate, volunteers are estimated to have contributed about 3,000 hours of habitat restoration work during 1995 in the Area of Concern.

5. *The Ivanhoe Nature Preserve Restoration*

This preserve is owned by The Nature Conservancy and is surrounded by a residential community in West Gary. Restoration is proceeding with local volunteers and three part-time workers hired by The Nature Conservancy from the local community.

6. *The Clark & Pine Nature Preserve, Eastern Addition Restoration*

The original Clark & Pine (C&P) Nature Preserve tract is 47 acres on the west side of Clark Road and contains the highest number of rare plants per acre in Indiana. A 253 acre addition was acquired by the state in the negotiated amendment to the MIDCO Superfund consent decree. The C&P Addition is frequently called the Bongi property. The C&P addition is being restored with stewards under the guidance of IDNR Division of Nature Preserves and the Natural Resource Trustees (IDEM, IDNR, and U.S. FWS), who are legally responsible for developing a restoration plan.

7. *The Lost Marsh Restoration*

AMOCO employees are leading the effort to restore this ten acre marsh south of George Lake. Remedial Action Plan participants include the United Citizens Association and the Friends of Gibson Woods.

8. *Interagency Technical Task Force on E. coli*

Representatives from IDEM and IDNR decided that the current efforts and experiences should be collaborated to address this problem. Members of these agencies brought together a group of technical experts from local, state, and federal agencies to address beach closures, an impaired beneficial use identified by the International Joint Commission. The resulting group of individuals, the Interagency Task Force on *E. coli* (Task Force), is currently working to solve Northwest Indiana's bacteria-induced beach closure problem.

The vision of the Task force is to take a comprehensive approach to the problem of beach closures. This will include consistent methods of data collection for the development of a real-time forecasting system, identification of the sources and fate of the bacteria, and a systemic program of remediation. These measures are necessary to ensure the safety, public health and economic vitality of the recreational use of the Lake Michigan shoreline.

Common Goals of the Task Force are:

- Prepare a scope of work which sets forth objectives and outlines a technical strategy to comprehensively eliminate bacteria induced beach closings.
- Define and prioritize the actions consistent with the scope of work that are needed to be accomplished in order to eliminate bacteria induced beach closings.
- Educate local officials and the general public about the efforts of the technical task force to eliminate the problem.
- Invite broad public participation in the development of a strategy to assure a healthy beach environment and for active participation in the solutions to beach closings.
- Pursue funding opportunities through active partnerships among the participants and through support for individual efforts, which are in harmony with the implementation of the actions outlined in the scope of work.
- Maintain a forum that provides the opportunity for continued communication and exchange of information between cooperating agencies and interested citizens.

The Task Force also plans to support a variety of projects in the Lake Michigan Basin. Through

the establishment of minimum standards, the group will provide guidance to these projects.

9. *Indianapolis Boulevard Sewer Project*

The storm sewer replacement and roadway infrastructure upgrade of Indianapolis Boulevard is an example of cooperation between Indiana Department of Transportation, IDEM, and Amoco. Amoco worked with Indiana Department of Transportation and IDEM to handle ground water and soils from the project. Temporary wellpoint systems were installed by Amoco to lower ground water levels so that the storm sewer could be installed. The removed ground water was treated through the Amoco wastewater treatment plant. Soils were stored on site by Amoco until they could be hauled to a landfill for disposal.

10. *Amoco Bank Cleaning and Stabilization Project*

Amoco Petroleum has obtained a Section 401 Water Quality Certification to "clean and stabilize" 670 lineal feet of a drainage ditch connecting Lake George to the Lake George Canal. The ditch is in the northeast section of the intersection of US 912 and Calumet Avenue. The first phase of the project involved installing a french drain and sheet piling barrier near the same drainage ditch. The second phase involves the removal of oil contaminated soil from the ditch banks, reconfiguration of the ditch, the placement of an impermeable barrier on the east bank of the ditch, and overlay of the impermeable barrier with riprap.

11. *Coordinated Resource Management Process*

Through IDEM's Nonpoint Source Program, assistance has also been provided to watershed restoration and other interest groups in the utilization of the Coordinated Resource Management (CRM) process. CRM is a tool for local land users, managers, and other concerned parties for cooperative development of management plans that reflect the needs and desires of the citizens in the use of the many resources within a watershed. The CRM process should continue to be used to develop watershed management plans in the Area of Concern. Partnerships that form through the process can use The Natural Resources Planning Guide for Indiana, to assist them in the development of the management plans.

12. *Great Lakes Watershed Initiative*

In conjunction with The Conservation Fund, the Great Lakes Council of Governors announced a Great Lakes Watershed Initiative in all of the Great Lakes states. Each state is sponsoring a nonpoint source pollution control project. Indiana's project will be located in Northwest Indiana, and sponsored locally by the Northwest Indiana Pollution Reduction Work Group working in conjunction with the IDEM. The work elements will be initiated and completed by Purdue University.

The project will initially monitor nonpoint source pollution from a highway segment

which discharges directly to the Grand Calumet River, and evaluate BMPs for control of this discharge. An implementation of a pilot-scale demonstration BMP will follow, with results of this demonstration to be monitored. According to available statistics, highways account for 2.3 percent of the land area within the watershed, but they may contribute over nine percent of the total suspended solids to waterways.

The Great Lakes Watershed Initiative is the outgrowth of recommendations made by the National Forum on Nonpoint Source Pollution. It was convened in 1994 by The Conservation Fund and the National Geographic Society and co-chaired by Governor Engler of Michigan. The forum brought together Fortune 500 corporations, national environmental organizations, and governmental groups seeking to formulate nonregulatory solutions to nonpoint source pollution based on economic incentives, voluntary initiatives, and education.

Environmental Issues of Concern

- Removal of contaminated sediments alone will not restore the impaired beneficial uses. In fact, it will temporarily destroy habitat used by a limited number of species. This temporary destruction of habitat may be preferable to the existing risk of injury to organisms that use the river. Proper source control is necessary to avoid re-contamination that might jeopardize the environmental improvements achieved by sediment remediation activities.
- Although environmental benefits will result from the U.S. Army Corps of Engineers project in the Indiana Harbor Ship Canal, it was not designed to be solely an environmental remedy. The U.S. Army Corps of Engineers is concerned with restoring navigation to this waterway. Unless private sponsors are found, substantial amounts of contaminated sediment will remain in the canal outside the navigation channel.
- Large portions of the Area of Concern were once wetlands. These areas have been filled by slag, fill material, sediment, and other solid wastes. The contamination caused by these materials has not yet been determined although the potential certainly exists. If these "sources" of contamination are not evaluated and controlled then other source control and remediation efforts may be ineffective.

13. *Sediment Transport Model*

The U.S. Army Corps of Engineers is developing a sediment transport model to estimate loadings to the water column during dredging. The estimates of sediment transport will be used as inputs to the GIS in preparation of Total Maximum Daily Load modeling. For a complete discussion of the implications of this project on the Area of Concern, please see the Sediment Clean-up and Restoration and Alternatives Project, 1997, by the U.S. Army Corps of Engineers.

14. *Dredged Sediments Disposal*

Many dredging activities to remove deposited sediments from major waterways are currently under way in Northwest Indiana. Many of these sediments are heavily contaminated and require the waste characterization and proper disposal of large volumes of material. The U.S. EPA and IDEM under the Northwest Indiana Action Plan have an agreement to coordinate all these efforts and to facilitate future actions to cleanup other areas of these waterways.

15. *Memorandum of Cooperation (MOC)*

U.S. EPA, IDEM, and five companies who own property along the Grand Calumet River and the Indiana Harbor Canal negotiated, in August 1994, a Memorandum of Cooperation, known as the Grand Calumet Cooperative Project. This project aims to identify, contain, and/or clean up free phase hydrocarbons, or simply, remove oil that is floating on the ground water. The companies who signed are: Amoco Corp., Mobil Oil Co., Northern Indiana Public Service Co. (NIPSCO), Phillips Pipe Line Co., and Safety-Kleen Corp.

The Memorandum of Cooperation outlines voluntary actions the companies will take to identify the presence of and to prevent the movement of oil floating on top of ground water. It is a voluntary effort to stem the migration of this oil to the Lake George Branch of the Indiana Harbor and Ship Canal and, ultimately, into Lake Michigan. The companies will install a barrier and/or collection system along the canal if they find the oil migrating toward the canal.

This cooperative endeavor is precedent setting. The U.S. EPA and IDEM are working together with industry, in a voluntary association to improve the environment without use of the traditional "command and control" regulatory approach. While enforcement actions are still possible for violations of the law, the two agencies consider current voluntary efforts as a better way of cleaning up the environment. U.S. EPA, IDEM and the companies began discussion on this approach in 1992.

The project used two steps. 1) A neutral mediator met with the property owners and determined their key concerns. The City of East Chicago also participates in these meetings as an interested outside party. 2) The agencies and the companies then met and, using the neutral mediator, developed the actions and schedule for the activities identified in the Memorandum of Cooperation. The companies agreed to the following: 1) The neutral mediator will continue to facilitate communications among all parties and will review all relevant reports to insure the technical criteria are met. 2) The companies will measure fluid levels and gather other information to determine if oil is migrating from ground water on their property to surface water in the area. 3) The companies will install a barrier, or a barrier collection system if one is not already in place, should the installation of such a system become necessary. The system is monitored for effectiveness in preventing the migration of oil.

16. *Lake Michigan Air Directors Consortium*

Indiana has been active in the Lake Michigan Air Directors Consortium (LADCO) which was formed to address the severe ozone pollution in the Chicago-Milwaukee-Northwest Indiana region. LADCO also includes Illinois, Wisconsin, and Michigan. Recognizing ozone as a regional problem, this consortium has worked together to study ozone formation and look for regional approaches to reducing ozone. In the summers of 1990 and 1991, a comprehensive monitoring and modeling study, known as the Lake Michigan Ozone Study, (LMOS), was undertaken by LADCO to develop a better understanding of the relationship between precursor emissions and ambient ozone concentrations. The LMOS was also designed to develop a photochemical model that could be used to predict ozone concentrations under varying meteorological conditions and under various control scenarios. LADCO is currently evaluating the recommendations of the Ozone Transport Assessment Group, discussed later in this chapter. In addition, modeling efforts continue to evaluate regional transport of ozone and its precursors.

17. *Ride sharing*

The Clean Air Act also required states to develop rules requiring employers with 100 or more persons to implement programs to reduce work related vehicle trips and miles traveled by employees. The Indiana Air Pollution Control Board adopted an Employee Commute Options (ECO) rule in 1993 to establish these requirements. IDEM began initial outreach on the rule to help affected companies in Northwest Indiana become familiar with the rule's requirements. Because of the many concerns with the ECO requirements including the administrative burden, lack of viable alternatives, and the questionable ability of employers to change employee commuting habits, Congress relaxed these provisions of the Clean Air Act making ECO voluntary instead of mandatory.

IDEM works with the Northwestern Indiana Regional Planning Commission (NIRPC), the Indiana Department of Transportation and other interested partners in the development and implementation of measures to reduce transportation-related emissions. NIRPC is responsible for ensuring that transportation plans, programs, and projects that are federally funded or approved conform with state and federal air quality planning provisions. Conformity determinations are required in Lake County because it is a non attainment area for ozone.

18. *Clean Cities Program*

While not solely transportation-related, another approach being considered in Northwest Indiana is the Clean Cities Program. This program, which is voluntary and is coordinated by the United States Department of Energy (U.S. DOE), uses a "grass roots" approach to developing an alternative fuels market in an effort to reduce reliance on imported oil and to improve air quality, and in general raise public awareness of alternative fuels. In this program, local government and industry work together to develop and implement flexible market based solutions to meet the program's objectives. NIRPC has indicated interest in possibly becoming a partner in this

program in Northwest Indiana.

19. *Ozone Action Days*

While continuing with the more traditional regulatory approach, Indiana has also focused resources recently on a voluntary ozone reduction program that emphasizes public awareness and individual responsibility for high-emitting activities. During the Summer of 1995, Indiana, along with Illinois, Michigan, and Wisconsin implemented the Ozone Action Day program in the Chicago-Milwaukee-Northwest Indiana Region. The intent of this program is to forecast a day in advance when meteorological conditions will be conducive to high ozone formation and encourage the public, through various types of outreach activities, to refrain from activities that may contribute to ozone formation. To spread the word about Ozone Action Days, Indiana and Illinois have formed the Partners for Clean Air, a cooperative partnership of the states, the American Lung Association, industry, and other groups. The partners agree to proactively reduce activities that contribute to ozone formation whenever an Ozone Action Day is forecast. The program, which started in Lake and Porter Counties, has been very positively received and now includes LaPorte County.

As of January 16, 1997, Indiana has 63 Partners in Lake, Porter, and LaPorte Counties. They include business and industry, state and local government, environmental groups, hospitals and health associations, educational institutions, and transportation organizations. During the summer of 1996, six Ozone Action Days were declared with seven days when ozone levels exceeded the standard of 120 ppb. However, only one exceedence was within the Area of Concern. Some creative approaches used by Indiana Partners to spread the word included: flying banners with the Partners logo at all factory exits, posting Ozone Action Day notifications and a list of "Top Ten Tips" for reducing ozone on a company's electronic bulletin board, sending out information on ozone in customer bills, and providing a bike rack in order to encourage employees to ride bicycles to work on Ozone Action Days. In 1996, Gary Public Transportation and Hammond Transit System received a federal grant to begin offering free bus rides on Ozone Action Days.

20. *Ozone Transport Assessment Group (OTAG)*

In an unprecedented cooperative effort to control ozone, the 37 states east of the Rocky Mountains have formed a partnership with U.S. EPA, known as the Ozone Transportation Assessment Group. OTAG's mission is to undertake a "supra regional" modeling study of the entire eastern region of the country and develop control strategies on a much broader scale than the current non attainment area approach contemplates. States that do not have any nonattainment areas, or only marginal non attainment areas are included in OTAG. National measures such as clean cars are being considered in addition to more geographically specific measures.

One of the most significant developments in the area of ozone control occurred during

1995 with the formation of the Ozone Transport Assessment Group (OTAG). It has been recognized for some time that ozone is a regional air quality issue, not confined within the boundaries of an individual state or even a single interstate region. In the 1990 Clean Air Act Amendments, Congress authorized the establishment of "Ozone Transport Regions" for interstate ozone problems and required the creation of the Ozone Transport Commission for the northeast United States. The Lake Michigan Air Directors Consortium (LADCO), though not formally created as an Ozone Transport Region under the Act, functions in the same way: states working together to study and address a shared ozone non attainment problem.

As LADCO has done, the Ozone Transport Commission and other areas of the eastern United States have developed their air quality models and other tools necessary to identify a menu of control measures that will bring their areas into attainment with the ozone standard, it has become clear that contributions of ozone and ozone precursors from areas outside the designated nonattainment areas contribute significantly to high ozone in the nonattainment areas. Modeling completed by LADCO demonstrates that the levels of ozone coming into the non attainment area are already so high that drastic, unrealistic control measures would need to be implemented in the nonattainment area itself (for example, a 90 percent reduction in NO_x) in order to reach the standard.

Indiana is fully engaged in the OTAG process and, through LADCO, is taking a leadership role in the technical work and policy decisions necessary to move this project forward. U.S. EPA has formally recognized the OTAG project and has asked states with non attainment areas to commit to participating in the project prior to developing their ozone attainment demonstrations.

The OTAG process was completed in June 1997 with consensus reached on a variety of control strategies to be recommended to U.S. EPA. The following recommendations were made:

- Utility NO_x controls;
- Additional monitoring and air quality analysis;
- Non-utility point source analysis;
- National measures, such as additional engine standards;
- Vehicle Emission Inspection and Maintenance Controls;
- Use of Federal Reformulated Gasoline;
- Consideration of diesel fuel standards;
- Voluntary ozone programs;
- Market-based trading approaches for NO_x.

Several of the recommended measures are already in place within the Area of Concern, including enhanced vehicle inspection and maintenance, reformulated gasoline, and a voluntary ozone program.

21. *Atmospheric Deposition*

The USGS will have utilized approximately \$422,000 by 1998 to establish and conduct a program in the Grand Calumet River Basin to appraise the water quality impacts of atmospheric deposition, including toxic inorganic and organic compounds. The first study began in 1992 and was the first precipitation data collected in this watershed.

The final report on the methods from the first project is being used in the follow-up projects, entitled "Quality of Precipitation/Area of Concern" and "Quality of Precipitation in the Grand Calumet Watershed, Northwest Indiana". All of these projects were funded through FFY 1991 and FFY 1994 Section 319 Nonpoint Source Program grants.

The wet deposition monitoring has been conducted at a site located at the Gary Regional Airport. The first project collected 52 weeks of data and is being followed up by an additional 104 weeks of monitoring at the same location. To provide for an historical perspective of the types and qualities of atmospheric pollutants affecting the water quality of the Area of Concern, it would be advantageous to continue this work through the Stage III Implementation of the Remedial Action Plan. A proposed study for the continuation of these studies has been outlined in chapter 6, along with a proposal for a study of dry deposition.

22. *Coastal Environmental Management Project*

Three sanitary districts in the Area of Concern are currently evaluating the extent to which Combined Sewer Overflows (CSOs) contribute to sediment contamination. In an effort to help watershed development by controlling CSOs, the FY 1996 Coastal Environmental Management (CEM) grant awarded \$300,000 collectively to the Gary, Hammond, and East Chicago Sanitary Districts. The districts are working to meet the goals of enhancing the water quality of the Grand Calumet River, determining how CSOs respond to wet weather conditions, and ascertaining long term control plans for the entire watershed. The districts are also generating their Stream Reach Characterization Evaluation Reports in satisfaction of other regulatory requirements.

The three districts have met numerous times and have dispersed the grant money. The sanitary districts are now evaluating and prioritizing key elements of the plan in order to create a more sustainable watershed. The results will be used by numerous future parties to further gain knowledge of CSO operations relating to wet weather event discharges and to improve water quality in the Grand Calumet River and its watershed.

C. Federal, State and Local Regulatory Actions that Support Remedial Action Plan Goals

1. *Natural Resource Damage Assessment (NRDA)*

The elements of a natural resource damage assessment include: a pre-assessment screen; assessment plan; an injury determination phase; an injury quantification phase; damage determination and finally, restoration. The natural resource trustees issued the pre-assessment screen in June 1996. The trustees have developed an Assessment Plan and initiated a public comment process. (For a more detailed discussion of NRDA, see Appendix, "Description of Regulatory and Resource Management Programs for the Northwest Indiana Area of Concern Remedial Action Plan - Stage II").

2. *Soil and Water Conservation District (SWCD) Programs*

At this time, the Lake County Soil and Water Conservation District has taken the technical lead in the local field work of this joint effort until more IDEM staff are available to assist with the Remedial Action Plan and the Lakewide Management Plan (LaMP) on coastal Nonpoint source assignments. Thus far, the SWCD and the Natural Resources Conservation Service have been working with the area municipalities and other interested groups to implement demonstration best management practices, such as sand filters at storm water discharges, grassed swales with and without check dams, filter strips along streams and tributaries, and dune restoration along the Lake Michigan shoreline.

IDEM has sponsored work by the Lake County SWCD and the IDNR's Division of Soil Conservation and Division of Water to provide technical assistance for the prevention of soil erosion within the Area of Concern. The SWCD has provided the technical advise necessary to apply urban best management practices to specific sites within the Area of Concern. The locations include:

- a. The south bank of the Grand Calumet River in Gary, Ambridge/Mann area

The Lake County SWCD has designed a BMP to control the seasonal storm water runoff from the adjacent residential neighborhood, and supervised the construction of this during the summer of 1993.

- b. Roxanna Marsh in East Chicago

As a part of the mission of Indiana's SWCDs, the Lake County SWCD provided technical information to a local industrial firm in the re-design of a storm water discharge to the Marsh. The new design will reduce Nonpoint source pollution to Roxanna Marsh. Any reduction in pollutant loadings to the marsh is significant because it may benefit long-range migratory shorebirds which feed at this site. The ornithological value of this wetland of the Grand Calumet

River is important in restoring the impaired uses dealing with wildlife and habitat degradation.

c. The east shore of Wolf Lake in Hammond

The Lake County SWCD has designed and reconstructed an old concrete rubble revetment which had been previously ineffective in preventing erosion of the shoreline. Erosion had visibly progressed toward Calumet Avenue in recent years. The BMP construction methods protected the stand of Silverweed Cinquefoil (*Potentilla anserina*), an Indiana endangered species found on site, by coordinating with IDNR ecologists.

The IDNR, Division of Natural Resources has been providing a program of technical assistance to the Lake County Area of Concern in order to help implement the nonpoint source best management practices plan developed by the Lake County SWCD. Baseline data of the effects of the practices are being collected to complement the educational effort by the Grand Calumet Task Force.

3. *Coastal Coordination Project*

The Lake Michigan Coastal Coordination Program is an initiative by the State of Indiana to improve communications and cooperation among the agencies, organizations, and individuals who participate in activities in the Lake Michigan coastal region. The program is administered by IDNR. IDEM will cooperate with IDNR on the Coastal Coordination Project to the extent feasible. IDEM will include appropriate Coastal Coordination Project requirements in the State's Nonpoint Source Management Program as it is updated. Also, IDEM will encourage local conservation and environmental organizations with water quality expertise to participate in coastal zone management citizen education within the Remedial Action Plan process.

4. *Watershed Management Program*

The nonpoint source Program will continue to include best management practice demonstration projects, technical assistance, surveillance of water conditions, Nonpoint source education programs for local officials and citizens, sampling and biomonitoring, data collection and analysis, and a coastal nonpoint source pollution prevention program. Priorities for the Section 319 nonpoint source program are found in the Section 319 Management Plan. Further nonpoint source priorities are included in the Section 104(b)(3) Watershed Management Program and the Section 604(b) Water Quality Planning Program, both of which address point source pollution issues that may also relate to the NPDES permit program. The Nonpoint Source Program (Section 319) is not involved with point source pollution issues, but may be involved in the mitigation of pollutants before they reach the water body.

5. *Water Quality Certification*

Data gathered from the Section 401 Water Quality Certification program within IDEM's Office of Water Management (OWM) is useful for evaluating the wetland impacts in the Area of Concern. The Water Quality Certification program has been tracking wetland impact data since 1984. According to the OWM data, a total of 384 projects have resulted in approximately 200 acres of wetlands lost to filling, or excavation. Most of the impacts were a result of commercial or residential site development.

Mitigation was required as a condition of the Water Quality Certification granted to some of the applicants whose impacts are included in the above total. Applicants were required to mitigate losses by restoring or creating wetlands. The approximate total of wetlands restored or created in the Area of Concern was 20.16 acres.

The Water Quality Certification program recognizes that not all wetland impacts in the Area of Concern are on record. The reasons for this are that the OWM assumes an unknown number of impacts occurred before the regulations were in place, and some impacts did not go through the permitting process.

The U.S. Army Corps of Engineers permits wetlands under Section 404 of the CWA. The U.S. Army Corps of Engineers does not issue the permit if the State denies Section 401 certification.

6. *Storm Water Control Program, Including Best Management Practices*

The IDEM is operating the storm water control program as required by 327 IAC 5 and 327 IAC 15 under Rules 5 and 6. Rule 5 requires land disturbing activities of five (5) acres or more to operate and maintain soil erosion control practices. Rule 6 requires affected industries to implement best management practices to prevent storm water runoff from contamination caused by their operations.

7. *Control of Urban Runoff*

Through IDEM funds granted to local agencies, specific sites have been and will continue to be determined for the installation of best management practices to help prevent urban runoff. Urban runoff may include excess concentrations of road de-icing agents, petroleum products leached from paving materials, herbicides, pesticides, fertilizers, and animal waste. Additionally, atmospheric deposition of pollutants can result from windborne particles and gases. Some of the best management practices which may be utilized include vegetated buffer strips to filter runoff from developed areas before discharge to live streams or ground water bodies, construction of retention basins, and revitalization of wetlands. The latter could include the preservation and restoration of ecologically functioning wetlands and oak savannas and prairies to utilize their natural filtering and water retention functions without overloading their natural capacities or

reducing their native biodiversity.

8. *U.S. Army Corps of Engineers' Indiana Harbor and Canal Dredging Project*

The Indiana Harbor Ship Canal has not been dredged since 1972 "due to the lack of an approved economically feasible and environmentally acceptable disposal facility for dredged materials from" the Indiana Harbor Ship Canal (Indiana Harbor and Canal Maintenance Dredging and Disposal Activities Feasibility Report and Draft Environmental Impact Statement 1995). The sediments exceed criteria for open water disposal. According to the U.S. Army Corps of Engineers's Environmental Impact Statement released in October 1995, the system is in equilibrium, meaning that the total volume of sediment in the Indiana Harbor Ship Canal is generally constant. Incoming material pushes existing material into Lake Michigan. The U.S. Army Corps of Engineers estimates that one hundred thousand (100,000) to two hundred thousand (200,000) cubic yards of material is flushed into Lake Michigan annually. (Indiana Harbor and Canal Maintenance Dredging and Disposal Activities 1995). Acute toxicity was observed during toxicity analysis of sediment collected from the Indiana Harbor Ship Canal (ARCS, 1993). Assays conducted with Hyaella azteca, Chironomus riparius, and Chironomus tentans showed mortality ranging from 53 percent to 100 percent when exposed to sediments collected from the Indiana Harbor Ship Canal.

The accumulation of sediment in the Indiana Harbor Ship Canal has increased costs for industry. Ships carrying raw materials have difficulty navigating in the Harbor and Canal. "In addition, ships come into the harbor loaded at less than optimum vessel drafts. There is also restricted use of various docks requiring unloading at alternate docks and double handling of bulk commodities to the preferred dock. Some vessels approaching the Inland Steel Company docks must temporarily berth in the navigation channel and then be winched into the docks as they are unloaded and their draft decreases. These problems are currently causing increased transportation costs of waterborne commerce at Indiana Harbor Ship Canal, presently estimated at \$12.4 million annually." (Draft Environmental Impact Statement, 1995). Removal of these sediments will address one use impairment, added cost to industry, in the Indiana Harbor Ship Canal.

The U.S. Army Corps of Engineers and the U.S. EPA undertook an extensive review of the environmental and economic impacts of contaminated sediment in the Indiana Harbor Ship Canal in 1995. This review is entitled "Indiana Harbor and Canal Maintenance Dredging and Disposal Activities" and can be found at the IDEM Northwest Regional Office or at local libraries in Northwest Indiana. The Confined Disposal Facility (CDF) at the former Energy Cooperative, Inc. (ECI) site has a design capacity of 4.67 million cubic yards.

The U.S. Army Corps of Engineers, Chicago District, issued a Draft Environmental Impact Statement (DEIS) in October, 1995. In the DEIS, the U.S. Army Corps of Engineers proposed to dredge portions of the Indiana Harbor and Ship Canal to allow for the passage of

ships. The proposed work includes: construction of a CDF; maintenance dredging of the channel to authorized depths; disposal of dredged sediments in the CDF; and routine maintenance of all navigation structures.

A portion of the Indiana Harbor Ship Canal will not be a part of this Federal navigation project. Additionally, the U.S. EPA and IDEM have determined that a portion of the sediments within the navigation channel are "presumptively hazardous" and subject to the provisions of the Resource Conservation and Recovery Act (RCRA). These sediments will have to be addressed by non-Federal interests as part of site-specific remedial activities which will be undertaken in the berthing/dock areas adjacent to the Federal channel.

A portion of the ECI property is the tentative site for the construction of a Confined Disposal Facility (CDF). ECI is located in East Chicago and is the former site of a petroleum refinery. The site acquired interim status for storage and treatment of hazardous waste under RCRA in 1981 because the past petroleum refining activities contaminated soils and ground water. This site housed several RCRA hazardous waste units. Under a court order in the mid-1980's, all buildings on the site were razed, and the site was graded and covered with top soil. These activities failed to meet the closure requirements under RCRA for hazardous waste units. ECI is also subject to RCRA corrective action provisions. The RCRA closure and corrective action requirements associated with the affected portions of the site have been integrated into the proposed CDF design.

The proposed plan will provide many environmental benefits to the Indiana Harbor Ship Canal. Millions of cubic yards of contaminated sediments will be removed. The migration of sediments into Lake Michigan will also be partially mitigated. Section 312 of the Water Resources Development Act of 1990, also enables the U.S. Army Corps of Engineers to perform additional dredging beyond the navigation channel boundaries, provided a non-federal sponsor pays 50 percent of the dredging costs and 100 percent of the disposal costs.

9. *Ralston Street Lagoon*

The Gary Sanitary District has received Section 401 Water Quality Certification for the placement of fill material in wetlands adjacent to the Grand Calumet River as part of the raising and widening the existing berm between the Ralston Street Lagoon. The purpose of the project is to protect the Grand Calumet River from additional contamination by discharge by seeping or leaking of water from the lagoon through the existing berm as well as the river coming in direct contact with the lagoon via flooding.

10. *Elimination of the Use of Slag as Fill Material*

Several parties bordering Lake Michigan have used slag to fill in the lake and reclaim submerged lands. Placement of material in Lake Michigan is regulated by the IDNR's Division of Water in the Lake Permits Section. Parties wishing to use slag in such reuses must

demonstrate that the slag does not have a detrimental environmental effect and that the material serves as a legitimate substitute for a normally used material. IDEM has recently issued decisions which indicate that the use of slag to fill in bodies of water is not a legitimate and demonstrated environmentally protective reuse.

11. *U.S. EPA Advanced Identification of Wetlands Unsuitable for Filling*

In 1987, the U.S. EPA, Region V, and the U.S. Army Corps of Engineers, produced a study and map of wetlands in the Grand Calumet River and Indiana Harbor Canal Area under the Advanced Identification of Wetlands program. Areas identified during this study are presented in the map on the following page; wetlands on the west side of Lake George in Section 18, T 37 N, R 9 W, and wetlands on the southeast side of Wolf Lake in Sections 12, and 13, T 37 N, R 10 W are not included on the map. The base maps were adapted from National Wetlands Inventory maps produced by the U.S. Fish and Wildlife Service.

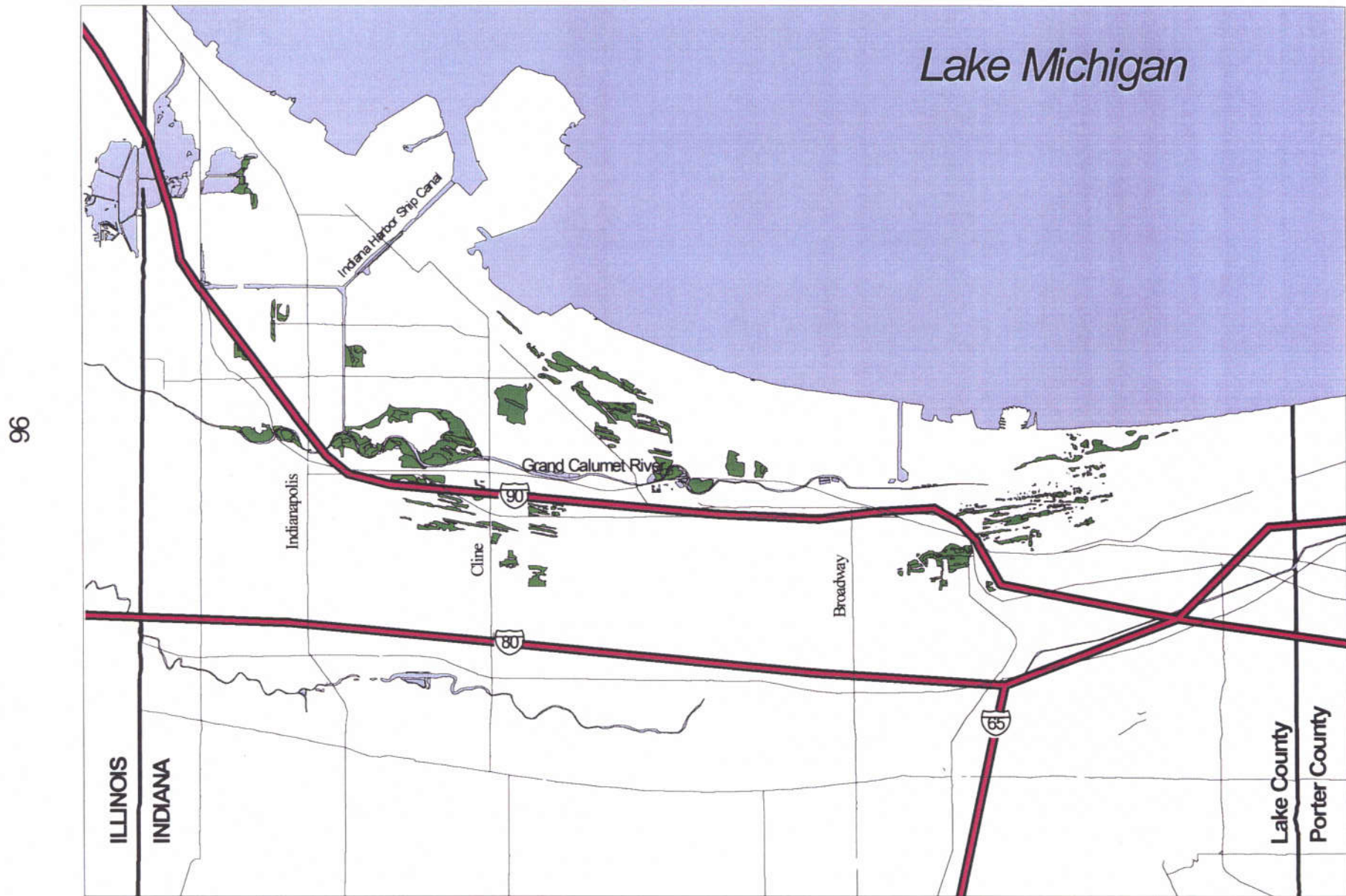
Section 230.80 of the Guidelines provide U.S. EPA with the authority to make a determination on the suitability of specific wetlands for filling before the U.S. Army Corps of Engineers receives a permit application. This process was used to advise the U.S. Army Corps of Engineers that filling these wetlands would likely fail to meet requirements of the Guidelines and that U.S. EPA would recommend that permit applications for these wetlands should be denied. The advanced identification of these wetlands was anticipated to help landowners (planners) develop plans that did not involve filling of these wetlands, increasing chances of approved permits and preserve this most important natural resource. The Advanced Identification of Wetlands Unsuitable for Filling adds predictability to the Clean Water Act Section 404 permitting process; it increases its efficiency as well.

This study concluded that natural wetlands five acres or larger, where surface water was present for more than 25 percent of the growing season, and all natural wetlands regardless of size that are part of a dune and swale complex, were unsuitable for filling. A total of 1,758.4 acres of wetlands were identified as unsuitable for filling in the Grand Calumet River and Indiana Harbor Ship Canal area of Lake County. These included palustrine wetlands which were five acres or greater, water regime seasonal or wetter, not artificial or excavated. Other wetlands identified in the area included 869.3 acres of palustrine wetlands greater than five acres, water regime seasonal or wetter, but excavated or disturbed; 249.6 acres of riverine wetlands; and 6,312.3 acres of lacustrine wetlands and palustrine wetlands less than five acres in size. A total of 9,189.6 acres of wetlands existed in the area. This acreage represents approximately 30 percent of the area's original wetland acreage.

Wetlands in the Area of Concern that were not included in the advanced identification project are not necessarily suitable for filling. A permit from the U.S. Army Corps of Engineers is still required for placing fill material in these wetlands, and the U.S. Army Corps of Engineers will deny permits for activities that are not in the public interest.

Currently, an advanced identification of wetlands unsuitable for filling is being prepared for Lake, Porter and LaPorte Counties. This project should result in a map and functional analysis of high quality wetlands. The study will provide information that can be used to plan for growth while protecting the natural resource values provided by wetlands. Applications of information provided include wetland avoidance, storm water retention planning, and development of wetlands protection ordinances.

Wetlands Unsuitable for Fill



Source of Data: U.S. EPA Advanced Identification of Sites Program
Map Date: October 1997



12. *Hazardous Waste - Facilities regulated under the Resource Conservation and Recovery Act*

IDEM continues to utilize formal enforcement action for facilities out of compliance. However, an increased emphasis has been placed on compliance assurance tools to reduce the number of severe violations by working with facilities through the use of more frequent and targeted inspections; compliance assistance; compliance monitoring; appropriate permit conditions; and incentive and recognition programs. This provides more opportunities for IDEM to assist facilities in the education and understanding of environmental rules and requirements. In addition, IDEM is working with facilities to identify areas of waste reduction and waste minimization, removing the presence of hazardous waste wherever possible. While it is too early to measure the effectiveness of these measures, IDEM will be monitoring these activities to determine overall effectiveness.

Since 1990, Indiana has taken advantage of additional hazardous waste grant funding under U.S. EPA's Great Lakes Initiative. The state will seek increased funding to provide for the current and ongoing activities identified.

13. *Solid Waste (Illegal Dumps)*

Illegal solid waste dumping has been an historic, recurring problem in northern Lake County. Open dumps have contributed to urban blight, fire hazards, and degradation of sensitive habitats for plants and animals. These open dumps have frequently led to more serious pollution problems on those sites, such as dumping of hazardous waste and contaminated debris. IDEM has obtained the cooperation of municipal authorities in targeted, coordinated compliance inspections and joint municipal/state enforcement efforts. Frequent referrals are made for criminal enforcement of serious violations.

In addition, IDEM has been able to organize groups within the Area of Concern to prevent future dumping on some of the oldest recurring dump sites after they have been cleaned. Local neighborhood groups, block clubs, and environmental organizations have been recruited to notify officials of suspicious activities near historic open dump sites. IDEM is cooperating with an effort of The Nature Conservancy and the Shirley Heinze Environmental Fund to clear debris from the Ivanhoe Nature Preserve, Ivanhoe South, and surrounding natural areas and buffer zones and to keep those sites under surveillance. Solid waste dumping can only be prevented by a combination of responsive compliance activities by state and local officials and locally involved residents.

As a result of IDEM's compliance activities in the Northwest Regional Office, 1,780,200 used tires, 60 tons of construction debris and 40 tons of yard waste was identified and removed from open and illegal dumps in the Area of Concern in 1996.

14. *State Clean Up*

Only four of the original eight sites are currently active within the State Cleanup program. Two sites (ECI and Indiana Harbor Ship Canal) have been combined, two other sites (Amoco Refinery and USS Lead) have been turned over to RCRA Corrective Action, one has been remediated (Black Oak Drums), one remains open but with no further action at this time (Calumet Containers), and one site has been referred to Site Investigations for scoring. U.S. EPA completed its final removal action at the Industrial Fuels and Asphalt site in April 1996. U.S. EPA has no other actions planned for this site.

15. *Superfund*

There are four Superfund sites in the Area of Concern: Lake Sandy Jo; MIDCO I; MIDCO II; and Ninth Avenue Dump. These four sites are all on the National Priority List (NPL) and are currently involved in remediation activities between IDEM, U.S. EPA, and the potentially responsible parties. One site, Lake Sandy Jo, is expected to be removed (delisted) from the National Priority List by the end of 1997.

16. *Waste Minimization*

Waste minimization was introduced in the 1984 Hazardous and Solid Waste Amendments to RCRA and has been defined as "the reduction, to the extent feasible, of hazardous waste that is generated and subsequently treated, stored, or disposed of. It includes any source reduction or recycling activity that is undertaken by a generator that results in either (1) the reduction of total volume or quantity of hazardous waste, or (2) the reduction of toxicity of hazardous waste, or both, so long as such reduction is consistent with the goal of minimizing present and future threats to human health and the environment."

The hazardous waste manifest program has provided generators with documentation to identify areas for potential improvement in the inventory management, operations, production process, and recycling/reuse of hazardous waste. IDEM is working with facilities to identify opportunities for reduction of hazardous waste generation.

17. *Transportation Programs*

Using Clean Water Act Section 104(b)(3) grant funding, the IDEM hired a staff person to be based in the Northwest Regional Office to work with the Indiana Department of Transportation staff. This person surveys areas to identify sites that are suitable for installing best management practices. This person also uses the Source Loading and Management Model, or another Nonpoint Source model presently used by the Federal Highway Administration, to estimate pollutant loadings from various discharge points that are identified during site surveys.

Based on these estimates, stretches of the toll road that are significant sources of nonpoint

source pollution will be identified, and best management practices will be included in design plans to control highway runoff. The staff person also works with staff from the Federal Highway Administration and from Indiana Department of Transportation to initiate demonstration projects along the toll road. Funding to install and monitor a best management practice may become available in the near future from outside current operating programs.

Over the term of the Section 104(b)(3) project, this employee solicits additional support from the Cities of Gary and Hammond, Indiana Department of Transportation, and the Lake County Soil and Water Conservation District to implement additional best management practices along the toll road and to help maintain the demonstration sites. After completion of the project, the IDEM may work with the Indiana Department of Transportation to broaden the geogRemedial Action Planhic scope by initiating toll road best management practice demonstration projects such as grassed swales, filter strips, and wetlands.

In addition, the Indiana Department of Transportation participates regularly in the reduction of Nonpoint Source pollution. For example, sensors are installed in roadbeds to more accurately gauge the need for road salt. Additionally, the Borman expressway is swept regularly to help reduce debris entering the runoff.

18. *Air Toxics Program*

The 1990 Clean Air Amendments substantially revised the way facilities that emit hazardous air pollutants are regulated. The list of pollutants regulated under the federal air toxics program was expanded to 189. Section 112 (Title III) of the Clean Air Act provides that U.S. EPA establish technology-based control strategies for numerous categories of sources. These standards are known as National Emission Standards for Hazardous Air Pollutants (NESHAP). IDEM is developing a comprehensive statewide program to reduce emissions of hazardous air pollutants. Incorporation of the NESHAP and other federal air toxics regulations and programs will be part of this program. IDEM has also initiated the process to receive delegated authority from U.S. EPA for the implementation of all Section 112 standards and programs. U.S. EPA has published approval of Indiana's delegation request.

Several of the NESHAPS, also referred to as Maximum Achievable Control Technology standards, will help to reduce the emission of toxic contaminants from major stationary sources into the air. These new standards regulate sources such as coke oven batteries, synthetic organic chemical manufacturing, petroleum refineries, gasoline distribution, chromium electroplaters, halogenated degreasers, and dry cleaners. Future NESHAPs that should have significant impact on toxic emissions from sources in Lake County include coke oven battery requirements, integrated iron and steel manufacturing, steel pickling, and foundries.

Several NESHAPs address smaller sources that traditionally have not been regulated by IDEM (e.g., dry cleaners, vapor degreasers, chromium electroplaters). IDEM is helping these sources to understand why these new requirements apply to them and what they need to do to

come into compliance. IDEM has made great efforts to provide educational and outreach opportunities to these sources and to make information (e.g., guidance, fact sheets) readily available through mailings and access to other information systems.

Section 112(r) of the Clean Air Act requires U.S. EPA to promulgate regulations to prevent accidental releases of regulated substances and reduce the severity of those releases that do occur. These provisions require U.S. EPA to develop a list of pollutants to be regulated, primarily those that are of concern due to acute toxicity, and establish requirements for source reporting.

In 1994, U.S. EPA published a final list of pollutants to be regulated under these provisions. U.S. EPA has subsequently published final rules establishing requirements for sources to develop a risk management program and submit "risk management plans." The risk management program will include:

- a) a hazard assessment including worst-case analysis and five-year accident history,
- b) a documented risk management system,
- c) a prevention program including safety information, operating procedures, training, maintenance, incident investigation, and compliance audits,
- d) an emergency response plan and program, and
- e) a written risk management plan.

The level of detail required for the risk management program is determined based on potential off site impacts of an accidental release and whether the source is within specified high risk source categories.

Beyond the Clean Air Act requirements, IDEM is looking at new ways to identify, evaluate, and prioritize addressing pollutants and sources of concern. This includes gaining a better understanding of the sources that emit hazardous air pollutants and identifying appropriate approaches to controlling their emissions, identifying sources subject to federal standards and addressing compliance issues, and developing an inventory of sources of hazardous air pollutants. These efforts are especially focused in Northwest Indiana.

Currently, IDEM does not have a comprehensive emissions inventory for sources of hazardous air pollutants. The Toxic Release Inventory (TRI) database provides the greatest amount of information on air release of toxic chemicals. The Emergency Planning and Community Right-to-Know Act (EPCRA) of 1996, requires companies to submit an annual report of their toxic chemical releases to all environmental media. Two hundred and seventy-four sources in Lake County reported toxic air emissions to TRI in 1994.

The three main limitations of TRI data are:

- a) Only manufacturing companies within a specified Standard Industrial

Classification Code (SIC) range are required to report. Types of industrial sources that impact air quality in the area of concern that are not required to report include electric utilities, publicly owned treatment plants, bulk gasoline terminals and municipal solid waste landfills. However, newer regulations will require utilities and others to submit TRI reports;

- b) Only manufacturers who use over a specific quantity (more than 10,000 or 25,000 pounds per year) must report. Many smaller types of sources, commonly referred to as area sources, are not required to report. This includes smaller surface coating and printing operations, degreasing operations, and combustion sources. Of the 9700 manufacturing facilities in Indiana in 1991, only 1000 facilities submitted a report. An analysis of the data reported to TRI by the Office of Pollution and Technical Assistance (OPPTA) indicated that if all nonreporting manufacturing facilities used one toxic chemical just below the reporting threshold, and this entire quantity of chemical was converted to an environmental waste, the cumulative totals would only increase by 10 percent;
- c) Emissions reported are only estimates and are not subject to quality assurance measures. Because of the importance of this data in evaluating the effectiveness of statewide pollution prevention efforts, the OPPTA has started working with companies to assist in submitting the required information and to assure the quality of information that is submitted for Indiana sources.

IDEM is currently participating in an air toxics emissions inventory development project as part of the Great Waters Program (see below). This inventory project, which is known as the Regional Air Pollutant Inventory Development System, is designed to establish a repository for air toxics emissions information for the Great Lakes region and coastal waters. Indiana is one of three states working on the pilot project to develop the database software and inventory development protocol. This emissions inventory will help states to be able to identify pollutants and source categories that have the most significant impact on water quality.

IDEM monitors ambient air concentrations of certain toxics and heavy metals at the Hammond CAAP site. Additional ambient air data will become available through the photochemical assessment monitoring site (PAMS-II) which recently began operation at the Gary IITRI air monitoring site. This monitoring will be performed during the ozone formation season, April 1 to September 30, and will provide hourly determinations of ozone precursors (56 organic compounds and carbonyl compounds), most of which are considered Hazardous Air Pollutants (HAPs).

Congress recognized that air pollution can have a significant impact on water quality, and thus, included provisions in the Clean Air Act requiring U.S. EPA to take a closer look at this impact. A program, known as the Great Waters Program, was established to focus on atmospheric deposition of air pollutants to the Great Lakes, Lake Champlain, Chesapeake Bay,

and coastal waters. The Great Waters Program focuses primarily on bioaccumulative pollutants (those that become more concentrated with each level of the food chain) that persist (do not readily degrade) in the environment (Table 16). The Clean Air Act requires U.S. EPA to report back to Congress. The *First Report to Congress: Deposition of Air Pollutants to the Great Waters* was published in May 1994. The relationship between atmospheric deposition and the impaired uses of bodies of water is uncertain. Information contained in the Great Waters Report was derived from three detailed reports developed by committees of leading independent scientists. These committees were established by U.S. EPA to summarize the current state of scientific knowledge on atmospheric deposition to the Great Waters. These committees prepared reports of their research on atmospheric loading to the Great Waters, identification of sources contributing to this contamination, and the effects of exposure.

Table 16. Pollutants of Concern in the Great Lakes¹

Pollutant	Examples of Uses ²
Cadmium and compounds	Naturally occurring element used in metals production processes, batteries, and solder. Often released during combustion of fossil fuels and waste oil and during mining and smelting operations
Chlordane	Insecticide used widely in the 1970s and 1980s. All U.S. uses except termite control canceled in 1978; use for termite control voluntarily suspended in 1988. Use of existing stocks permitted.
DDT/DDE	Insecticide used widely from introduction in 1946 until significantly restricted in U.S. in 1972. Still used in other countries. Used in U.S. for agriculture and public health purposes only with special permits.
Dieldrin	Insecticide used widely after introduction in late 1940s. Used in U.S. for termite control from 1972 until registration voluntarily suspended in 1987.
Hexachlorobenzene	Fungicide used as seed protectant until 1985. Byproduct of chlorinated compound and pesticide manufacturing. Also, a byproduct of combustion of chlorine-containing materials. Present as a contaminant in some pesticides.
<i>α</i> -Hexachlorocyclohexane (<i>α</i> -HCH)	Component of technical-HCH, an insecticide for which use is restricted in U.S., but used widely in other countries.
Lindane (<i>γ</i> -Hexachlorocyclohexane) (<i>γ</i> -HCH)	Main component of lindane, an insecticide used on food crops and forests, and to control lice and scabies in livestock and humans. Currently used primarily in China, India, and Mexico. U.S. production stopped in 1977. Use restricted in 1983; however, many uses are still registered, but are expected to be voluntarily canceled in the future.
Lead and compounds	Naturally occurring element commonly used in gasoline and paint additives, storage batteries, solder, and ammunition. Released from many combustion and manufacturing processes and from motor vehicles. Use in paint additives restricted in U.S. in 1971. U.S. restrictions on use in gasoline additives began in 1973 and have continued through the present, with a major use reduction in the mid-1980s.
Mercury and Compounds	Naturally occurring element often used in thermometers, electrical equipment (such as batteries and switching equipment), and industrial control instruments. Released from many combustion, manufacturing, and natural processes. Banned as paint additive in U.S., for interior paint (1990) and for exterior paint (1991).

Polychlorinated biphenyls (PCBs)	Industrial chemicals used widely in the U.S. from 1929 until 1978 for many purposes, such as coolants and lubricants and in electrical equipment (e.g., transformers and capacitors). In the U.S., manufacture stopped in 1977 and uses were significantly restricted in 1979. Still used for some purposes because of stability and heat resistance, and still present in certain electrical equipment throughout the U.S.
Polycyclic organic matter (POM) ³	Naturally occurring substances that are byproducts of the incomplete combustion of fossil fuels and plant and animal biomass (e.g., forest fires). Also, byproducts from steel and coke production and waste incineration.
2,3,7,8-Tetrachlorodibenzofuran (2,3,7,8-TCDF)	Byproduct of combustion of organic material containing chlorine and of chlorine bleaching in pulp and paper manufacturing. Also, a contaminant in some pesticides.
2,3,7,8-Tetrachlorodibenzo-p-dioxin (2,3,7,8-TCDD)	Byproduct of combustion of organic material containing chlorine and of chlorine bleaching in pulp and paper manufacturing. Also, a contaminant in some pesticides.
Toxaphene	Insecticide used widely on cotton in the southern U.S. until the late 1970s. Most U.S. uses banned in 1982; remaining uses canceled in 1987.
Nitrogen Compounds	Byproducts of combustion processes and motor vehicles. Also, compounds used in fertilizers.

¹ Published in "First Report to Congress: Deposition of Air Pollutants to the Great Waters, U.S. EPA, May 1994.

² Applicable restrictions (including bans) on use or manufacture in the United States also are described.

³ POM is a large class of chemicals consisting of organic compounds having multiple benzene rings and a boiling point greater than 100 °C. Polycyclic aromatic hydrocarbons (PAHs) are a chemical class that is a subset of POM.

The report recommended that U.S. EPA continue to develop and implement provisions of the Clean Air Act Amendments of 1990, especially the development of section 112 standards and programs. It also recommended the U.S. EPA publish emission standards affecting pollutants of concern to the Great Waters ahead of schedule and establish lesser-quantity emission rates (LQERs) to define smaller sources of these emissions as "major sources" and require that they install maximum achievable control technology (MACT).

Discussions among the U.S. EPA Region V states - Illinois, Indiana, Michigan, Minnesota, Ohio, and Wisconsin - indicate the states generally agree that applying some level of control to reduce emissions of pollutants identified as high risk pollutants on the Great Lakes Commission list makes sense. The mechanism for accomplishing this would be to accelerate the MACT development schedule and identify smaller sources that contribute significant emissions of these pollutants. A lot of this effort will be tied into other work going on in the Great Waters program including the development of the RAPIDS emissions inventory and integration of

atmospheric deposition monitoring activities with the inventory efforts. Much of U.S. EPA's work on LQERs has slowed due to the complexity of establishing thresholds and partly because of budget constraints.

Further, there needs to be an integrated multimedia approach to this problem. Coordination will have to occur across other program areas to address nonwaterborne sources of water pollution. U.S. EPA is looking at ways to exercise powers under other regulatory programs, such as the Clean Water Act, and at ways to strengthen these laws to further reduce releases of toxics to the Great Waters. There is also a national effort to inventory pesticide use with the United States and to establish a program to identify and quantify stockpiles and emissions of pesticides of known and potential concern, including banned pesticides. The states and U.S. EPA have recognized that pollution prevention plays a significant role in reducing releases to the Great Waters. Several pollution prevention projects have been initiated over the last few years including a "virtual elimination pilot project" which is focusing on a small group of toxics and performing an in-depth analysis of opportunities for reductions from all sources.

Finally, U.S. EPA will focus research planning on a mass balance approach, and research will continue to develop tools such as risk assessment and loading models. The focus is on how to better identify those persistent chemicals with the tendency to bioaccumulate that may become problematic if emissions continue. This research will integrate monitoring, modeling, and emission inventory efforts.

IDEM actively participates in regional efforts to provide a better understanding of the linkage of air deposition to water quality. The Great Lakes Action Team (Action Team) has been established to advance environmental issues relevant to the Great Lakes region and works closely with U.S. EPA in research and policy development. Efforts of this group have led to a joint project between U.S. EPA and Great Lakes states to develop a more comprehensive emission inventory for hazardous air pollutants. This effort is part of the Great Waters Program. Indiana, Illinois and Wisconsin participated in the pilot project to develop the database repository for this inventory information. Due to uncertainty on funding at the federal level, completion of initial testing and implementation of this program is not certain at this time. Other work has included developing a model to help create greater linkages between the Great Waters program and MACT standard development. This model, once completed, would help the Action Team to prioritize efforts on those MACT standards that have the greatest impact in the Great Lakes region.

Complementing the Great Waters program are several regional efforts that focus on specific pollutants or issues of concern. Among these are focused efforts on reducing mercury and PCBs from the environment. These efforts involve participants from federal, state, local, and tribal governments as well as the public and industry. The focus is to identify realistic measures to reduce emission of these pollutants into all environmental media (e.g., air, water).

19. *Mercury*

Mercury is in Indiana's environment. Indiana has mercury fish advisories for a number of lakes, rivers and streams in Indiana. Many of Indiana's fish can not be eaten due to mercury contamination. Mercury gets into our fish through the water and sediment where the fish live. Mercury entered the sediment and water primarily through air deposition and waters discharged from waste water treatment plants. Other ways the mercury enters Indiana's waters and land include spills, discharges, industrial and chemical products, and a variety of consumer products. Sources producing airborne mercury include burning coal for fuel, incinerating mercury-containing waste and a variety of other sources. This airborne mercury can then be redeposited on fields and in watersheds across Indiana.

Once mercury is introduced into the air, land or water, bacteria and other processes in lakes and rivers can convert mercury into methylmercury, which fish may acquire from the water and food they eat. Methylmercury builds up in the fish tissue and may then be carried up the food chain to humans. Mercury contamination can affect the human central nervous system, kidneys and liver. Fetuses and young children are the most sensitive to mercury toxicity.

Mercury is used because of its unique characteristics. Its high conductivity and liquidity at room temperature make it a useful component in electrical switches and thermostats. Mercury is also used in dental amalgams, thermometers, lighting, electrical equipment, laboratory chemicals and pharmaceuticals. IDEM is working to reduce mercury in all aspects of our environment through the efforts summarized in this document and the Environmental Performance Partnership Agreement with EPA Region V.

IDEM's Approach: For the past four years, IDEM has worked to reduce mercury levels throughout the state. In the beginning, IDEM worked through a three pronged approach: 1) opportunistic initiatives; 2) monitoring mercury levels; and 3) permitting facilities where we could. Two years ago, Indiana changed to a risk based approach for mercury contamination in fish tissue to better protect human health. Indiana published the fish consumption advisories which included mercury detections based on the OWM monitoring studies. IDEM worked with the Indiana State Department of Health and the Indiana Department of Natural Resources to publish the Indiana Fish Consumption Advisories. Finally, IDEM permitted facilities for air, water and waste wherever possible.

In order to focus efforts, IDEM formed an internal mercury workgroup. The focus of this workgroup is to continue approaching mercury reduction from three prongs. However, now we are integrating the work of each office and coordinating our activities. The workgroup insures all IDEM mercury initiatives take a multi-media approach and not only deal with the problem, but also figure out how mercury is getting to the environment. The workgroup continues to look into what is out there related to mercury and what IDEM can do control the mercury in our environment. Every six weeks, members of each office attend a workgroup meeting to discuss office activities and ideas concerning mercury reduction are discussed. The workgroup continues

to work together between meetings and discuss the best approaches for mercury reduction and how to measure progress.

IDEM staff also participate on national and regional workgroups which focus on reducing the amount of mercury in the environment. The Region V Mercury Workgroup addresses sources of concern for mercury in the Midwest and tries to achieve tangible reductions in mercury emissions. The group has been active in the halting of the sale of the national mercury stockpile and in establishing a thermostat take-back program with the Thermostat Recycling Corporation. IDEM staff participate in the national Virtual Elimination Group, actively follow and provide comments on the National Mercury and Utilities Studies, and have provided formal comments on U.S. EPA's risk assessment and carcinogenic pathway information contained in both studies.

20. *Dioxin*

Dioxin has been identified as one of the pollutants of concern for the Great Waters. A significant effort and several studies have attempted to identify the fate of dioxin in the environment. These efforts focused on bioaccumulation and the risks to humans and wildlife in the environment. U.S. EPA has established a focused strategy to reduce emissions of dioxin into the air and water including stringent air and water quality standards for specific source categories.

U.S. EPA has proposed or promulgated more stringent standards to reduce air emissions from waste combustion sources (medical, municipal and hazardous). Other major sources of dioxin include cement kilns, sinter plants, and bituminous coal combustion. U.S. EPA is currently conducting research on dioxin emissions from these operations and will propose new standards by 1999. In most cases, emission reductions will be greater than 99 percent.

U.S. EPA is currently conducting research on air toxics emissions from steel mills and will propose new standards by 1999 to reduce air toxic emissions including dioxins from sinter plants and emissions from coke oven batteries.

21. *Accidental Releases*

The Clean Air Act Amendments included provisions to develop a comprehensive program to prevent the accidental air release of certain toxic, flammable and explosive substances. This program, which is being developed under Section 112(r) of the Act, will require comprehensive release prevention and emergency planning measures to be put in place by companies that use listed substances above a specified threshold.

22. *Particulate Matter (PM₁₀)*

Particulate emissions have historically been a significant concern in Lake County. In the

1970s and 1980s ambient levels of Total Suspended Particulates frequently exceeded health standards by significant margins. In 1993, IDEM completed a rulemaking that established new emission limitations for sources in Lake County to meet the NAAQS for PM₁₀. These rules are part of Indiana's PM₁₀ State Implementation Plan (SIP). The PM₁₀ SIP requires the collection and continual update of source emissions data and ambient air monitoring data. IDEM analyzes data on an ongoing basis to identify issues of concern and then develops rules and policies in an effort to maintain the PM₁₀ National Ambient Air Quality Standards (NAAQS).

The PM₁₀ SIP also includes a control strategy that focuses on Lake County which has the most serious particulate pollution in the state. This strategy includes process specific emission limitations for major stationary sources which have resulted in significant emission reductions (e.g., shutdown of the Inland Steel coke batteries), fugitive dust control plans, and other measures meant to ensure continuous compliance and improved enforceability. The PM₁₀ SIP was approved by U.S. EPA in 1995, making it federally enforceable. The PM₁₀ levels in Lake County have dropped significantly due to new particulate rules and efforts of Lake County industry.

U.S. EPA is also in the process of reviewing the health- and welfare-based NAAQS for particulate matter. On November 27, 1996, the U.S. EPA announced its proposal to revise the current health-based particulate matter standard by adding a new annual PM_{2.5} (particles less than 2.5 microns in diameter) standard set at fifteen micrograms per cubic meter and a new 24-hour PM_{2.5} standard set at 50 micrograms per cubic meter. The U.S. EPA also sought comment on stricter and more lenient levels of the PM_{2.5} standards. Over the duration of the public comment period, the U.S. EPA received thousands of comments regarding the revision to the particulate matter standard. The U.S. EPA has reviewed these public comments and promulgated a rule revising the state health-based standard and added a PM_{2.5} component.

23. *Ozone*

The Clean Air Act requires states to develop a State Implementation Plan containing comprehensive measures to eliminate the health threat from ozone in severe non attainment areas by 2007. Based on the three percent annual rate of progress requirement of the Clean Air Act, total Volatile Organic Compound (VOC) emission reductions by that time should total approximately 48 percent from 1990 baseline emission levels. The first phase of the ozone reduction strategy is the development of measures aimed at reducing VOC emissions by 15 percent from 1990 baseline emission levels by 1996. Indian submitted a "15 Percent Plan" for the reduction of emissions from stationary sources to U.S. EPA on November 15, 1994.

The 15 Percent Plan relies on eight volatile organic compound reducing measures. New requirements for the area include an enhanced vehicle inspection and maintenance program, which commenced testing early in 1997, Stage II vapor recovery at gasoline stations and other refueling operations, a ban on residential open burning, and the application of reasonably available control technology to certain industrial facilities. Two federal programs, reformulated

gasoline and requirements for architectural and industrial paints, provide significant volatile organic compound reductions. Closure of major volatile organic compound emitting industrial facilities at two Lake County sources provides the remainder of the necessary credits. Table 17 provides a summary of the measures included in the 15 percent plan and the associated VOC reductions.

TABLE 17. LAKE AND PORTER COUNTY 15% PLAN	
Reduction needs by 1996 to achieve 15% net of growth	68,130
Measure	Reductions (lb/day)
Mandatory Controls	
Mobile Sources	
Enhanced I/M Program	6,817
Reformulated Gasoline (Phase I)	14,905
Area Sources	
Stage II Vapor Recovery	9,824
Architectural and Industrial Maintenance Coatings	2,920
Point Sources	
Non-CTG RACT	4,559
Non Mandatory Controls	
Point Sources	
Keil Agreed Order	5,327
Coke Oven Battery Shutdowns at Inland Steel Flat Products	22,850
Area Sources	
Residential Open Burning	929
Total Reductions	68,131

IDEM met with its NW Indiana Advisory Committee several times during the development of the 15 percent plan to get community input and comment. A formal public hearing on the plan was also held before the plan was finalized. U.S. EPA has published approval of Indiana's 15 Percent Plan.

The rules and programs put into place by the 15 percent plan will complement existing rules that regulate emissions from mobile sources, and industrial and commercial facilities such as surface coating operations, metal degreasing, gasoline marketing, oil refining, petroleum storage,

printing, and other processes that use organic solvents. Many of the National Emission Standards for Hazardous Air Pollutants (NESHAPS) will help to reduce emissions of those volatile organic compounds that are also classified as hazardous air pollutants. IDEM recently incorporated several NESHAPS into state rules that will affect VOC sources located in Lake County including the Hazardous Organic National Emission Standards for Hazardous Air Pollutants, Coke Oven Battery, halogenated solvent cleaning (degreasing), and dry cleaning NESHAP.

IDEM is currently developing the second phase of the ozone reduction strategy which will achieve another nine percent reduction in VOC emissions from the 1990 baseline. These measures will be in place no later than 1999 and include several additional NESHAPs. A key component of the nine percent plan is a rule currently being developed by IDEM to control emissions from sintering operations at steel mills.

IDEM works with the Northwestern Indiana Regional Planning Commission (NIRPC), the Indiana Department of Transportation and other interested partners in the development and implementation of measures to reduce transportation-related emissions. NIRPC is responsible for ensuring that transportation plans, programs, and projects that are federally funded or approved conform with state and federal air quality planning provisions. Conformity determinations are required in Lake County because it is a non attainment area for ozone.

24. *Other Transportation Measures*

Starting in January 1995, only "reformulated" gasoline can be sold in Lake County. Reformulated gasoline contains less of the volatile organic compounds that are precursors of ozone. In 1990, the enforcement mechanism for the inspection/maintenance (I/M) program was revised to require each motorist to provide proof of passing an emissions test (certificate) before new license plates were issued. This requirement greatly improved the effectiveness of this program. An enhanced I/M program was implemented in 1997. The new program more effectively identifies high emitting vehicles. In Lake County, both Stage I and Stage II vapor recovery systems are required for gasoline handling. Stage I vapor systems collect and control gasoline vapors emitted during the loading and unloading between gasoline transports and storage tanks. Stage II vapor systems collect and control vapors from the refueling of vehicles.

Effective November 27, 1995, most gasoline stations in Lake County are required to install and utilize Stage II vapor recovery. There are approximately two hundred and fifty retail gasoline stations in Lake County subject to these requirements with about 40 percent being smaller independent oil marketers. All sources subject to these requirements must submit a registration to IDEM when the Stage II vapor recovery system has been installed. The Hammond Department of Environmental Management is currently working under agreement with IDEM to conduct all Stage I and II vapor recovery system inspections in Lake County. Each station is inspected annually on a random basis. Other measures, such as anti-tampering and fuel switching rules, which have been in place since 1990, have also helped reduce emissions

in Lake County.

25. *The Environmental Performance Partnership Agreement*

One of the ten strategic goals that IDEM and the U.S. EPA have formally agreed to cooperate on is to "Focus on Northwest Indiana". The vision of this goal is that Northwest Indiana's air is safe to breathe; its water is safe for swimmers, fish, wildlife, and the public water supply; and its land is restored for productive use for the citizens of Lake, Porter, and LaPorte counties. For a complete discussion of this topic, see the September 1997 - June 1999 Environmental Performance Partnership Between the Indiana Department of Environmental Management and the U.S. Environmental Protection Agency Region V. This document is available upon request from IDEM.

26. *Oil Pipeline Memorandum of Cooperation*

Proposed Pipeline Memorandum of Cooperation - IDEM and US EPA Region V are pursuing a partnership with pipeline companies operating in northwest Indiana. The purpose for the partnership is to investigate and recover crude oil and petroleum distillates in the ground water that are entering or threatening to enter surface water from active and abandoned pipelines. The primary purpose for this agreement is to protect the surface water resource. The Northwestern Indiana Regional Planning Commission (NIRPC) and Clean Sites will be facilitating anticipated discussions.

D. Administrative Orders, Agreed Orders and Consent Decrees that Support Remedial Action Plan Goals

1. *H & H Autofluf Contaminant Removal Project*

Unilateral Administrative Order issued by U.S. EPA requires reconstruction of "dune and swale" habitat in previously filled wetland areas after removal of autofluf from site.

2. *Amoco Pipeline Company*

IDEM and Amoco Pipeline Company entered into an agreed order for further assessment and remediation activities for a xylene pipeline spill area near Calumet Avenue and 129th Street in Hammond.

3. *U.S. Steel (water decree)*

In October 1990, U.S. Steel entered into a consent decree, Civil Action No. H88-558, with the U.S. EPA. The decree alleged that U.S. Steel violated the Clean Water Act, National Pollutant Discharge Elimination System Permit Number IN0000281, and U.S. EPA Administrative Order V-W-88-AO-04. The original decree required a compliance program that

includes the following:

a. Remedial Wastewater Programs: Plans to limit the discharges of contaminants from the Coke Plant, the Blast Furnace/Sinter Plant Area, Steelmaking Area, and the Finishing Mill Area, shall be developed and implemented.

b. Visible Oil Discharges: U.S. Steel developed a Visible Oil Corrective Action Monitoring Program (VOCAMP) for outfalls 007, 010, 019, 028, 030, 033, and 034. The objectives of the VOCAMP were to determine the source or sources of visible oil and to identify and implement any corrective actions that will eliminate or reduce to the maximum extent practicable the discharge of visible oil.

Since this decree was filed in court, the U.S. EPA and U.S. Steel have begun negotiating a new consent decree. This proposed decree expands the size of the Grand Calumet River Sediment Remediation Project.

4. *U.S. Steel (sediment)*

a. Grand Calumet River Sediment Characterization and Remediation Project: In accordance with the October 1990 Decree, U.S. Steel conducted an investigation of sediment contamination of a thirteen mile stretch of the Grand Calumet River, from the culvert upstream of USS outfall 001 to the Columbus Street Bridge in East Chicago, including the West Branch of the River between Indianapolis Boulevard and the confluence of the Indiana Harbor Ship Canal. The study was completed in 1993 and showed that the river sediments contained heavy metals, oil and greases, PCBs, PAHs, benzene, cyanide and other pollutants.

b. Proposed Remediation Project/RCRA Corrective Action

The proposed RCRA Consent Decree is the subject of ongoing negotiations among U.S. Steel, U.S. EPA, and IDEM. U.S. Steel has offered to hydraulically dredge approximately five miles of contaminated sediment in the river. The dredging would begin at USS outfall 001 and would continue downstream to the Pennsylvania Railroad Bridge in Gary. The sediments would then be placed in a forty acre RCRA corrective action management unit for dewatering and disposal. Because certain sediments contain elevated levels of PCBs, the disposal unit will contain a special cell for PCB wastes. Water generated by the dredging and dewatering processes would be processed in a treatment system built specifically for this project prior to discharge back into the river. The corrective action management unit will be designed with excess capacity that may be used by U.S. Steel to dispose of other compatible remediation wastes from the U.S. Steel Gary Works. Other remediation wastes may be generated by U.S. Steel Gary Works as it implements RCRA corrective action to clean areas where wastes from its facility may pose a threat to human health or the environment.

c. Public Involvement

During June, July, and August 1996, U.S. EPA and U.S. Steel sponsored public meetings in Gary to explain the proposed Sediment Remediation Project, the proposed corrective action management unit for sediment disposal (including the cell for PCB-contaminated sediments) and the proposed RCRA corrective action order. There were also opportunities for oral and written public comment on each of the proposals. At this writing, U.S. EPA is in the process of reviewing the public comments. If a decision is made to not construct this proposed corrective action management unit, another disposal method will need to be proposed and evaluated. U.S. EPA will document and announce its decision with respect to the proposed corrective action management unit including the PCB disposal cell in a Response to Comments document.

5. *Inland Steel Sediment Characterization Study in the Indiana Harbor Ship Canal*

Inland Steel entered into a federal Consent Decree in June, 1993, which addressed the characterization of contaminated sediments in the Indiana Harbor Ship Canal and Roxana Marsh. The Consent Decree requires Inland to study sediment in the Indiana Harbor Ship Canal and remediate portions of the Indiana Harbor Ship Canal next to its property. U.S. EPA estimated that as much as 750,000 cubic yards of sediments may be remediated when the entire project is complete.

The contaminated sediments contain lead, zinc, PAHs, PCBs, and other contaminants which present a potential threat to health, aquatic life, and the environment. Such contaminants can affect human health through the food chain. The U.S. Army Corps of Engineers estimates that as much as 157,000 cubic yards of contaminated sediments enter Lake Michigan annually from the Grand Calumet River and Indiana Harbor Ship Canal. Lake Michigan is the primary source of drinking water for six million people in Northwest Indiana, Chicago, and Chicago's suburbs and is used by citizens of these communities for fishing and recreational purposes. This study work plan is in its final phase of review.

6. *Removal Action by LTV Steel*

The U.S. EPA and LTV Steel entered into a consent decree on May 26, 1992. The decree stated that LTV Steel illegally discharged oil and other pollutants into a waterway at its Indiana Harbor facility. In February, 1988, several hundred gallons from an oil reclamation site escaped into the facility's primary intake channel. LTV recovered a portion of the oil from the channel, but some oil reached the Indiana Harbor and Lake Michigan. An investigation revealed that sediments in the intake channel were contaminated with oil. The project was completed in 1996; 116,000 cubic yards of contaminated sediments were removed, dewatered and properly disposed, at a cost to \$16 million to LTV. 30,000 gallons of petroleum product were removed from the sediments.

7. *Gary Sanitary District (GSD)*

The U.S. EPA and Indiana entered into a consent decree with the Gary Sanitary District in

October 1992. That consent decree required the Gary Sanitary District to implement a remedial program to clean and close its Ralston Street Lagoon under the Toxic Substance Control Act (TSCA) and implement a Grand Calumet River Remediation Project with a value of at least \$1.7 million. The remediation project is to be coordinated with the U.S.S. proposed project, working toward the goal of long term improvement of the Grand Calumet River.

8. *Amoco Soil Characterization Work Plan and Ground Water Evaluation*

Amoco has conducted environmental remediation projects at the Whiting Refinery for a number of years. Most of these projects have been directed at the goal of containment and recovery of subsurface free phase hydrocarbons (FPH) that resulted from historic releases. At present there are thirty-six separate active systems operating to recover subsurface FPH and prevent FPH migration. While control of FPH migration has been accomplished, additional systems will continue to be installed for recovery of the subsurface oil that is present within the interior of the refinery. Other remediation projects that have been conducted at the site have included the removal and proper disposal of wastes and closure of a surface water impoundment. Concurrent with remediation work, many projects are underway that will improve spill prevention. These include replacing underground piping in road crossings with new, more corrosion resistant crossings and a line raising project to eventually move most below ground piping to above ground.

In the past, some instances of oil migrating past the refinery boundaries have occurred. Amoco has addressed these instances by construction of perimeter recovery systems that have prevented further migration and begun the removal process. In addition, Amoco has installed a bioventing system in one off-site area to clean up the stained soils that remained after the oil was recovered. The construction of this system required the placement of more than a half-mile of underground piping, and was conducted utilizing new drilling technologies that minimized disturbances to the residents in the area.

In December of 1995, Amoco and IDEM signed an agreement to govern the future course of the majority of environmental remediation projects at the refinery. Under this agreement (Agreed Order Cause No. H11187), IDEM has review and approval authority for the installation of further remediation systems or programs. IDEM will also have enforcement authority to ensure that completed systems meet the requirements of the agreement.

The agreed order incorporates provisions for continuing certain community relations activities including continued Citizens' Advisory Committee (CAC) meetings, and public access to work plans and reports. In addition, the agreed order contains guidelines for continued action by Amoco for leak and spill prevention. In essence, the agreed order is a continuation of the past investigation, remediation, and spill prevention measures begun by Amoco. Now, however, IDEM as a part of the corrective action team, will exercise review, approval and verification authority. Programs no longer rest solely on Amoco's initiative.

One program that was initiated by Amoco and will continue under the agreed order is periodic fluid level monitoring. Amoco monitors fluid levels at selected locations on a schedule ranging from weekly to semi-annually. On a semi-annual basis, fluid levels from approximately 750 monitoring wells are measured to provide a broad picture of the groundwater and subsurface oil status. More frequently, fluid levels from about 130 selected wells are measured. This information is used to insure that remediation systems continue to prevent oil migration and to monitor progress in subsurface oil recovery. Maps are generated showing groundwater gradients and the extent of subsurface oil plumes. Volumes of subsurface oil are estimated and recovery progress evaluated. Some of the information from this program was recently shared with the United States Geologic Survey (USGS) that was conducting an unrelated study in the area. In return, the USGS provided ground water information that helped complete the ground water gradient maps.

Also, under agreements with the U.S. EPA and IDEM, Amoco decommissioned a surface water impoundment at the Amoco Lakefront Wastewater Treatment Facility. The six acre stormwater surge basin was closed and its sludges solidified in place in 1992. Closure plans were designed such that the area is suitable for future reuse for construction of other refinery facilities. Under the provisions of the post-closure plan for this unit, ground water gradients and quality are monitored at the Lakefront and annual reports prepared.

9. *Amoco Agreed Order*

In addition to the previously mentioned Memorandum of Cooperation, there are three additional cooperative efforts Amoco has taken with the community and IDEM:

a. Amoco Agreed Order: IDEM and Amoco have worked together to combine three mutual concern issues within the refinery into one voluntary but enforceable agreement. The areas covered by the Agreed Order are solid waste management units, petroleum contamination and the J&L site. This Agreed Order is a product of IDEM working with industry to address suspected problems in an effective and workable program. This Agreed Order provides IDEM additional oversight and enforcement authority over the many remedial measures in place at the refinery, as well as those which will be installed in the future.

b. The Biovent Project: A plume of free phase hydrocarbons that had migrated off site into a residential area was pulled back to refinery property. This plume left the soils stained. The Biovent Project is a voluntarily installed system to address hydrocarbon stained soil off site of Amoco property. Amoco installed this system under First Street in Whiting after discussing the project and receiving input from the Citizen's Advisory Committee, IDEM, and the City of Whiting officials. The Biovent System uses horizontal piping and a vacuum system to pull air through the soil, increasing the amount of oxygen available to enhance growth of natural occurring bacteria that breaks down hydrocarbons.

10. *Gary Lagoons Removal Site; 5622 and 5624-34 Industrial Highway, Gary, Indiana*

On April 12, 1996, U.S. EPA issued an Administrative Order pursuant to Section 106(a) of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980, as amended, 42 U.S.C. Section 9606 (a) directing potentially responsible parties to conduct a removal of contaminated sludges from lagoons and other impacted areas on this site. Various legal and economic considerations resulted in the U.S. EPA conducting a fund lead removal action on this site. The U.S. EPA completed its final removal action at the Gary Lagoons site in May 1997.

The Gary Lagoons site was a seven acre vacant property containing two unlined and uncovered lagoons situated in a sandy environment adjacent to wetlands. Analyses indicated presence of PCBs and heavy metals in lagoons as result of historic illegal dumping. Sampling to identify extent of contamination was conducted in late August 1996. Between September 25 and December 20, 1996, 500,600 gallons of surface water was collected and 8,700 tons of TSCA-contaminated (containing >50ppm PCBs) soils and sediments were excavated from the south lagoon; and 1,550 tons of special waste soils and sediments (containing < 50 ppm PCBs) and 9,000 gallons of PCB-contaminated oil were excavated or collected from the north lagoon. Over 340 cubic yards of construction debris, a truck load of tires and grubbed vegetation were recycled. All excavated or collected media were disposed offsite. All excavated areas were backfilled with a clay/loam soil at least two feet deep. Sand was placed over the fill material to a depth of two to five feet; deepest areas were associated with reconstructed dunes. With the assistance of the U.S. Fish and Wildlife Service, Indiana Department of Environmental Management and Indiana Department of Natural Resources, a seed mixture of native plants was selected and planted on the entire area (approximately ten acres).

11. *United States Steel Corporation (U.S. Steel)*

In a landmark agreement, U.S. Steel and IDEM settled more than one hundred air pollution violations at the blast furnace, coke battery, sinter plant, steel making shops and other Gary Works Operations. U.S. Steel Corp. agreed to pay a \$6 million fine, make \$100 million in additional environmental improvements, and reduce air emissions from its Gary, Indiana facility by more than 15,000 tons each year. This agreement is the largest administrative settlement in state history and was achieved without filing a lawsuit or involving the U.S. EPA or the Department of Justice.

The agreement requires several Gary Works operations to be brought into compliance with Indiana clean air standards, and requires rigorous monitoring of operations now in compliance. All operations affected by the agreement are scheduled to be in compliance by July, 1997. Additionally, U.S. Steel agreed to invest in four supplemental environmental projects to reduce air emissions. (*Material taken from IDEM press release*).

III. Additional Actions Necessary to Delist Impaired Beneficial Uses

The impaired beneficial uses in the Area of Concern are driven by contamination of water and/or sediments in the Grand Calumet River, Indiana Harbor Canal, Indiana Harbor and Nearshore Lake Michigan and the impacts of contaminants from adjacent/surrounding areas. Delisting of the Area of Concern can not occur until the sources of contaminant have been addressed. Items identified in the Actions in Progress have, and will continue to address sources of contamination which result in impaired beneficial uses. Activities need to be initiated to address any contaminant source in the Area of Concern that is not addressed in current/planned actions.

Over the past one hundred years our industrial culture has restructured the landscape of the Calumet Region to fit its needs. Dunes were leveled, wetlands drained and filled, and rivers channelized in order to make the area more suitable for urban development. The destruction of habitat and disruption of ecological processes shattered the natural landscape leaving only small fragments that are out of context with their surroundings. Storm water that once recharged the groundwater table is now urban run-off, and considered non-point source pollution that is collected in sewer systems to be piped away. Native species no longer range freely across the lakeplain to form and reshape communities. A small number of exotic species that thrive in the wake of urban development dominate the landscape.

Physical changes to the river corridor and surrounding landscape will in part determine the levels to which we can restore natural processes. The drainage pattern and flow of the river are dramatically different from one hundred and fifty years ago. With 90 percent of the water coming from industrial and municipal discharge, water quality will be determined more by government regulation than natural processes. Wetland complexes occur sporadically along the river, with artificial berms forming large sections of the bank. On much of the river industrial and residential development pushes right to the water's edge. The situation dictates that habitat quality will not be consistent throughout the corridor. By maximizing habitat potential in key areas and establishing system-wide standards that support diversity, improvements will be made to the ecology of the river.

With at least 90 percent of the dune and swale destroyed, the fragments are the last refuge for the biotic communities that formed while natural processes shaped the landscape of the Grand Calumet River watershed. Significant ecological interaction is restricted, for the most part, to these fragments. Currently our stewardship of these lands is limited to management of protected nature preserves. They are like gardens that operate independent of the surrounding landscape. At present, our best efforts to restore ecological processes keep the dynamic flow alive only within the borders of individual preserves.

Nature preserves are created to protect the highest quality examples of natural communities, their intrinsic value as a natural area controls their cultural land use. Conservation and restoration of biodiversity that is limited to designated Nature Preserves is severely restricted in

its range. If we can develop a conservation ethic geared toward maintaining ecosystem health throughout the region a variety of habitats will be available to support native species. Creating buffers around existing natural areas, developing biological corridors, and replacing exotics with native species on properties not solely dedicated to conservation will enhance habitat conditions. To accomplish this, conservation and restoration activities will need to be coordinated with compatible land uses, and implemented through partnerships between government agencies, private landowners and conservation organizations.

Several broad-based initiatives in the Calumet Region are assessing current and future land use. The Remedial Action Plan, Corridor Planning, Brownfield Redevelopment and Sustainable Development all offer opportunities for incorporating conservation into broader land use planning. Conservation issues, remediation of environmental degradation, economic development and community development will all help shape the changing landscape.

Protection and stewardship of the fragments of the native landscape are essential to maintaining biological diversity in the region. These areas hold the biological reserves necessary for reintroduction of native species to the broader landscape. They are also the last examples of the natural systems and serve as models for improving degraded areas.

The physical destruction of habitat has created a series of problems associated with fragmented communities. Physical changes in habitat conditions along the edges of fragments disrupt biotic communities and allow for the influx of exotic species. Small habitat patches generally have increased rates of extinction, decreased rates of re-colonization and lower levels of species diversity. Species that once interacted across the broader landscape are limited to these small islands, impacting ecological interactions such as succession, pollination, and predator - prey relationships. The ecological niches created by natural and human influences on the landscape go unfilled without the influx of new species. Buffering natural areas and restoring connectivity between sites compensates for some of the negative impacts of fragmentation. The potential for positive impacts on high quality natural areas should be a priority in designing specific restoration projects.

Ongoing stewardship is needed to maintain the ecological processes necessary to preserve the biotic communities at these sites. Natural processes are so impaired that without management the habitat quickly degrades. Without fire the savannas and prairies become choked with saplings and brush, shading out herbaceous species. Areas left unburned build-up heavy fuel loads that, in the event of a wildfire, can be dangerous to people, property and the natural system. Controlled burns re-introduce fire as a process to maintain the balance of woody and herbaceous species. Dividing natural areas into burn units, so that an entire tract is never completely burned, helps insure re-colonization of fire sensitive species.

A. Protection of critical habitats

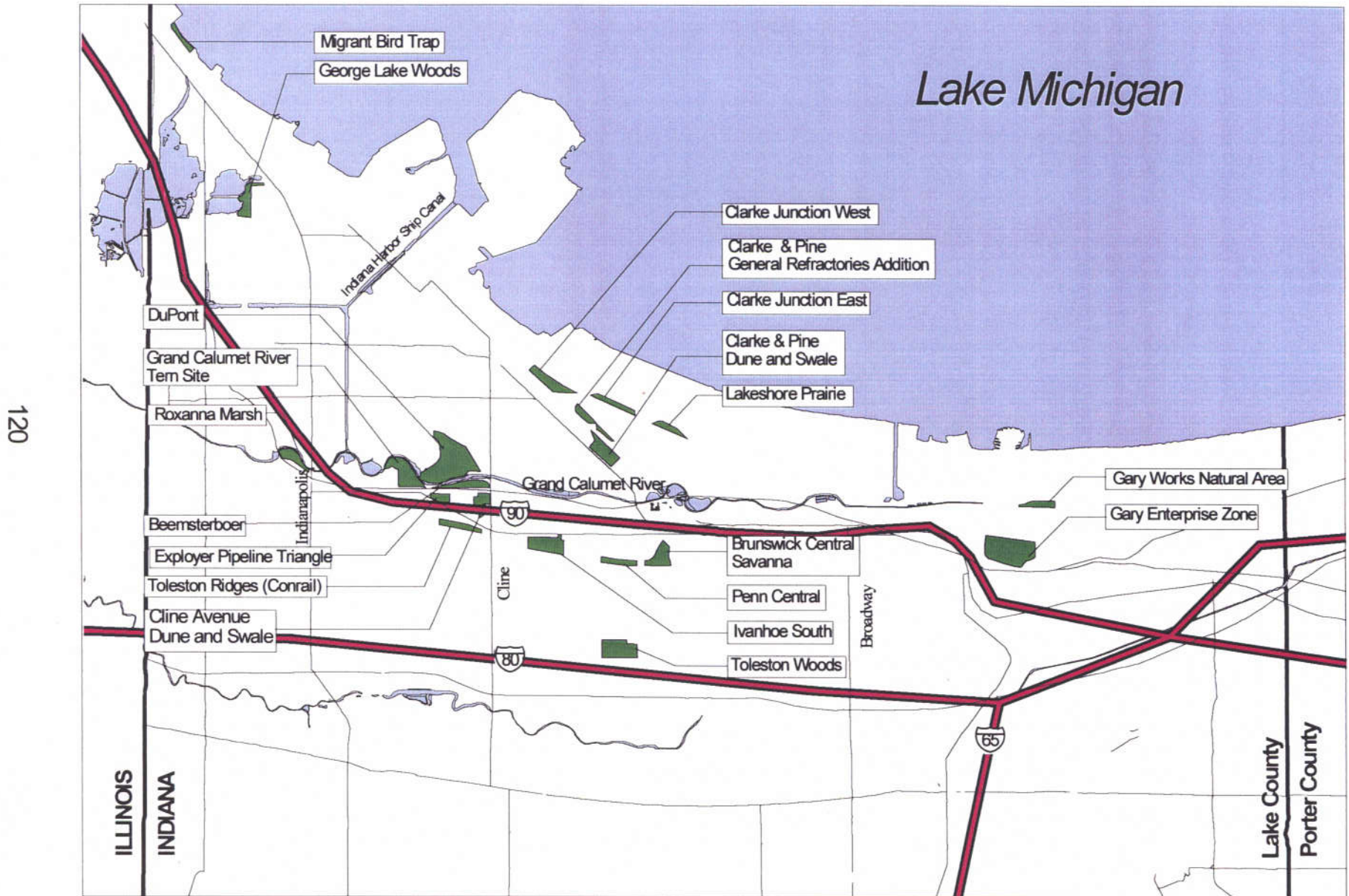
The Habitat Subcommittee of the CARE has identified twenty areas that should be targeted

for preservation and restoration in attempting to meet the subcommittee's objective to preserve and restore globally endangered and other critical habitats in the Area of Concern. The areas are listed in the order of priority for protection, recognizing that any opportunity to protect and or restore these sites would be addressed.

1. Lakeshore Prairie
2. Gary Enterprise Zone
3. Clarke & Pine Dune and Swale
4. Clarke Junction West
5. Clarke & Pine General Refractories Addition
6. Toleston Ridges (Conrail)
7. Gary Works Natural Area
8. Cline Ave. Dune and Swale
9. Ivanhoe South
10. DuPont
11. Beemsterboer
12. Clarke Junction East
13. Brunswick Central Savanna
14. Grand Calumet River Tern Site
15. Toleston Woods
16. Penn Central
17. Exployer Pipeline Triangle
18. Roxanna Marsh
19. Migrant Bird Trap
20. George Lake Woods

The above sites represent the remaining dune and swale habitat in the Area of Concern that is not in some type of protective ownership with the exception of Roxanna Marsh, The Migrant Trap and George Lake Woods. The remnant dune and swale areas, if protected would greatly enhance biodiversity and provide core areas for maintaining ecosystem integrity of the Area of Concern. The other three areas, while not representing high quality habitat, provide critical habitat to migratory birds within the area. See Figure vii on the next page for location of these sites.

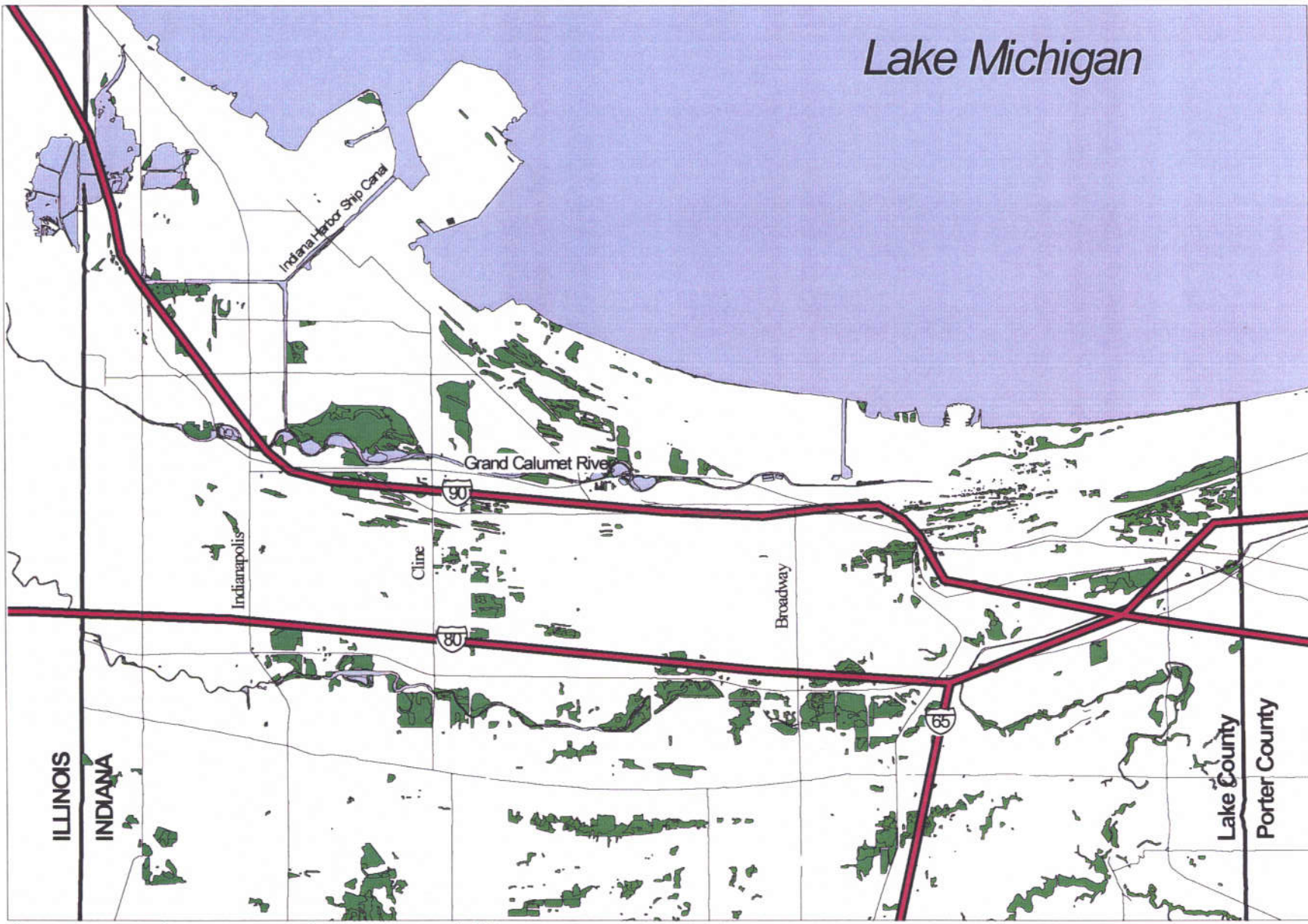
Critical Habitat to Preserve or Protect



Source of Data: Habitat Subcommittee of the CARE Committee
 Date of Map: October 1997

Wetlands

121



Lake Michigan

Indiana Harbor Ship Canal

Grand Calumet River

Indianapolis

Cline

Broadway

ILLINOIS
INDIANA

Lake County
Porter County

2 0 2 4 Miles

Source of Data: National Wetlands Inventory
Date of Map: October 1997



B. Riparian Restoration

Habitat restoration/protection should accompany remedial activities along the river corridor. Activities that enhance or preserve shoreline habitat should be addressed during or immediately after dredging and/or *in situ* isolation of contaminants within the river channel. Contaminated side channels should be remediated. Banks should be stabilized by placement of clean materials (sand, soil, stone, etc.) and/or revegetated with native plants. Shallow emergent wetlands could be created by dredging or cutting back banks where feasible. These areas should then be revegetated to native plants. Control of invasive plants should be incorporated into riparian restoration.

The Grand Calumet River formed as a natural land feature along with the dune and swale on the Tolleston strandplain. Despite fragmentation, the river corridor and remnant sites share a common ecological heritage. The divisions between these areas are artificial impairments to the natural ecological processes. No matter how disturbed the landscape, the remnants are elements of a larger system. Understanding how that system functions and its potential for improvement gives context to habitat restoration projects along the river corridor. The long term viability of the native communities will depend on restoring ecological processes along the river and throughout the watershed. The key ecological processes of the dune and swale system are: the natural succession of communities, the interplay of prairie, Atlantic coastal plain and boreal species, the hydrologic link between the groundwater table and Lake Michigan, and periodic fires. Habitat restoration projects along the river corridor should be designed to help remove impairments to these processes.

C. Wetland Protection/Restoration

As the opportunity to create new wetlands is extremely limited, all wetlands remaining in the Area of Concern should be protected to the fullest extent possible. Preservation of wetlands was a primary purpose of the Advance Identification of Wetlands Unsuitable for Filling and Dredging described earlier in this document. For purposes of protection and/or restoration wetlands should be defined and recognized by the scientific definition adopted by the Indiana Wetlands Conservation Plan (1996): "Wetlands are lands transitional between terrestrial and aquatic systems where the water table is usually at or near the surface or the land is covered by shallow water. For purposes of this classification, wetlands must have one or more of the following three attributes: (1) at least periodically, the land supports predominantly hydrophytes; (2) the substrate is predominantly undrained hydric soil; and (3) the substrate is nonsoil and is saturated with water or covered by shallow water at some time during the growing season of each year (from Cowardin et al., 1979. Classification of Wetlands and Deepwater Habitats of the United States, U.S. Fish and Wildlife Service FWS/OBS-79/31. 104 pp.)". Wetlands meeting this definition in the Area of Concern are identified on National Wetland Inventory Maps developed by the U. S. Fish and Wildlife Service (see Figure XXX). National Wetland Inventory maps were developed from aerial photographs with some ground proofing. As with all large scale mapping projects, the maps have some degree of error and actual wetlands identification should

be ground proofed.

The responsibility to protect wetlands is described in the U.S. EPA Guidelines to Section 404 of the Clean Water Act. Individuals must obtain a permit from the U.S. Army Corps of Engineers in order to fill wetlands meeting regulatory definitions. The U.S. Army Corps of Engineers is required to deny a request for a permit if the proposed activity fails to comply with the guidelines. Proposed activities fail to meet the guidelines when: a) there is a less damaging alternative; b) will result in adverse affects on water quality; or c) there will be adverse affects on fish and wildlife or wetland functions.

Filling, draining or development of all remaining wetlands in the Area of Concern should be prevented. All legal avenues available should be employed to prevent draining or filling of Advanced Identified Wetlands. Restoration of degraded wetlands should be given a high priority.

D. Instream Habitat Restoration

Activities that could be completed to enhance instream habitat include the construction of underwater riffles by placement of gravel or cobble in deeper areas of the channel, construction of Lunker boxes along steep banks to create cover for fish and add stability to banks, placement of other structures within the remediated channel as biologs, halflogs, or natural snags to enhance cover for various species of fish. The feasibility of placement of underflow culverts to create silt free areas within the stream channel (Kelso and Hartig, 1995) might also be explored to enhance fish spawning areas within the river channel. The feasibility of creating off channel shallow wetland areas should be explored. Cleaning and replanting side channels, dredging shallow off channel areas and connecting or reconnecting wetlands, lagoons, ponds and lakes with the river should all be considered. Enhancement of sheet pile walls with sloping cobble in areas outside the navigation channel should also be explored.

E. Invasive Plant Control

A major stressor to habitat function in the Area of Concern is the large, sometimes monotypic, expanses of invasive plants such as common reed, purple loosestrife, narrow-leaved cattail and others along the river, in wetland areas and in terrestrial habitats in the Area of Concern. A major effort should be initiated to eliminate where possible, and control where elimination is not possible, these invasive species. Areas where these plants are removed should be replanted and/or monitored to ensure native vegetation reestablishment.

The proliferation of exotic species is one of the greatest management concerns in the region. Species introduced through human activity, that have no natural controls, need to be removed manually. Although they will never be completely eradicated, effective management programs can prevent their spread. Phragmites and purple loosestrife are exotic species that are well established throughout the entire river corridor, and need to be addressed at a system-wide level. Each purple loosestrife plant can produce as many as 250,000 seeds, that are dispersed through

flowing water. Phragmites spreads by sending off long rhizomes and seeds. Both of these plants form large monocultures, choking out beneficial native species. The long-term viability of all wetland habitat is subject to our ability to control these plants throughout the entire river system. Control of non-native species will be an ongoing management issue. Programs to control exotic species need to be established to ensure the integrity of both natural areas and restored habitat.

Without proper management the long-term viability of conservation and restoration efforts is questionable. The ongoing stewardship requirements of sites and identification of potential land management agencies or organizations is a necessary part of planning restoration projects.

II. Conclusion

Individual actions alone may not result in delisting of impaired uses. However, voluntary actions initiated through or in support of the Remedial Action Plan process, coupled with regulatory action initiated in support of the Remedial Action Plan may lead to delisting. Environmental Performance Partnership Agreements also support Remedial Action Plan goals. These actions will at least fill information gaps or delineate new actions to be accomplished to lead to ecosystem health.

CHAPTER SIX INFORMATION GAPS

I. Introduction

In order to identify the current status of use impairments, describe causes of these impairments, and quantify sources, additional studies of all components of habitat within the Area of Concern must be completed. A great number of studies are either currently underway, or have been completed. Future studies will fill in data gaps present within information which is currently available regarding the Area of Concern. This chapter presents a list of the types of studies needed to gather the requisite information. The factors for consideration are:

- a) Identification of data gaps the study is meant to fill (e.g., status of use impairment unknown, sources and/or causes unknown or uncertain),
- b) Description of study,
- c) Cost,
- d) Sequence of actions and time required to complete,
- e) Relative priority, and
- f) Responsible entity.

Integrity of an ecosystem includes the health of the biological populations and interactive communities of the ecosystem and the ecosystem's ability to withstand stress or adapt to it. Studies of the habitat in the Area of Concern can determine whether ecological communities are thriving and whether they exist within ranges of conditions that occur as the result of natural forces. Stressors, which adversely affect the health of an ecosystem, must also be identified. Finally, human factors or actions, that are the main source of ecosystem stress, must be identified. This chapter sets out the information gaps to be filled to address these layers of the Area of Concern's ecosystem.

II. Implementation: Transitioning from Stage II to Stage III

This document provides a framework for addressing the 14 beneficial use impairments in an ecosystem context and presents the current environmental conditions in the Area of Concern. While the Stage II document provides a draft matrix of actions underway and beneficial use impairments, an analysis of the matrix has yet to be completed. Further, prioritization of the beneficial use impairments and actions underway is needed and will be submitted as an addendum to the Stage II document.

The CARE Committee and IDEM have begun to address these issues by compiling the matrix of actions underway and beneficial use impairments as a starting point for a more in depth analysis. The table defining each beneficial use impairment, its listing and delisting guidelines, rationale, and source or cause of problem will be used. The two tables that illustrate the connections between ecological processes, environmental stresses and the beneficial use

impairments are central to this analysis. In addition, CARE committee members attended an introductory Comparative Risk workshop in October 1997 and will be evaluating that process as a possible tool to assist in prioritizing the 14 beneficial use impairments and the actions to restore them.

A Stage II Addendum will be prepared by IDEM and the CARE Committee and will be submitted to the International Joint Commission by the fall of 1998. The Addendum will establish priorities and timelines for restoring each of the 14 beneficial use impairments in an ecosystem approach.

III. Studies Proposed

A. Inventory of habitats, locations, and species now occupying the habitats

Description of Study: This category of study focuses on the need to build a complete picture of the current state of the environment in general and habitats in particular within the Area of Concern. Information on wetlands, fish and macroinvertebrates, birds, dune and swale areas, wet prairie, and other habitat components exist, but have not been drawn together into a cohesive format. Phase I of this study involves locating all available information and compiling this information for use in computer mapping and report forms. Information must be collected from federal, state, and local agencies, as well as Area of Concern businesses, non-governmental organizations, land trusts and educational institutions. Phase II will take this information and build maps or other assessments about the following components:

1. Spatial distribution of benthic, aquatic, terrestrial, and avian biota, focusing on breeding, foraging, and nesting areas of native and non-native species.
2. Spatial distribution of habitat types, including wetlands, open water, forests, dune/swale, and prairie. This distribution assessment should also show marginal areas such as the CITGO asphalt wetland, and areas which are currently protected, such as state parks and nature preserves.
3. Spatial distribution of beneficial, non-invasive plant and animal species, including native species found currently within the Area of Concern.

Phase III will include compiling a list of all components not currently assessed or for which no information is available. This information, needed to complete a present-day picture of the Area of Concern, will be the basis of studies needed to show the present condition of habitat and species within the Area of Concern. Studies needed to complete these gaps will include analysis of satellite imagery, use of U.S. Army Corps of Engineers Advanced Identification of Wetland studies, biological assessments of fish communities performed by IDEM for Index of Biotic Integrity metrics, as well as overlays of USGS topographic maps, soil surveys, and county and city plat maps.

a. Assessment of the overall "health" or condition of habitats and species within the Area of Concern.

Coupled with studies characterizing the existing habitats, species composition, and spatial relationships, is the need to gather information regarding the environmental condition or health of these areas. Data, which must be collected for this section, will first provide a spatial overview of pollutants and sources, showing the movement of these pollutants through the Area of Concern. Studies needed include ground water modeling, surface water run off patterns, identification of NPDES outfalls and the types of pollutants which are introduced, locations of hazardous and non-hazardous landfills, including slag and municipal solid waste, locations and characterization of underground storage tanks and materials handling facilities, and any other study which provides information as to the location, vector, and intensity of pollutant loading to a given habitat. This layer of information is currently being compiled by other Remedial Action Plan teams, and a GIS-based overlay of this information with data collected from Study 1 will provide a complete picture of habitats and their current state or condition.

b. Inventory of existing habitat areas and criteria used for ranking parcels to be preserved, enhanced, or restored.

An application of data collected in Study 1 will be an analysis of information regarding areas which may still have all or some of the impaired habitat functions present or intact. Areas which have non-impaired habitat functions have been identified and will be rank-ordered for eventual protection through Remedial Action Plan-sponsored initiatives. This inventory can also be used to identify adjacent areas which may require pollution remediation but could be restored and added to current habitat parcels.

B. Assessment of the tolerances of native and beneficial plant and animal species to pollutants located within the Area of Concern

Data Gaps: This information, which needs to be assembled for computer analysis, can be paired with the aforementioned layers to develop feasibility studies for pollution remediation and habitat restoration. Areas identified by other Remedial Action Plan teams that are to be cleaned of pollutants must be evaluated after clean up to determine the potential for successful habitat restoration. There will be areas that are restored to human health standards, but may not support beneficial habitat functions.

Description of Study: Much information is available now to assess potential effects and violations of Indiana's environmental standards.

A second important aspect of this study is to identify a pollutant or suite of pollutants which are having an adverse physiological, reproductive, survivability, or fertility effect on a given species. The study will then relate that information to the spatial distribution of that species and the spatial distribution of the pollutants in question. This information will then be

used to target cleanups and remediation efforts to sites where pollution is having the greatest adverse effect on existing habitats, especially globally endangered habitats.

Cost of Study: To be determined

Sequence of Actions: Compile current information; identify pollutants or in situ effects; relate information; target cleanups

Relative Priority: To be determined

Responsible Entity: IDEM

C. Assessment of migration or patterns of movement of mobile species, including interactions of species within habitats

Description of Study: As areas within the Area of Concern are targeted for habitat restoration, and other areas are protected by Remedial Action Plan initiatives, information regarding the movement of species within habitats will be needed.

Data Gaps: It will also be necessary to compile information regarding colonization of newly restored habitats by both desirable and exotic species so that short- and long-term land management decisions will allow for the control of exotic species and encourage the propagation of desirable species. This information will be used to create appropriate corridors and islands of protected and restored habitat, which will provide nesting and breeding areas, and also to appropriate foraging ranges and nature lanes to allow movement from habitat to habitat.

Cost of Study: To be determined

Sequence of Actions: To be determined

Relative Priority: To be determined

Responsible Entity: To be determined

D. Studies which evaluate the feasibility of restoring, enhancing, or recreating habitat types, to a level determined by the Remedial Action Plan committees

Description of Study: Once information is collected that allows the Remedial Action Plan participants to assemble a picture of the current state of impaired habitat functions, Remedial Action Plan activities will focus on remediation of pollution and contamination. As areas are cleaned or restored to standards set by the Remedial Action Plan, each area will require a site investigation and analysis to determine the feasibility of restoring, enhancing, or recreating viable fish and wildlife habitat.

Data Gaps: Previously identified

Cost of Study: To be determined

Sequence of Actions: To be determined

Relative Priority: To be determined

Responsible Entity: IDEM

E. Total Maximum Daily Load (TMDL)

The Grand Calumet River Watershed has been targeted for initiation of a Total Maximum Daily Load (TMDL) model prior to the year 2000 for renewal of the NPDES permits issued. It will be coordinated with completion of dredging projects, since existing conditions will change markedly after dredging and will significantly influence the calibration and verification of this model. This step is as specified in the 303(d) List of Impaired Waters of the State issued by the Assistant Commissioner of IDEM's Office of Water Management. A TMDL is used to establish a regulatory basis for allocating loadings of pollutants for discharges, including nonpoint sources on the river system. It is in accordance with 40 CFR 130 et seq. and U.S. EPA guidance documents. (U.S. EPA, Office of Water, 1991).

This study will determine the total allowable loading for each pollutant in Grand Calumet River and Indiana Harbor Ship Canal. This loading will then be allocated among the various point and nonpoint sources along the river, except for a loading necessary to guarantee a margin of safety. A portion of this allowable loading may also be reserved for use by future discharges.

The U.S. Army Corps of Engineers has issued a contract for development of a sediment transport model to estimate loadings to the water column during dredging. The estimates of sediment transport will be used as inputs to the GIS in preparation of TMDL modeling. IDEM is currently addressing this issue in relation to the Great Lakes Initiative and the effect these rules may have on the loading allocation process.

Cost: Currently being developed by the IDEM Office of Water Management.

Sequence of Actions: Currently being developed by IDEM's OWM.

Relative Priority: Currently being developed by IDEM's OWM.

Responsible Entity: IDEM

F. Storm water runoff and sediment contamination

Data Gaps: Storm water runoff is a known source of sediment accumulation/contamination. The *Grand Calumet River Basin BMP Demonstration* stated that the loss (of soils and sand) amounts to 10,000 tons annually. More work needs to be done to determine the total impact.

Description of Study: To be determined

Cost of Study: To be determined

Sequence of Actions: To be determined

Relative Priority: Low, the Nonpoint Source group at IDEM is implementing procedures to reduce the overall effect of storm water runoff.

Responsible Entity: IDEM

G. Assessment of Dewatering Characteristics of Odor Impacts of Grand Calumet River Sediment

Data Gaps: The removal and handling of highly contaminated sediments from the Grand Calumet River and Indiana Harbor Ship Canal has the potential for significant odor and volatile organic impacts. In addition, the dewatering and stability of the sediments will have impacts on their placement within a CDF and on overall sediment management.

In federal fiscal year 1997, the U.S. Army Corps of Engineers plans to have laboratory studies conducted to evaluate the odor impacts and dewatering/stability characteristics of sediments collected from the federal navigation channel. The sediments from outside the federal channel, particularly those from the Grand Calumet River, will likely have different properties. Therefore, it is recommended that the same analyses be conducted with sediments from other locations to provide information necessary for the remediation of sediments from other areas of the Grand Calumet River and Indiana Harbor Ship Canal.

Description of Study: Analyze sediment from the Grand Calumet River to determine its suitability for dewatering and disposal in a CDF. Address the production of odors and volatilized organic contaminants as a result of handling and disposal.

This work consists primarily of physical testing of the sediment. Bench scale tests will be conducted to determine the dewatering and stability characteristics of sediment from selected reaches. Prediction of the volume occupied by the dredged material will be made using the Primary Consolidation, Secondary Compression, and Desiccation of Dredged Fill (PSDDF) model. The model will be used to aid selection of the more viable sediment management

alternatives. The scope of the alternatives will be developed in conjunction with the investigation on dredging and placement methods. Bench scale tests will also be conducted using VOC flux chambers to assess the contaminant emissions of PCB's, PAH's, TRPH's, ammonia, and other parameters of health and nuisance concerns.

Cost of Study: \$140,000

Sequence of Actions: To be determined

Relative Priority: To be determined

Responsible Entity: U.S. Army Corps of Engineers

H. Grand Calumet River and Indiana Harbor Ship Canal Mass Balance

Data Gaps: Pollutants find their way to the Grand Calumet River and Indiana Harbor Ship Canal from a variety of sources: CSOs, point source discharges, Nonpoint source runoff, atmospheric deposition, and contaminated ground water are included in this group of sources. Loadings of selected pollutants to the river from some sources, such as NPDES outfalls, can be easily quantified because data is readily available. Information on other sources is more difficult to obtain or does not exist. IDEM acknowledges that the resuspension/re-release of contaminants in place sediments pose a problem for this study, and requests information on procedures for measuring these sediments. IDEM will discuss with U.S. EPA the difficulties associated with this work.

Description of Study: Choose a small segment of the river. Collect data on pollutant loadings during wet and dry weather from this segment. Information will be collected from:

<u>Information Source</u>	<u>Type of Information</u>
stream gages	1) elevation of river during wet and dry weather. 2) duration
Combined Sewer Overflows	1) chemical analysis 2) flow 3) duration
NPDES Outfalls	1) chemical analysis 2) flow 3) duration
dry weather atmospheric deposition	1) chemical analysis
wet weather atmospheric deposition	1) chemical analysis

ground water	<ol style="list-style-type: none"> 1) potentiometric surface 2) hydraulic conductivity 3) chemical analysis 4) sample depth
nonpoint source runoff	<ol style="list-style-type: none"> 1) flow 2) duration 3) chemical analysis
rain gages	<ol style="list-style-type: none"> 1) amount of rainfall 2) duration

Pollutant loading values will be calculated for each source. This information will be used to prioritize source control efforts for the river segment studied.

Cost: Unknown

Sequence of Actions: The U.S. Army Corps of Engineers is under contract from IDEM to complete a study entitled Sediment Cleanup and Restoration Alternatives Project. As part of their work they are going to identify the sequence in which selected river segments will be remediated. This study should mirror their recommendations for sequence. If possible information should be collected from all sources during the same time period.

Relative Priority: The priority of this study is high because it can be used as a tool to prioritize source control activities.

Responsible Entity: IDEM and the U.S. Army Corps of Engineers

I. Study Sediment Toxicity Sources in the Indiana Harbor Ship Canal

Data gaps: Contaminants reach the sediment via NPDES outfalls, combined sewer overflows, ground water contamination, and storm water discharges. It is not known to what extent NPDES outfalls, even if substantially compliant, contribute to sediment accumulation and contamination.

Description of Study: A series of samples should be taken from the Indiana Harbor Ship Canal using a statistically valid grid. The sediments should then be analyzed for both toxicity and chemistry. The data will then be plotted on the grid and contours (similar to a topographic map) to determine if trends in the data exist. The Remedial Action Plan committees recommend that the study be conducted using the following criteria:

- Sites should be chosen that will be free of transport of upstream contaminants. There are several possible study locations of which the Hammond Sanitary District, U.S. Steel, and

the East Chicago Sanitary District are included.

- A pre-remediation assessment should be made. This might include more than one sampling effort.
- A post-remediation assessment should be made. This effort should be continued until the data show that no impact is occurring.
- Sampling should include chemical analysis, sediment toxicity, and benthic community analysis.

Sequence of Actions: Data assessment; investigation; corrective measure

Cost of the study: This depends upon the sampling plan which has not been developed.

Relative priority: The team has classified this as medium to high because of the pending U.S. Army Corps of Engineers project and because of the many remedial activities under way outside of the river channel. The team believes that it is crucial to get a handle on the sources so that the sediments do not re-contaminate.

Responsible entity: IDEM and the U.S. EPA using the U.S. EPA Fields Computer System; the NPDES permit holder.

J. Bedload and Suspended Sediment Discharge Study at the Grand Calumet River and Indiana Harbor Canal

Data Gaps: Estimates of the sediment loadings from the Grand Calumet River system indicate that it is one of the largest sources of contamination to Lake Michigan. The U.S. Army Corps of Engineers developed these estimates with funds from its confined disposal facility (CDF) project based on theory and supported by historical dredging records. Unfortunately, there is currently little or no data for loads of suspended sediment, or for bedload sediment discharge for the Grand Calumet River and Indiana Harbor Canal.

Description of Study: Calculate the loads of bedload and suspended sediment through the harbor and estimate suspended sediment discharge for the East and West Reaches of the Grand Calumet River. This information can be used to establish sediment loads for the Grand Calumet River and Indiana Harbor.

Cost of Study: \$110,000

Sequence of Action: During a one year period, suspended sediment samples, bedload sediment samples, and near bottom suspended sediment samples will be collected in the Indiana Harbor Canal near the mouth of the harbor, and additional suspended sediment samples will be

collected at sites near East Chicago and Gary. This information will be used to calculate sediment loads and bedload sediment discharge. A report containing a description of the study methods, the data, and results of the data analysis will be written and published at the end of the study.

Relative Priority: To be determined

Responsible Entity: U.S. Army Corps of Engineers and IDEM

K. Fill Material Location and Assessment

Data gaps: Identify location and potential impact of pre-regulation sediment disposal.

Description of Study: Both the Indiana Harbor Ship Canal and the Grand Calumet River have been subject to periodic dredging in the past 100 years. Anecdotal evidence and oral history revealed that a great deal of material was removed from the river after the onset of industrial activity and prior to the implementation of environmental regulations. It is probable that these sediments were disposed in a manner that is not protective of the environment. It is possible that dredging activities may disturb old disposal areas. This study will locate and assess the potential impact of this material.

Cost of Study: Unknown at this time.

Sequence of actions: Locate material with suspected contamination; identify pathways to sediment; assess potential for contamination (present and historical).

Relative priority: The priority of this project is medium to low because the U.S. Geological Survey is currently performing a similar project. Furthermore, the Natural Resource Damage Assessment will also address these issues.

L. Handling of Materials and Storage Practices

Data Gaps: No data is available at this time.

Description of Study: The study of materials handling and storage practices at industrial facilities and how they effect the quality of sheet runoff from these areas.

Cost of Study: To be determined.

Sequence of Actions: Before beginning this project, IDEM will evaluate information currently generated from existing NPDES permits to determine if this data is sufficient for sheet pile runoff and material storage areas. Inventory all facilities with outside handling and storage areas of raw materials; identify contaminants to be monitored and over what period of time; identify

criteria for monitoring; develop a strategy for sampling frequency; prepare procedures and personnel to begin monitoring process; assess data collected and other site-related data available.

Relative Priority: Medium to low.

Responsible Entity: To be determined.

M. Underground Storage Tanks

An updated inventory of the total number of underground storage tanks in the Area of Concern is needed. Due to the high level of industrialization and urbanization in the Area of Concern, it is possible that a number of underground storage tanks may not yet be identified and some of these unidentified tanks may be leaking and contributing to the ground water contamination in the area. In addition, a study is needed to assess the nature and extent of ground water contamination related to leaking underground storage tanks in order to evaluate the effectiveness of remedial measures taken to date.

N. Air Deposition (Wet and Dry) Studies

There is currently a study under way that is monitoring dry deposition of atmospheric pollutants which is a continuation of monitoring efforts completed under a previous project. (See Chapter Five for more information about this project). Further study of wet deposition should be undertaken to compile enough data to adequately reflect the impacts of air quality regulations as they ultimately affect water quality. The following study proposals for wet and dry deposition will need to be done as outlined below.

Data Gaps: Wet deposition should be collected once the current project is completed. To date, the study area for this work has been at one location. Also no dry deposition data has been collected at any location.

Description of study: Following the study methods and parameters of the current study for wet deposition for the continuation study and adopting those methods and parameters for a new dry deposition study would provide consistency for analyses of all data collected over time. Additional sampling sites will be chosen to aid in determining the extent of water quality impacts from atmospheric deposition.

Cost of Study: The costs of the wet deposition studies from 1991 and 1994 have totaled approximately \$422,000. Costs for the future, continuing study of wet deposition and the new study of dry deposition are yet to be determined.

Sequence of Actions: Identify contaminants to be monitored and over what period of time; identify criteria for site selection of monitoring stations; develop a strategy for sampling frequency for both wet and dry; prepare procedures and personnel to begin monitoring process;

assess data collected with historic and other current data available.

Relative Priority: With adequate funding, the USGS could possibly continue with their efforts to monitor atmospheric deposition. While there is a minimum level of monitoring taking place at this time, the priority for this type of study has been medium to low.

Responsible Entity: USGS and IDEM

IV. Conclusion

To determine what information is lacking in reaching the ultimate goal of delisting the impaired uses in the Area of Concern, information regarding the state of biological health must be developed, the state of the habitat must be assessed and the source of stress must be uncovered through studies developed in the Area of Concern. This chapter presents a list of the types of studies needed to gather the information required to fill data gaps, thus allowing each layer of the Area of Concern ecosystem to be addressed.

These studies are as follows:

- Inventory of habitats, locations, and species now occupying the habitats
- Assessment of the tolerances of native and beneficial plant and animal species to pollutants located within the Area of Concern
- Assessment of migration or patterns of migration of mobile species, including interactions of species within habitats
- Studies which evaluate the feasibility of restoring, enhancing, or recreating habitat types
- Initiation of a Total Maximum Daily Load
- Storm water runoff and sediment contamination
- Combined Sewer Overflows (CSOs) as a known source of sediment accumulation/contamination
- Assessment of dewatering characteristics of odor impacts of Grand Calumet River sediment
- Grand Calumet River and Indiana Harbor Ship Canal mass balance
- Study sediment toxicity sources in the Indiana Harbor Ship Canal
- Bedload and suspended sediment discharge study at the Grand Calumet River and Indiana Harbor Canal
- Fill material loading and assessment
- Handling of materials and storage practices
- Air deposition (wet and dry) studies

CHAPTER SEVEN SURVEILLANCE AND MONITORING PROGRAM

I. Introduction

Surveillance and monitoring leads to the development of specific studies conducted to track and evaluate the successes or failures of remedial actions and goals. Specifically, monitoring will incorporate the use of environmental indicators. Indicators are developed to track an increase or decrease in environmental quality. This type of analysis, as indicated above, will allow the evaluation of remedial actions. A positive evaluation or an improvement in environmental quality will be a tool useful in restoring impaired beneficial uses. An example of the use of surveillance and monitoring and the use of environmental indicators is macrobenthic community analysis. The IDEM Office of Water Management collects samples of the macrobenthic community from six locations on the Grand Calumet River and Indiana Harbor Ship Canal. This monitoring will provide important data to assess the quality of the environment. The results of the monitoring will be converted to an Invertebrate Community Index score or ICI. These scores relate to the overall quality of the environment where the macrobenthic organisms were collected. To restore this specific impaired beneficial use, stakeholders may determine an acceptable prescribed for this aquatic system, and when that score is achieved, delisting could occur.

IDEM staff, in conjunction with interested stakeholders, are currently developing surveillance and monitoring strategies for each of the fourteen impaired beneficial uses. These strategies will be designed to measure the quality of the environment, and when the appropriate endpoints have been established, will lead to restoration of the impaired beneficial uses.

II. The Impaired Beneficial Uses

This document describes several studies necessary to complete identification of use impairments, description of causes, and quantification of sources. The purpose of this section is to develop a surveillance and monitoring program to assess the impaired beneficial uses and keep track of progress toward delisting. Because ecosystems do not recognize the artificial boundaries of the various programs within IDEM, the Remedial Action Plan Coordinating Committee decided to evaluate each impaired use individually.

The IDEM Office of Water Management (OWM) has committed to biennial monitoring of sediment contaminants at six locations on the Grand Calumet River and Indiana Harbor Ship Canal. The locations include Bridge St., Cline Ave., Kennedy Ave., Indianapolis Blvd., Sohl Ave., and at the Dickey Road bridge over the Indiana Harbor Ship Canal. The monitoring effort will provide important data to assess long term trends of the sediment contaminant levels in the Grand Calumet River and Indiana Harbor Ship Canal. It will also aid in evaluating the successes and/or failures of remediation actions and goals. Results of the samples collected in 1996 have

not been finalized.

i. Restrictions on Fish and Wildlife Consumption

When fish tissue analyses show that contaminants no longer exist at levels so as to cause a fish consumption advisory, the impaired use will be restored. This beneficial use impairment is based on the Indiana State Department of Health's annual Indiana Fish Consumption Advisory.

ii. Tainting of Fish and Wildlife Flavor

IDEM has committed to performing a statewide survey to monitor tainting of fish flavor. As a result of the Great Lakes Initiative, Northwest Indiana will be a focal point of the survey. IDEM is currently drafting a proposal for this study. Additionally, CARE's habitat subcommittee is devising a study to monitor wildlife flavor. Both phenolics and low oxygen affect the taste of fish and wildlife. Other compounds in Northwest Indiana may also taint fish and wildlife flavor.

iii. Degraded Fish and Wildlife Populations

Establishment of a monitoring program to assess change and improvement in populations of fish and wildlife species in the Area of Concern will depend on the establishment of a baseline condition of these populations. Sufficient data on fish populations may exist for the establishment of baseline conditions; however, these data have not been collected in a manner specifically designed for delisting purposes. Current monitoring programs should be modified or new programs developed that allow collection of data necessary to measure changes in specific fish populations. Such a monitoring program should provide a measure of all species present and allow for detailed enumeration of population structure and size for a small number of indicator species (species from each trophic level of the fish community should be included in this monitoring effort). After standardized methods of monitoring have been instituted and the baseline population conditions established, monitoring should be conducted at least once every five years. Delisting should be based on community goals established by the Great Lakes Fishery Commission (1995).

No evaluation of wildlife populations in the Area of Concern is currently available that would provide a baseline upon which to evaluate delisting for this impaired beneficial use. Some basic surveys of wildlife populations have been completed on select areas or sites within the Area of Concern (see TAMS, 1991; ___) but relatively little detailed information exists on wildlife populations. Data gaps identified in Chapter Six if adequately addressed should provide the foundation upon which wildlife population monitoring programs could be established. Populations that have been and are continuing

to be impacted by the decrease of and degraded condition of existing habitat. Delisting guidelines require environmental conditions which support healthy, self-sustaining communities of desired fish and wildlife at predetermined levels of abundance that would be expected from the amount and quality of suitable physical, chemical and biological habitat present in the Area of Concern. Surveys identifying the amount and quality of habitat needs to be completed prior to establishment of monitoring programs for wildlife populations. Monitoring programs should be designed such that indicators for all major classes of aquatic and terrestrial wildlife are included.

iv Fish Tumors or Other Deformities

Additional fish community surveys may be used to monitor for this impaired use. Fish community samples are collected using standard electrofishing techniques. All fish are identified to species, weighed to nearest grams, measured to nearest millimeters and checked for the presence of external anomalies. External anomalies are categorized by the acronym DELT (deformities, eroded fins, lesions, and tumors). Deformities can affect the head, spinal vertebrae, fins, and stomach shape; eroded fins are a necrosis of the tissue; lesions and ulcers appear as open sores or exposed tissue; tumors are the loss of carefully regulated cellular proliferative growth in the tissue, generally referred to as neoplasia. A virus, bacteria, parasite or exposure to toxic chemicals or the combination can cause anomalies (OEPA 1987). Anomalies that are not included with DELT anomalies are recorded as "other" (such as swirled scales and Popeye disease). "A high frequency of DELT anomalies is a good indication of poorly treated effluents, intermittent stresses, and chemically contaminated substrates."(OEPA 1987).

v. Bird or Animal Deformities or Reproductive Problems

Delisting of this impaired beneficial use can occur when incident rates of deformities or reproductive problems in sentinel wildlife species do not exceed background levels in inland control populations. Establishment of a monitoring program to determine when delisting objectives have been met will require monitoring of indicators on the Grand Calumet River or Indiana Harbor as well as similar populations at some inland location. Species selected for this type of monitoring must be relatively common and easily obtained from the areas selected for monitoring. Nesting birds should be utilized as a surrogate for other classes of wildlife in the Area of Concern, unless future problems are identified in small mammals and /or amphibians. Development of a monitoring program using Early Embryo Assay (Henshel, et. al., submitted for publication, 1997) on colony nesting birds could be an effective method of determining delisting of this impaired beneficial use in the Area of Concern.

vi. Degradation of the Benthos

At each sample location benthic community analysis and sediment toxicity tests will be performed. These tests have been tentatively planned to be performed at two year intervals. Unless there are scientific reasons to add or subtract sites, the same locations will be used for the life of the Remedial Action Plan. Results will be compiled, compared, and published in some form of periodical. The cost for this study is dependant on the number of sampling points. A detailed sampling plan will be developed in the near future.

vii. Restrictions on Dredging Activities

Monitoring stations have been chosen (Figure xv). Every two years (tentative) IDEM will collect grab samples at each monitoring station and analyze them for PCB's, PAH's, metals, and other pollutants from the Inland Dredged Materials Guidance. Before dredged sediments can be open-lake disposed, these sediments are evaluated based on the Inland Testing Manual (ITM). The ITM is a tiered approach to determine whether dredged material can be discharged into CWA Section 404 waters.

viii. Eutrophication or Undesirable Algae

IDEM's OWM Biological Studies section will examine the nutrients associated with eutrophication, such as phosphates and nitrates.

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

The IDEM's OWM Drinking Water branch evaluates all monitoring data collected by public water systems for compliance with standards. No requirements for additional treatment have been issued. Additionally, water samples should be taken regularly to detect contaminant levels below water quality standards. IDEM is currently developing rules for ground water standards.

x. Beach Closings

The National Park Service and local health agencies monitor coliform levels in Lake Michigan beaches. Swimmers exposed to elevated levels of bacteria and coincidental pathogens risk skin, ear, and intestinal infections. Therefore, pursuant to 327 IAC 2-1-6, the criteria Indiana uses to evaluate full body contact for recreational uses is as follows: *E. coli* concentrations shall not exceed 125 cells per 100 ml of water as a geometric mean based on not less than five (5) samples equally spaced over a thirty day period, nor exceed 235 cells per 100 ml of water in any one (1) sample. There are many uncertainties associated with determination of *E. coli* sources. Preliminary studies

associate high *E. coli* concentrations with heavy rainfall and wind direction, but data are not sufficient to confirm this association. Scientists do not understand how extensively tributaries transport *E. coli* to Lake Michigan.

The Inter-agency Technical Task Force on *E. coli*, consisting of technical experts from local, state, and federal agencies, has come together to develop an implementation strategy that addresses causes and solutions to *E. coli* contamination. The Task Force will develop methods of data collection, a real-time forecasting system identification of the sources and fate of bacteria and a systemic program of remediation to address this issue.

xi. Degradation of Aesthetics

Unightly or Objectionable deposits are common in the Grand Calumet River. They can be placed in three categories:

1. General refuse or debris. Shopping carts, automobile rims, and many other items have been discarded in the river and can be seen from the banks;
2. Sediment Islands. Discharge practices at the Hammond Sanitary District caused the formation of a sediment "island" in the Grand Calumet River on the west side of Columbia Avenue; and
3. Sediment Consistency. Sediment samples taken from the Grand Calumet River and Indiana Harbor Ship Canal have been referred to as "driveway sealer" because of their tar like appearance.

Prior to each report cycle, IDEM staff will traverse the river to determine if unsightly or objectionable deposits are visible. If so, photographs will be taken and published in the reporting document. Photographs will also be taken of sediment samples. These will also be published in the reporting document.

xii. Added Cost to Agriculture or Industry

The U. S. Army Corps of Engineers routinely assesses the navigability of the Indiana Harbor and Canal. These assessments are public information. The assessments will be published in periodic reporting documents.

xiii. Degradation of Phytoplankton or Zooplankton Populations

Regular phytoplankton / zooplankton samples should be taken to restore this impaired beneficial use.

xiv. Loss of Fish and Wildlife Habitat

This impaired beneficial use can be restored when the amount and quality of physical, chemical and biological habitat required to meet fish and wildlife management goals have been achieved and protected. A detailed inventory of habitats within the Area of Concern needs to be completed and then surveyed every three to five years to determine status of protection and/or restoration. These surveys should be conducted such that suitability for feeding, nesting and cover of resident and migratory birds, mammals, reptiles and amphibians can be determined. A Floristic Quality Index (Swink and Wilhelm, 1994) should be completed on areas being restored to native plant species. Stream habitat should be evaluated every three to five years after remediation/restoration activities. Ohio's Biological Criteria for the Protection of Aquatic Life (1987) or US EPA Remedial Action Plan and Bioassessment Protocols for Use in Streams and Rivers (1989) should be utilized to monitor stream habitat improvements.

III. Environmental Indicators

Most measurements can be tied to compliance monitoring activities or to specific incidents in which compliance enforcement resulted or was avoided. As we move forward, those mechanisms will continue to be used and translated into environmental indicators to measure progress. To develop environmental indicators, IDEM is developing a new program to improve the quality and reliability of data received by the agency and coordinate the information with our compliance monitoring efforts. Major efforts on developing environmental indicators will be made this year.

The Environmental Performance Partnership Agreement allows IDEM to use performance measures as the tools to assess the agency's progress toward achieving its goals and objectives. Administrative Indicators and Environmental Indicators will be used as these performance measures. Administrative Indicators are used to measure management responses that trigger or correct environmental problems. In the Partnership Agreement, Environmental Indicators are used to measure environmental stresses or conditions showing progress toward achieving environmental strategic priorities, goals, and objectives.

IV. Mapping

An increasing number of state agencies and other individuals throughout Indiana are utilizing the GPS to record and accurately locate sampling points, boundaries, and data collection points. This new technology will enhance locating major spills, etc. and accurately identifying these points on maps. The GPS will allow for quicker map making through the use of the GIS by allowing for more accurate and reproducible maps of the area.

V. Conclusion

IDEM staff are currently developing surveillance and monitoring strategies for each of the fourteen (14) impaired beneficial uses. These strategies are designed to restore these uses by identifying use impairments, describing causes, and quantifying sources. This chapter evaluated the impaired beneficial uses individually and IDEM staff will follow suit for the initial development of each surveillance and monitoring strategy. An update of continuing work in monitoring and indicators will be provided in a biennial report to be submitted to the International Joint Commission by IDEM and the CARE Committee. When there is apparent overlap within the agency or other agencies, then those uses will be addressed together.

The Environmental Performance Partnership Agreement document will aid in the delisting of these impaired beneficial uses by the creation of the environmental indicators. Some of these indicators will be the building blocks for which surveillance and monitoring strategies are established and/or revised. Each strategy may address just one or many impaired beneficial uses that can lead to the delisting of each beneficial use.

The studies that have been described in this chapter have the commitment of various agencies within the state and federal government to address and restore these beneficial uses. The administrative indicators will be the check and balance step for revising an environmental indicator whenever necessary. In turn, this will lead to the modification and reevaluation of a particular strategy.

CHAPTER EIGHT

MULTI-MEDIA DATA COORDINATION RESPONSIBILITIES

As prescribed by the Remedial Action Plan Coordinating Committee, the responsibility of the Multi-Media Data Coordination (MMDC) team is to provide coherence and consistency in data for Stage II document. The MMDC team's primary tool for achieving this is implementation of a geographic information system (GIS) for Northwest Indiana. The GIS facilitates access to locational data sets common to the other Remedial Action Plan teams.

I. Introduction

A GIS is defined as an organized collection of computer hardware, software, geographic data, and personnel designed to efficiently capture, store, update, manipulate, analyze and display all forms of geographically referenced information. GIS technology provides a means of integrating information and organizing data so that users are better able to understand the spatial relationships of the issues being addressed from different data sets. GIS can answer questions on location, conditions, trends, and patterns, as well as create models to assess possible environmental changes. Although it can create maps at different scales using different projections, GIS serves more importantly as a powerful analytical tool by allowing the user to identify the spatial relationships between map features and to associate information with those features. GIS will provide IDEM staff with a way of maximizing the use of existing data sets.

To reduce the risk of miscommunication, each of the Remedial Action Plan teams appointed a data management liaison to the MMDC team. The liaisons provide direct exchange of technical information. They were asked to assess the quality and reliability of their team's data sets to determine how they could be used in a GIS layer. To aid the liaisons in determining each team's data needs, the MMDC team conducted a survey. The survey proved beneficial in prioritizing each team's data needs, determining overlap of data needs among the different teams, and ensuring against duplication of effort in data collection. The MMDC team expects to have a data dictionary which will provide a concise description of information and limitations of information contained in each data set. The level of detail and specificity in each subdirectory will be determined by the owner of those data sets. Should a more detailed description be required, the requestor will be directed to contact the owner of that data set. The MMDC team anticipates that liaisons and members of MMDC team will adequately represent the owners of the data.

In order for the MMDC team to function over the long term as a service group, providing and archiving other groups' data and allowing access to the archives, it must respond dynamically to other teams' changing needs. The inevitable changes in environmental regulations and GIS technology will necessitate that the team undergo a continuous review and evaluation process. Consequently, the MMDC team will rely on feedback from liaisons at periodic meetings. These meetings will provide a forum for review of the MMDC team's

progress and future goals. In the event this review process is ineffective, the MMDC team will again query teams using surveys to determine their data needs and priorities and define future activities.

II. Resource Assessment

From a budgetary standpoint, short term needs are adequately addressed through existing resources. The dynamic nature of GIS means long term objectives may require long term funding. Options for funding projects include annual program grants from U.S. EPA and cooperative funding projects with federal and local agencies. Projects requiring this level of support would include the development and maintenance of new data sets and the establishment of GIS programs within a working unit. Should such needs be identified, the MMDC team will request the other committees implement such funding mechanisms.

In addition to one pentium computer and monitor, copies of GIS software were provided to Remedial Action Plan teams and supporting staff. This software, Arc View, is user-friendly and is produced by Environmental Systems Research Institute, Inc. (ESRI). IDEM's agency standard GIS software, ARC/INFO, also produced by ESRI is compatible with Arc View. Coverages which are created and manipulated using ARC/INFO can be made available to Arc View users, allowing GIS technology to be more broadly utilized within the agency. As IDEM currently has on staff an ESRI certified instructor, in-house training for Arc View will be provided for team members.

III. Data Sharing

Data sharing is an issue of much concern for the MMDC team. When a data request is received, the team attempts to fill the request within one month. The shared coverages include boundaries, buildings, fences, and lakes. All were digitized from facility maps.

Requests that come from within IDEM are relatively easy to fill. Outside requests pose a number of problems. Some of the data in the Remedial Action Plan GIS is deliberative. Providing easy access to some of the information may have damaging consequences. For example, providing the general public with access to IDNR's Heritage database which identifies habitat location of rare, threatened and endangered species could ultimately threaten the well-being of these species.

Another difficulty regarding data sharing is the compatibility of data. Therefore, all data collection will conform to the Indiana State Agencies ARC/INFO Data Collection Standard (see Appendix). This will ensure that the data being collected and the technology being used complies with established guidelines of quality and compatibility. Standards for GIS are critically important to ensure consistency in the databases and GIS applications that are being developed within the state agencies. Standards will provide guidance in transferring files, overlaying data,

sharing data and developing integrated systems. Before submitting any datasets to the MMDC team in the specified electronic format, each team is responsible for quality assurance and quality control of its own data.

The MMDC team has formulated a data sharing policy that will be implemented upon approval by upper management and the completion of a data dictionary. In the interim, all data requests will go through the Remedial Action Plan Coordinating Committee to the agency GIS Coordinator who will fill the request from a limited selection of formats. This GIS Coordinator will also ensure that consistency concerns and legal obligations are being honored. Although the MMDC team has committed to forwarding data requests not owned by IDEM to the respective agency, the GIS coordinator will provide less restricted subsets in response to requests from within IDEM.

GIS technology used by collaborating agencies and groups has great potential to exponentially improve the decision-making capability of the individual groups through maximizing each group's existing data sets. An example of this type of collaboration is the Northwest Indiana Action Plan. This project is a collaboration between U.S. EPA and IDEM to bring about long term restoration and environmental protection, stronger communication and more effective use of resources. GIS advances made by Remedial Action Plan committees have the potential to aid Northwest Indiana Action Plan committees in the accomplishments of their goals. Similarly, any progress made by Northwest Indiana Action Plan committees could benefit Remedial Action Plan committees. U.S. EPA members of Northwest Indiana Action Plan committees have already incorporated Arc View and ARC/INFO to support their data needs. Some of the first projects to be undertaken involve making existing EPA data sets available through Arc View technology.

In addition to collaborating with other agencies as a way of enhancing data sharing capabilities, IDEM is currently investigating the appropriateness of using the internet as a medium for sharing data. In the event this becomes a reality, the MMDC team will develop a homepage for the Remedial Action Plan GIS. Ultimately, the data sharing process will be automated. IDEM perceives this as one of its strongest options for implementation of a data sharing service.

Supplementary Material
for the
Stage II Remedial Action Plan

Glossary of Common Terms

Acidification: Tending to form an acid. (The American Heritage College Dictionary, third edition, Houghtin Mifflin Company 1993).

Anthropogenic: The scientific study of the origin and development of human beings. (The American Heritage College Dictionary, third edition, Houghtin Mifflin Company 1993).

Aquifer: An underground geological formation, or group of formations, containing usable amounts of groundwater that can supply wells and springs. (United States Environmental Protection Agency, Terms of Environment 1994).

Benthos: The collection of organisms living on or in sea or lake bottoms. (p. 129, The American Heritage College Dictionary, third edition, Houghtin Mifflin Company 1993).

Best Management Practices: Methods that have been determined to be the most effective, practical means of preventing or reducing pollution from non-point sources. (United States Environmental Protection Agency, Terms of Environment 1994).

Best Management Practices: Schedules of activities, prohibitions of practice, treatment requirements, operation and maintenance procedures, use of containment facilities, and other management practices to prevent or reduce the pollution of waters of the state. BMPs can be employed, for example to control plant site runoff, spillage or leaks, sludge or waste disposal, or drainage from raw materials storage resulting from manufacturing, commercial, mining, or silvicultural activities. (327 IAC 5-1-2(5), 1997).

Bioaccumulative chemicals of concern: Any chemical which, upon entering the surface waters, by itself or as its transformation product, bioaccumulates in aquatic organisms by a factor greater than one thousand (1,000) at six percent (6%) lipids. (Indiana Department of Environmental Management, Office of Water Management, revisions to 327 IAC 2-1, 2-1.5, 5 and 15, 1997).

Bioavailability: The property of a toxicant that governs its effect on exposed organisms. A reduced bioavailability would have a reduced toxic effect). (Burton, Manual for Evaluating Stormwater Runoff Effects in Receiving Waters 1991 Draft).

Bioconcentration: The increase in concentration of the chemical of concern and its metabolites in or on the target organism (or specified tissues thereof) relative to the concentration of the chemical of concern in the ambient water. (Indiana Department of Environmental Management, Office of Water Management, revisions to 327 IAC 2-1, 2-1.5, 5 and 15, 1997).

Biodiversity: Refers to the variety and variability among living organisms and the ecological

complexes in which they occur. Diversity can be defined as the number of different items and their relative frequencies. For biological diversity, these items are organized at many levels, ranging from complete ecosystems to the biochemical structures that are the molecular basis of heredity. Thus, the term encompasses different ecosystems, species, and genes. (United States Environmental Protection Agency, Terms of Environment 1994).

Bioindicator (indicators of the environment): Measurable features used to show environmentally significant trends, reflect a change in human welfare due to a change in the environment, and measure environmental stresses, conditions and management responses. (Indiana Department of Environmental Management Fact Sheet 1996).

Biological Magnification: Refers to the process whereby certain substances such as pesticides or heavy metals move up the food chain, work their way into rivers or lakes, and are eaten by aquatic organisms such as fish, which in turn are eaten by large birds, animals or humans. The substances become concentrated in tissues or internal organs as they move up the chain. (United States Environmental Protection Agency, Terms of Environment 1994).

Biomonitoring: The use of living organisms to test the suitability of effluents for discharge into receiving waters and to test the quality of such waters downstream from the discharge. (United States Environmental Protection Agency, Terms of Environment 1994).

Carcinogen: A chemical which causes an increased incidence of benign or malignant neoplasms, or a substantial decrease in the latency period between exposure and onset of neoplasm through oral or dermal exposure, or through inhalation exposure when the cancer occurs at nonrespiratory sites in at least one (1) mammalian species or man through epidemiological and/or clinical studies. (Indiana Department of Environmental Management, Office of Water Management, revisions to 327 IAC 2-1, 2-1.5, 5 and 15, 1997).

Chironomus tentans: *c. tentans*, Test organism. (Hoke et al., 1993)

Chronic toxicity: The capacity of a substance to cause long-term poisonous human health effects. (United States Environmental Protection Agency, Terms of Environment 1994).

Clean up: After June 30, 1997, clean up means, for purposes of Indiana Code 13-18-6, to take the action necessary to neutralize, remove, collect, gather, pump, separate, cover, and as is otherwise necessary, affirmatively act to most effectively prevent, minimize, or mitigate damage or threatened damage to: public health, safety, and welfare; aquatic biota; animal life; plant life; or recreational, domestic, commercial, industrial, or agricultural water uses; as a result of a spill. (Indiana Department of Environmental Management, IC 13-11-2-28, 1997).

Contaminant: Any solid, semi-solid, liquid, or gaseous matter, or any odor, radioactive material, pollutant (as defined in the federal Solid Waste Disposal Act (42 U.S.C. 6901 et seq.), as in effect on January 1, 1989), hazardous waste (as defined by the Federal Water Pollution

Control Act (33 U.S.C. 1251 et seq.), as in effect on January 1, 1989), any constituent of a hazardous waste, or any combination of the items described in this section, from whatever source that: is injurious to human health, plant or animal life or property; interferes unreasonably with the enjoyment of life or property; or otherwise violates: environmental management laws; or rules adopted under environmental laws. (Indiana Department of Environmental Management, IC 13-11-2-44, 1997).

Criteria pollutants: The 1970 amendments to the Clean Air Act required the U.S. EPA to set National Ambient Air Quality Standards for certain pollutants known to be hazardous to human health. EPA has identified and set standards to protect human health and welfare for six pollutants: ozone, carbon monoxide, total suspended particulate, sulfur dioxide, lead, and nitrogen oxide. The term, "criteria pollutants" derives from the requirement that U.S. EPA must describe the characteristics and potential health and welfare effects of these pollutants. It is on the basis of these criteria that standards are set or revised. (United States Environmental Protection Agency, Terms of Environment 1994).

Designated use: Under 327 IAC 2-1-3, as amended under the Great Lakes Initiative rulemaking, water uses are designated by the water pollution control board. (Indiana Department of Environmental Management, Office of Water Management, revisions to 327 IAC 2-1-3, 1997).

Effluent: A wastewater discharge from a point source to the waters of the state. (Indiana Department of Environmental Management, Office of Water Management, revisions to 327 IAC 2-1, 2-1.5, 5 and 15, 1997).

Effluent limitation: Any restriction established by the commissioner of quantities, discharge rates, and concentrations of pollutants that are discharged, or will be discharged, from point sources into waters of the state of Indiana. (Indiana Department of Environmental Management, Office of Water Management, revisions to 327 IAC 5-1-2(13), 1997).

Eutrophication: The process of the accumulation of refractory organic debris in the sediments of a body of water, and the buildup of organic matter and nutrient concentrations in the water column which occur naturally, as well as a decrease in the depth of the body of water caused by sediment accumulation. The process occurs over hundreds of thousands of years and can eventually cause most lakes to fill up with sediments. (Laws, Aquatic Pollution: An Introductory Text, second edition, 1993).

Geohydrology: The combined geology and hydrology of the area of concern. In this case, the geologic deposits of concern to this study are bedrock deposits of Silurian and Devonian age and unconsolidated deposits of Quaternary age. The four hydrologic units of concern to this study are surface-water bodies, the unconsolidated sand aquifer, the unconsolidated silt and clay confining unit, and the carbonate aquifer. (United States Environmental Protection Agency and United States Geological Survey, Water-Resource Investigations Report 95-4253, Geohydrology, Water Levels and Directions of Flow, and Occurrence of Light-Nonaqueous-Phase Liquids on

Ground Water in Northwestern Indiana and the Lake Calumet Area of Northeastern Illinois 1996).

GIS (Geographic Information System): A computer system designed for storing, manipulating, analyzing, and displaying data in a geographic context. (United States Environmental Protection Agency, Terms of Environment 1994).

Groundwater: Such accumulations of underground water, natural and artificial, public and private, or parts thereof, which are wholly or partially within, flow through, or border upon this state, but excluding manmade underground storage or conveyance structures. (Indiana Department of Environmental Management, Office of Water Management, revisions to 327 IAC 2-1, 2-1.5, 5 and 15, 1997).

Habitat: The place where a population (e.g., human, animal, plant, microorganism) lives and its surroundings, both living and non-living. (United States Environmental Protection Agency, Terms of Environment 1994).

Hyalella azteca: *h. azteca*, Test organism. (Hoke et al., 1993).

Holistic: Emphasizing the importance of the whole and the interdependence of its parts. (The American Heritage College Dictionary, third edition, Houghtin Mifflin Company 1993).

Hydrologic Cycle: The way in which water moves around the earth. During its endless circulation from ocean to atmosphere to earth and back to ocean, the water is stored temporarily in streams, lakes, the soil or groundwater and becomes available for use. (Dunne, Water in Environmental Planning, W.H. Freeman and Company, New York, 1978, 13th printing 1995 VB).

Lichens: A fungus, usually of the class Ascomycetes, that grows symbiotically with algae, resulting in a composite organism that characteristically forms a crust-like or branching growth on rocks or tree trunks. (The American Heritage College Dictionary, third edition, Houghtin Mifflin Company 1993).

Macroinvertebrate: Large invertebrate organisms sometimes arbitrarily defined as those retained by sieves with 0.425 - mm to 1.0 - mm mesh screens. (Burton, Manual for Evaluating Stormwater Runoff Effects in Receiving Waters, 1991 Draft).

Nonpoint sources: Diffuse pollution sources (i.e., without a single point of origin or not introduced into a receiving stream from a specific outlet). The pollutants are generally carried off the land by storm water. Common non point sources are agriculture, forestry, urban, mining, construction, dams, channels, land disposal, saltwater intrusion, and city streets. (United States Environmental Protection Agency, Terms of Environment 1994).

Oxidants: A substance containing oxygen that reacts chemically in air to produce a new substance; the primary ingredient of photochemical smog. (United States Environmental Protection Agency, Terms of Environment 1994).

Particulate matter: Any airborne finely divided solid or liquid material, excluding uncombined water, with an aerodynamic diameter smaller than one hundred (100) micrometers. PM_{10} is any particulate matter with an aerodynamic diameter less than or equal to a nominal ten (10) micrometers as measured by an applicable reference method specified in 40 CFR Part 50 or by an equivalent or alternative method approved by the commissioner. Total suspended particulate (TSP) is any particulate matter as measured by the method described in Appendix B of 40 CFR Part 50.

Point Sources: A discernible, confined, and discrete conveyance from which wastewater is or may be discharged to the waters of the state. (Indiana Department of Environmental Management, Office of Water Management, revisions to 327 IAC 2-1, 2-1.5, 5 and 15, 1997).

Pollutant: Means, but is not necessarily limited to, dredged spoil, incinerator residue, filter backwash, sewage, garbage, sewage sludge, munitions, chemical wastes, solid wastes, toxic wastes, hazardous substances, biological materials, radioactive materials (except those regulated under the Atomic Energy Act of 1954, as amended; 42 U.S.C. 2011, et seq.), heat, wrecked, or discarded equipment, rock, sand, cellar dirt, and other industrial, municipal, and agricultural waste discharged into water. (Indiana Department of Environmental Management, Office of Water Management, 327 IAC 3-1-2, 1997).

Primary NAAQS: National Ambient Air Quality Standards designed to protect human health with an adequate margin for safety. (United States Environmental Protection Agency, Terms of Environment 1994).

Protocol: A series of formal steps for performing a test. (United States Environmental Protection Agency, Terms of Environment 1994).

REMEDIAL ACTION PLAN (Remedial Action Plan): A remedial action plan is an ecosystem restoration plan for an Area of Concern that addresses the impairments to the fourteen beneficial uses, as designated by the International Joint Commission. (Indiana Department of Environmental Management, Remedial Action Plan Stage I, 1991).

Remediation: Actions necessary to: prevent; minimize; or mitigate damages to the public health or welfare or to the environment that may otherwise result from a release or threat of a release. Actions consistent with a permanent remedy taken instead of or in addition to removal actions if a release or threaten release of a hazardous substance or petroleum into the environment occurs to eliminated the release of hazardous substances or petroleum so that the hazardous substances or petroleum do not migrate to cause substantial danger to present or future public health or welfare or the environment. The cleanup or removal of released hazardous

substances or petroleum from the environment. (Indiana Department of Environmental Management, IC 13-11-2-186, 1997).

Secondary NAAQS: National Ambient Air Quality Standards designed to protect welfare, including effects on soils, water, crops, vegetation, manmade materials, animals, wildlife, weather, visibility, and climate; damage to property; transportation hazards; effects on economic values, and on personal comfort and well-being. (United States Environmental Protection Agency, Terms of Environment 1994).

Sediment: Native and non-native materials that have settled in a body of water.

Slag: The vitreous mass left as a residue by the smelting of metallic ore. (The American Heritage College Dictionary, third edition, Houghtin Mifflin Company 1993).

Superfund: The program operated under the legislative authority of CERCLA and SARA that funds and carries out EPA solid waste emergency and long-term removal and remedial activities. These activities include establishing the National Priorities List, investigating sites for inclusion on the list, determining their priority and conducting and/or supervising the cleanup and other remedial actions. (United States Environmental Protection Agency, Terms of Environment 1994).

Toxic Substances: Substances which are or may become harmful to plant or animal life, or to food chains when present in sufficient concentrations or combinations. Toxic substances include, but are not limited to, those pollutants identified as toxic under section 307(a)(1) of the Clean Water Act. (Indiana Department of Environmental Management, Office of Water Management, revisions to 327 IAC 2-1, 2-1.5, 5 and 15, 1997).

Troposphere: The layer of the atmosphere closest to the earth's surface. (United States Environmental Protection Agency, Terms of Environment 1994).

Watershed: A drainage area of basin in which all land and water areas drain or flow toward a central collector such as a stream, river, or lake at a lower level elevation. (United States Environmental Protection Agency, EPA-840-B-92-002, January, 1993).

Bibliography

Anderson, H.A., M.D., J. R. Amrhein, P. Shubat, J. Hesse. *Protocol for a Uniform Great Lakes Sport Fish Consumption Advisory*. 1993. Great Lakes Fish Advisory Task Force Protocol Drafting Committee.

Bacone, J.A. October 1979. Shell Oil Dune and Swale: A report on a natural area. Division of Nature Preserves, Indiana Department of Natural Resources, State of Indiana.

Bright, G.R. "Recent Water Quality in the Grand Calumet River as Measured by Benthic Invertebrates", *Proceedings of the Indiana Academy of Science*. vol. 98, p. 229-233. 1988.

Brinkhurst, R.O. and G.C. Cook. 1974. "Aquatic Earthworms (Annelida: Oligochaeta) in C.W." Hart and S.L.H. Fyuller eds., *Pollution Ecology of Freshwater Invertebrates*. Academic Press. p. 143-156.

Brinkhurst, R.O., K.E. Chua and N.K. Kaushik. 1972. "Interspecific Interaction and Selective Feeding of Tubificid Oligochaetes", *Limnology and Oceanography*. vol. 17, p. 122-133.

Chrzastowski, M.J. and T.A. Thompson. 1992. Late Wisconsin and Holocene coastal evolution of the southern shore of Lake Michigan. *Society for Sedimentary Geology* 48:397-413.

Burton, G.A. 1991. "Assessment of Freshwater Sediment Toxicity", *Environmental Toxicology and Chemistry*. vol. 10, p. 1585-1627.

Chapman, P.M. 1989. "Current Approaches to Developing Sediment Quality Criteria", *Environmental Toxicology and Chemistry*. vol. 8, p. 589-599.

Federal Water Pollution Control Act As Amended By The Clean Water Act of 1977. Bureau of National Affairs, Inc., Washington, DC.

Cook, D.G. and M.G. Johnson. 1974. "Benthic Macroinvertebrates of the St. Lawrence Great Lakes", *Journal of the Fisheries Research Board of Canada*. vol. 3, p. 763-782.

Crispin, S. and D. Rankin. January 1994. The conservation of biological diversity in the Great Lakes ecosystem: issues and opportunities. The Nature Conservancy Great Lakes Program, Chicago, Illinois, USA.

Dunne, Thomas, and Leopold Luna. 1995. *Water in Environmental Planning*. W.H. Freeman and Company. New York, NY.

Fenelon, J.M. and L.R. Watson. 1993. *Geohydrology and Water Quality of the Calumet Aquifer in the Vicinity of the Grand Calumet River/Indiana Harbor Canal, Northwestern Indiana*. U.S. Geological Survey. Water-Resources Investigations Report 92-4115.

Fullner, R.S. 1971. "A Comparison of Macroinvertebrates Collected by Basket and Modified Multiple-plate Samplers", *Journal of the Water Pollution Control Federation*. vol. 43, p. 494-499.

Hilsenhoff, W.L. 1988. "Rapid Field Assessment of Organic Pollution with a Family Level Biotic Index", *Journal of the North American Benthological Society*. vol. 7(1), p. 65-68.

Hoke, R.A., J.A. Giesy, M. Zabik, and M. Unger. 1993. "Toxicity of sediments and sediment pore waters from the Grand Calumet River-Indiana Harbor, Indiana Area of Concern", *Ecotoxicology and Environmental Safety*. vol. 26, p. 86-112.

Indiana Department of Environmental Management. 1994. *First Annual Report on Pollution Prevention Progress for the Indiana Department of Environmental Management: for July 1, 1990 to July 1, 1994*. Indiana Department of Environmental Management. Office of Pollution Prevention and Technical Assistance. Indianapolis, IN.

Indiana Department of Environmental Management. *1994 Annual Report on Pollution Prevention in Indiana: A Period of Progress and Change July 1, 1990-July 1, 1994*. August 1994. Office of Pollution Prevention and Technical Assistance. Indiana Department of Environmental Management. Indianapolis, IN.

Indiana Department of Environmental Management. 1994. *Indiana 305(b) Report, 1992-1993*. Office of Water Management, Water Quality Surveillance and Standards Branch. Indianapolis, IN.

Indiana Department of Environmental Management. June 1989. *Indiana Nonpoint Source Water Pollution Management Plan*. Office of Water Management, Nonpoint Source Section. Indianapolis, IN.

Indiana Department of Environmental Management. 1996. *Section 319 Annual Report and Section 319 Semiannual Report, 1994-1995*. Office of Water Management, Nonpoint Source Section. Indianapolis, IN.

Indiana Department of Environmental Management. June 1989. *State of Indiana Nonpoint Source Assessment Report*. Office of Water Management, Nonpoint Source Section, Indianapolis, IN.

Indiana Department of Health (ISDH), Indiana Department of Environmental Management (IDEM), and Indiana Department of Natural Resources. 1997. *1997 Indiana Fish Consumption*

Advisory. State of Indiana. Indianapolis, IN.

Jafvert, Chad T. and Michael L. Ketcham. June 1994. *A GIS Toolbox for Targeting Nonpoint Source Pollution in Urban Areas, Demonstrated with the Grand Calumet River Watershed, Indiana*. School of Civil Engineering, Purdue University. West Lafayette, IN.

Kay, Robert T., Richard F. Duwelius, Timothy A. Brown, Frederick A. Micke, and Carol Witt-Smith. 1996. *Geohydrology, Water Levels and Directions of Flow, and Occurrence of Light-Nonaqueous-Phase Liquids on Ground Water in Northwestern Indiana and the Lake Calumet area of Northeastern Illinois*. U.S. Geological Survey. Water-Resources Investigations Report 95-4253.

Klemm, D.J.; P.A. Lewis; F. Fulk; and J.M. Lazorchak. 1990. *Macroinvertebrate Field and Laboratory Methods for Evaluating the Biological Integrity of Surface Waters*. U.S. Environmental Protection Agency (USEPA), Office of Research And Development, Office of Modeling, Monitoring Systems, and Quality Assurance. EPA 600/4-90/030. Environmental Monitoring Systems Laboratory. Cincinnati, OH.

Kennedy, C.R. 1965. "The Distribution and Habitat of *Limnodrilus claparede* and Its Adaptive Significance", *Oikos*. vol. 16, p. 26-28.

Ketcham, Michael L., V. Prasad Kunchakarra, and Chad T. Jafvert. December 1992. *Urban Targeting of Nonpoint Source Pollution in the Grand Calumet River Watershed*. School of Civil Engineering, Purdue University. West Lafayette, IN.

Landman, Bernard, IDEM Assistant Commissioner for the Office of Water Management. *Letter to Dale S. Bryson, Director Water Division, U.S. EPA, Region V*. February 9, 1993.

Lindsey, Greg, Ulrich, Dana, Burnham, Scott, and Duncker, Caroline. March 1995. *Urban Nonpoint Source Pollution Control in Indiana: An Assessment*. Center for Urban Policy and the Environment, School of Public and Environmental Affairs, Indiana University. Indianapolis, IN.

Moore, P.A. 1959. *The Calumet Region: Indiana's last frontier*. Indiana Historic Bureau, Indianapolis, Indiana, USA.

National Park Service. 1987. NPFLORA/COMMON: Coverage by Acreage of National Park Service Units, Unpublished NPS document.

National Park Service Air Resources Division, *National Park Services Visibility Research Program Fact Sheet*, Web Page.

Northwestern Indiana Regional Planning Commission. December 1994. *Air Quality Conformity Determination, Northwestern Indiana Regional Transportation Plan and Fiscal Year*

1995 Transportation Improvement Program. Portage, IN.

Ohio Environmental Protection Agency. 1989. *Biological criteria for the protection of aquatic life: Volume III: standardized biological field sampling and laboratory methods for assessing fish and macroinvertebrates*. Division of Water Quality Monitoring and Assessment, Columbus, OH.

Procedures for the Preparation of Emissions Inventories for Carbon Monoxide and Precursors of Ozone, Volume I, Draft Report. May 1991. Alliance Technologies Corporation, EPA Contract No. 68-D9-0173.

Simon, T.P., G.R. Bright, J. Rud, and J. Stahl. 1988. "Water quality characterization of the Grand Calumet River Basin using the Index of Biotic Integrity", *Proceedings of the Indiana Academy of Science*. vol. 98.

Simon, T.P. 1991. *Development of Index of Biotic Integrity expectations for the Ecoregions of Indiana. I. Central Corn Belt Plain*. EPA 905/9-91/025. U.S. Environmental Protection Agency Region V, Environmental Sciences Division, Monitoring and Quality Assurance Branch: Ambient Monitoring Section, Chicago, IL.

Sobiech, S.A., T.P. Simon, and D.W. Sparks. 1994. *Pre-Remedial biological and water quality assessment of The East Branch Grand Calumet River Gary, Indiana, June, 1994*. U.S. Fish and Wildlife Service Biological Report.

Stephan, C.E., D.I. Mount, D.J. Hansen, J.H. Gentile, G.A. Chapman, and W.A. Brungs. 1985. *Guidelines for deriving numerical national water quality criteria for the protection of aquatic organisms and their uses*. PB85-227049. National Technical Information Service. Springfield, VA.

State of Wisconsin. *Wisconsin 1995 Air Quality Report*. June 1996. Publication Number PUBL-AM-184-96. Department of Natural Resources, Bureau of Air Management. Madison, WI.

Swink, F. and G. Wilhelm. 1994. *Plants of the Chicago region*. Indiana Academy of Science. The Morton Arboretum. Lisle, Illinois, USA.

Mierzwa, K.S., S. Culberson, K.S. King, and C. Ross. 1991. *Illinois-Indiana regional airport study: Biotic communities*. Technical Paper No. 7, Appendix E, Volume II. TAMS Consultants Consultants, Inc. Chicago, Illinois, USA.

U.S. Department of Agriculture. , 1997. *Natural Resource Planning Guide for Indiana*. U.S. Department of Agriculture, Natural Resources Conservation Service.

- U.S. Fish and Wildlife Service. 1996. *Fish and Wildlife Coordination Act Report for the Indiana Harbor and Ship Canal Maintenance Dredging and Disposal Project*. U.S. Fish and Wildlife Service.
- U.S. Department of Transportation. 1985. *Effects of Highway Runoff on Receiving Waters*. Turner-Fairband Highway Research Center. McLean, VA.
- U.S. Department of Transportation. 1984. *Sources and Migration of Highway Runoff Pollutants*. Turner-Fairband Highway Research Center. McLean, VA.
- U.S. Environmental Protection Agency. 1995. *Great Lakes Program Progress Report: United States Report to the International Joint Commission*. U.S. Environmental Protection Agency. Chicago, Illinois.
- U.S. Environmental Protection Agency. 1985. *Master plan for improving water quality in the Grand Calumet River/Indiana Harbor Canal*. EPA 905/9-84-003C. U.S. Environmental Protection Agency, Region V. Chicago, IL.
- U.S. Environmental Protection Agency. 1990. *Biological Criteria: National Program Guidance for Surface Waters, Criteria and Standards Division*. EPA 440/5-90/004. U.S. Environmental Protection Agency. Washington, DC.
- U.S. Environmental Protection Agency. May 1994. *Deposition of Air Pollutants to the Great Waters, First Report to Congress*. EPA-453-R-93-055. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, NC.
- U.S. Environmental Protection Agency. October 1995. *National Air Quality and Emissions Trends Report, 1994*. EPA 454/R-95-014. U.S. Environmental Protection Agency, Office of Air Quality Planning and Standards. Research Triangle Park, NC.
- U.S. Environmental Agency. 1991. *Guidance for Water Quality-Based Decisions: The TMDL Process*. EPA 440/4-91-001. U.S. Environmental Protection Agency, Office of Water. Washington, DC.
- Wente, S.P. 1994. *Sediment background concentration distributions of 172 potential pollutants in Indiana*. National Network for Environmental Management Studies (NNEMS), Environmental Education Division (1701). U.S. Environmental Protection Agency and Indiana Department of Environmental Management, Office of Water Management. Indianapolis, IN
- Wilhelm, G.S. 1990. *Special vegetation of the Indiana Dunes National Lakeshore*. The Morton Arboretum. Lisle, Illinois, USA.

CARE Mission Statement

The purpose of the Citizen's Advisory for the Remediation of the Environment (CARE) Committee is to advise IDEM on development and implementation of the Remedial Action Plan (REMEDIAL ACTION PLAN) for the Grand Calumet River, Indiana Harbor Ship Canal and Nearshore Lake Michigan Area of Concern. CARE also will advise other agencies that work with IDEM to ensure consistency and adherence with the REMEDIAL ACTION PLAN and to ensure that these agencies promote the REMEDIAL ACTION PLAN. The REMEDIAL ACTION PLAN is a State requirement of the 1987 Great Lakes Water Quality Agreement that mandates an ecosystem approach for restoring beneficial uses.

Specifically, the purpose of CARE is to:

- Advise IDEM on the REMEDIAL ACTION PLAN
- Review components of the REMEDIAL ACTION PLAN
- Advocate and encourage agencies' actions to be consistent with the REMEDIAL ACTION PLAN
- Review State resources pertaining to the REMEDIAL ACTION PLAN
- Advise IDEM on adequacy of components
- Recommend a time-line for implementation of the REMEDIAL ACTION PLAN
- Promote activities consistent with the REMEDIAL ACTION PLAN
- Monitor and track implementation, and suggest appropriate action

List of Current CARE Members

The current CARE members and their organizational designees, if any, are as follows:

City Appointees

Hon. Scott King
Mayor of Gary, Indiana

Hon. Robert A. Pastrick
Mayor of East Chicago, Indiana

Hon. Duane W. Dedlow, Jr.
Mayor of Hammond, Indiana

Environmental Organization Appointees

Ms. Dorreen Carey
Former Grand Calumet River Task Force
Current, City of Gary

Mr. Steve Skavorneck
Lake Michigan Federation

Ms. Zemmer Morris
GARD

Tom Anderson
Save the Dunes

Corporate Appointees

Mr. Dan Wilson, Plant Mgr.
AMOCO Refinery

Mr. John Fekete
Indiana Steel
Industry Advisory Commission

Mr. Thomas McDermott
Northwest Indiana Forum

City Designees

none

Michael Suty
Utilities Director

Ronald Novak
Milan Kruszynski

Organizational Designees

Bowden Quinn
Grand Calumet River Task Force

Ms. Eleanor K. Roemer
Lee Botts

none

none

Corporate Designees

Ms. Julie Murphy
Mr. Shiv Baloo

Mr. Gary Allie

Ms. Christine Newell

Mr. Peter Wilke
The Hammond Group, Inc.

Mr. Mark Volkman

Academic Institution Appointees

Institutional Designee

Dr. Mark Reshkin
Indiana University Northwest

none

Citizen-At-Large Appointee

Ms. Lorraine Stasek

The services provided by former CARE member Sue Lynch, former Executive Director of the People Against Hazardous Landfill Sites ("PAHLS") were invaluable.

CARE's Subgroups responses to the challenge of restoring the Area of Concern provided an excellent foundation for the development of the Stage II document. The co-Chairpersons for CARE's Subgroups are:

Paul Labus
Habitat Subcommittee

Dan Olson
Toxic Pollution Prevention Workgroup

Tom Anderson
Lagoon Subcommittee

RAP Technical Team Members

The following list is by no means complete. Participants are listed under their primary team. Most participants contributed to more than one team.

Sediments Team

John Fekete (Inland Steel, CARE Champion)
Scott Ireland (IDEM, OWM)
Mary Fulghum (U.S. EPA)

Water Quality Team

Lee Botts (Lake Michigan Federation, CARE Champion)
Reggie Baker (IDEM, OWM)
Lonnie Brumfield (IDEM, OWM)
Dennis Clark (IDEM, OWM)
Lee Bridges (IDEM, OWM)
Brad Gavin (IDEM, OWM)
Rob Duncan (IDEM, OWM)
Jim Stahl (IDEM, OWM)
Amira Loney (IDEM, OWM)
Shelley Blakely (IDEM, OWM)
Demaree Thiesen (IDEM, OWM)
Stephanie Riddle (IDEM, OWM)
Andrew Pelloso (IDEM, OWM)
Dave Tennis (IDEM, OWM)
Brett Crump (IDEM, OWM)
Marty Maupin (IDEM, OWM)

Nonpoint Source Team

Doreen Carey (Grand Calumet Task Force, CARE Champion)
Sharon Jarzen (IDEM, OWM)
Joanna Wood (IDEM, OWM)
Chris Tippie (NRCS Liason)
Mike Kuss (IDEM, OWM)
Jean Lambert (IDEM, OWM)
Kathy Baird (IDEM, OWM)

Land and Groundwater Remediation Team

Julie Murphy (Amoco, CARE Champion)
Shiv Baloo (Amoco)
Elizabeth San Miguel (IDEM, OSHWM)
Jeff Sewell (IDEM, OSHWM)

Air Quality Team

Tom Anderson (Save the Dunes Council, CARE Champion)
Janet McCabe (IDEM, OAM)
Mike Brooks (IDEM, OAM)
Paula Smith (IDEM, OAM)

Habitat Restoration Team

Chris Newell (NIPSCO, CARE Champion)
Jim Smith (IDEM, OER)
Dawn Deady (IDNR)
Paul Labus (The Nature Conservancy)

Multimedia Data Coordination Team

Dr. Mark Reshkin (Indiana University Northwest, CARE Champion)
Roger Koelpin (IDEM, OSHWM)
Irv Goldblat (IDEM, MIS)
Audry Hyde (IDEM, OSHWM)
Russ Grunden (IDEM, MACS)

Remedial Action Plan Coordinator

Beth Admire

Legal Counsel

Jody Harney

List of Participants

Listed below are the internal participants, i.e., offices within IDEM that can provide technical and/or financial support toward comprehensively addressing the impaired beneficial uses. Also listed are partners external to the IDEM which can address these problems. These include federal, state, county, local, and nonprofit organizations, in addition to other interested entities and individuals potentially available as partners in the Area of Concern.

Internal Participants:

- Northwest Regional Office
- Office of Water Management
- Office of Air Management
- Office of Solid and Hazardous Waste Management
- Office of Environmental Response
- Office of Pollution Prevention and Technical Assistance
- Office of Media and Communication Services
- Office of Enforcement
- Office of Legal Counsel

External Participants:

Municipal Participants

- City of Gary
- City of Hammond
- City of East Chicago
- Gary Sanitary District
- Hammond Sanitary District
- East Chicago Sanitary District
- East Chicago Waterway Management District

State Participants

- Indiana Department of Natural Resources (IDNR)
 - Division of Water
 - Division of Fish and Wildlife
 - Division of Forestry
 - Division of Nature Preserves
 - Division of Outdoor Recreation
 - Division of Soil Conservation

- Indiana Geological Survey (IGS)
- Indiana University
- Purdue University

Federal Participants

U.S. Environmental Protection Agency (U.S. EPA)
U.S. Army Corps of Engineers (U.S. ACE)
U.S. Department of Agriculture, Natural Resources Conservation Service (NRCS)
U.S. Fish and Wildlife Service (U.S. FWS)
U.S. Geological Survey (USGS)
National Oceanic and Atmospheric Administration (NOAA)
National Park Service

Other Participants:

Citizens' Advisory for Remediation of the Environment
(CARE) Committee
Habitat Subcommittee
The Nature Conservancy (TNC)
Friends of Gibson Woods
Cooperative Extension Service Sea Grant Program
Grand Cal Task Force
Save the Dunes Council
Hoosier Environmental Council
Lake Michigan Federation
Northwestern Indiana Regional Planning Commission
Natural Resources Commission
Other private sector (industrial/commercial) entities including:
NIPSCO
Inland Steel
U.S. Steel, Gary Works
DuPont

How to Obtain IDEM Northwest Indiana RAP GIS Data

RAP GIS Database Request/Database Correction Form

Requests: Each request is to include the completed attached form, your floppies or tape, name, title, organization, phone number and mailing address. If necessary, include your anonymous ftp site address, and operating system (UNIX, DOS, etc.). Requests will be processed on an as-time-is-available basis.

Mail request with blank floppies or tapes to:

Ms. Beth Admire
Northwest Indiana Coordinator, IDEM
100 North Senate, PO Box 6015
Indianapolis IN 46206-6015

Data Delivery: Small requests (only a few files) will be mailed on 3.5" floppy disks that you included with your written request. Large requests will be mailed on 8mm helical scan data cartridges that you included with your written request. We do have the capability to ftp the data out.

The data are available only as Environmental Systems Research Institute's ArcView 2.1 shapefiles (.shp, .shx, .dbf). This is a Windows 3.1 compatible application for personal computers. The combined data are roughly 50 megabytes total. We do not have CD write capability, nor can we provide this data in formats other than as shapefiles.

Disclaimer: The data listed have not been tested for accuracy, precision or consistency. Release of the data DOES NOT imply any quality of the data. The data are released to facilitate the Remedial Action Plan (RAP) process. Continued maintenance of the data is not being considered at this time. It is the responsibility of the parties using the data to assure that the data are adequate for the intended use. The users of the data are solely responsible for any damages or liability from the use or interpretation of the data.

Additional Statewide Geographic Data & Contacts:

Wetlands

Federal & State Managed Lands

Barrett Cooper, IDNR (317) 232-0675

Rare, Threatened & Endangered Species

Cloyce Hedge, IDNR (317) 232-4052

Water Well Driller's Logs

Phil Bonneau, IDNR (317) 232-1106

Fish Tissue
Macroinvertebrates
Sediments

Lee Bridges, IDEM (317) 308-3183

Appendix

DESCRIPTION OF REGULATORY AND RESOURCE MANAGEMENT PROGRAMS FOR THE NORTHWEST INDIANA AREA OF CONCERN REMEDIAL ACTION PLAN - STAGE II

I. Introduction

Delisting of the fourteen impaired uses requires a multi-media approach. The coordination of multiple regulatory programs is necessary as pollutants enter the environment through the water, the soil, and the air. Additionally, pollutants cross media, going from the air into the river, for example, making them difficult to regulate effectively. The pollutants themselves exist as suspended solids in the waters, as sediments underneath the water, and in the soil, and as particulate matter in the air.

To restore and enhance the water quality in the Great Lakes system, the International Joint Commission signed the Great Lakes Water Quality Agreement. This agreement established the goals or beneficial uses for restoration and enhancement of water quality in the Great Lakes system. To effectuate these goals, this agreement and the Great Lakes Critical Programs Act of 1990 required the development of the Great Lakes Water Quality Guidance (Guidance). This guidance provides the foundation for the regulation of pollutants in the Grand Calumet River, the Indiana Harbor Ship Canal, and the near shore area of Lake Michigan, the three main water bodies in this Area of Concern.

In addition to the guidance, provisions of the Clean Water Act, Indiana statutes and rules, and other federal statutes contain provisions which have the potential to help restore the beneficial uses by regulating the release of pollutants into the environment. No single environmental statute is specifically designed to address sediment contamination and remediation. Federal statutes such as the Clean Air Act, Comprehensive Environmental Response, Compensation and Liability Act, the Resource Conservation and Recovery Act, and the Oil Pollution Control Act all may be used to restore the Area of Concern.

Existing state and federal laws may be used to compel the private party to clean up contaminated sediments; to obtain reimbursement from private parties for federally-funded clean ups; or to obtain monetary damages necessary to restore natural resources. To bring an enforcement action, the U.S. EPA may need to rely upon multiple information gathering and enforcement authorities to compel private parties to assume responsibility for the clean up. Additionally, IDEM has a state-funded clean up statute. To expedite the remediation and restoration processes, the U.S. EPA and IDEM encourage private parties to enter into voluntary partnerships.

II. Great Lakes Water Quality Guidance

A. Background of the U.S. EPA Great Lakes Water Quality Guidance

The Great Lakes Water Quality Agreement and the Great Lakes Critical Programs Act of 1990 required the development of this guidance. Representatives from the eight Great Lakes States, three Great Lakes U.S. EPA Regions, and U.S. EPA Headquarters, as well as representatives from various environmental groups and the regulated community worked together for over four years to develop this guidance.

This guidance contains three major parts:

- Great Lakes specific water quality criteria for the protection of aquatic life, human health, and wildlife, and procedures for calculating these criteria.
- Implementation procedures for translating these criteria into NPDES permit limits.
- An antidegradation policy and implementation procedures for bioaccumulative chemicals of concern.

The guidance was published in final form on March 23, 1995. The Great Lakes States were required to revise their own water quality standards and permitting regulations to be consistent with (as protective as) the guidance by March 1997. States were only required to adopt the guidance for those waters which are in the Great Lakes Basin. It is optional for other state waters. Indiana revised the water quality standards for waters in the Great Lakes Basin before this deadline. These provisions are referred to as the Great Lakes Initiative rulemaking.

B. IDEM Process to Develop Indiana's Great Lakes Program

In October 1995, Deputy Commissioner Method set up a Great Lakes Water Quality Guidance Advisory Work Group. The work group is made up of representatives from the environmental and regulated communities, U.S. EPA, Indiana Association of Cities and Towns, Indiana's Manufacturers' Association, Indiana Chamber of Commerce, various trade associations, legal firms, and IDEM staff.

The work group provided a forum for interested parties to participate in the development of Indiana rules to implement the Great Lakes Water Quality Guidance. This was accomplished by educating the members as to the substance of the guidance and providing opportunity for open discussions of issues involved in its implementation.

This work group, over the course of more than a year, met approximately fifteen times to develop the rules to implementing the guidance. The majority of these meetings were held in the Great Lakes basin in locations such as Fort Wayne, South Bend, East Chicago, Michigan City, and Gary. During this period, IDEM also held two public meetings in the Great Lakes Basin and had numerous meetings with individual components of the work group. On December 16, 1996, Indiana became the first state to adopt rules implementing the guidance when the rules developed by the work group were adopted by the Water Pollution Control Board in a meeting held in

Whiting. These rules were signed by Governor Bayh on January 10, 1997, and then submitted to the Secretary of State for filing. They became effective February 13, 1997.

III. Clean Water Act

The Federal Water Pollution Control Act. (Clean Water Act), 33 USC Sections 1251 *et seq.*, offers multiple remedies for the problems of contaminated sediments, and provides a regulatory framework to prevent re-contamination of the water bodies in the Area of Concern. Both state and federal agencies may enforce this act. The Indiana Water Pollution Control Board, under IC 13-1-3-4, has the power to adopt rules necessary to implement this Act. The following contains a list of specific provisions IDEM may use to remediate existing sediments in the waters of the state. IDEM may bring an action to remediate sediments in federal district court under specific provisions of the Clean Water Act listed below. However, IDEM generally brings its enforcement actions under state statutory authority.

A. Research Programs

The Clean Water Act mandates the undertaking of research and program initiatives which may provide the evidentiary basis for enforcement actions. IDEM and the IDNR are authorized under IC 13-2-7-2(b) to conduct research in their respective areas of jurisdiction for the purpose of securing the scientific and technical data and information necessary for the solution of problems involving the wise beneficial development, use, and management of the water resources of Indiana. This research may be accomplished through the state special fund, independently, or in cooperation with agencies of the state or of the United States. Examples of this include the Great Lakes Water Quality Agreement and the Great Lakes Critical Programs Act. These programs embody a systematic and comprehensive ecosystem approach, which includes nonpoint sources, to restore and protect beneficial uses in the Areas of Concern.

B. Federal Enforcement Authority to Remediate

To effectuate the available remedial measures, the Clean Water Act includes both the authority to bring enforcement actions in addition to provisions which allow governmental agencies to gather information necessary to bring an enforcement action under another statute. Further, certain provisions, such as Section 301, contain language allowing for citizen suits to enforce water quality standards. The following is a summary of sections of the Clean Water Act applicable to the remediation of sediments.

1. Section 115

Section 115 provides direct enforcement authority to take remedial measures. This Section directs the U.S. EPA administrator to identify the location of in-place pollutants and, through the Secretary of the Army, to make contracts for the removal of contaminated sediments.

2. Section 301

A citizen may commence an action under section 505 to enforce the provisions of

section 301, 302, 306, 307, 401, 402, or 405. The citizen must meet the qualifications of the eleventh amendment of the U.S. Constitution to bring a suit against the governmental agency alleged to be in violation of an effluent standard or limitation or agreed order.

3. Section 309

Enforcement actions which may be brought under the Clean Water Act are set forth here. Some case law supports bringing enforcement actions solely to remove contaminated sediments. Actions brought under this Section also serve to encourage dischargers to undertake sediment pollutant removal as an "environmentally beneficial expenditure" in lieu of a portion of a proposed penalty.

4. Section 311

Section 311 of the Clean Water Act addresses oil and hazardous substance liability and also offers the potential for addressing sediments which are contaminated with either of these substances. This section allows the U.S. EPA Administrator to act to mitigate the damage done by discharges of oil and hazardous substances to waters of the United States and then to recover the costs of this remediation from the owner or operator of the source of the pollutant. Oil and hazardous substances can be found throughout the Grand Calumet River and Indiana Harbor Ship Canal.

5. Section 404

This section of the Act regulates the discharge of "dredged and fill" materials into navigable waters, including wetlands. Persons wishing to do work in wetlands or other Waters of the United States must obtain a Section 404 permit from the U.S. Army Corps of Engineers, unless a nationwide permit exists for the type of work proposed. Before the U.S. ACE issues this permit, either the U.S. ACE or the applicant must also receive a Section 401 Water Quality Certification from IDEM for the activity.

Two projects, the Ralston Street Lagoon project and the U.S. EPA advanced identification of Sites Program wetlands unsuitable for filling, have been approved under both section 404 and section 401, and are currently underway in the Area of Concern. Clean Water Act Section 404 may afford an enforcement action in a situation where large quantities of materials are being discharged into a waterway. A violation results in a restoration order by the U.S. ACE.

6. Section 401

Section 401 is the state counterpart to a section 404 permit. All persons seeking to construct or operate a facility which may result in any discharge into the navigable waters must obtain a permit from the state water pollution control agency, or IDEM, Office of Water Management. Failure to obtain a permit may result in an enforcement action.

The Section 401 Certification ensures that unacceptable impacts to water quality

will not occur as a result of the proposed activity. IDEM has three options when reviewing an application for 401 certification: issue the permit; deny the permit; or waive certification. If IDEM determines that unacceptable impacts are likely to occur, it may deny this certification and the U.S. ACE must deny the Section 404 permit. If IDEM grants the certification with some conditions, the U.S. ACE must include these conditions in the Section 404 permit if it is issued. The U.S. ACE may choose to deny the permit even if IDEM waives or grants the Section 401 Water Quality Certification.

When reviewing applications for this certification, IDEM determines if potential impacts to wetlands or other waters can be avoided or at least minimized and allows the applicant to accomplish the purpose of the project. If both goals are obtainable, the applicant may be asked to modify the project accordingly. Unavoidable impacts may require mitigation to replace the lost functions of the wetlands or other waters with respect to its water quality regulating attributes. Some projects may result in water quality impacts that cannot be adequately avoided, minimized or mitigated. These projects are denied 401 certification.

7. Section 508

As a consequence of criminal or civil violations of the Clean Water Act, facilities may be prohibited from obtaining federal government contracts, grants, or loans. Section 508, Contractor Listing, provides the U.S. EPA with an administrative tool to obtain compliance with the Clean Water Act. See Clean Water Act Section 508, and Clean Air Act Section 306, as implemented by regulations promulgated at 40 CFR Part 15.

C. State Authority to Restore and Maintain Water Quality

U.S. EPA's efforts to protect the Nation's waters from future contamination emphasize the use of watershed programs. This marks a significant change in water quality management programs, which also regulate sediment quality. Rivers, lakes, streams, and groundwater are now viewed as part of an entire system, rather than as individual components with no interaction. A watershed approach allows the U.S. EPA, States, Tribes, municipalities and the public to better tailor to the characteristics, problems, risks, and implementation of management programs in individual watersheds with meaningful involvement from local communities. IDEM has adopted this approach and is currently in the process of using GIS to help implement it.

1. State Authority to Remediate and Restore Water Quality

IDEM adopted the objective of the U.S. Congress stated in the Clean Water Act Section 101. "The goal of the state is to restore and maintain the chemical, physical and biological integrity of the waters of the state." 327 IAC. Under the authority of IC 13-7-11-2, IDEM may bring an action to enforce water quality standards and goals. More specifically, under IC 13-18-7, IDEM may order the clean up of pollution to enforce water quality standards. As part of an enforcement action, may mandate corrective action, including corrective action to be taken beyond the boundaries of the area owned or controlled by the person to whom the order is directed, to alleviate the violation.

Enforcement actions typically are based upon a violation of a permit condition. State rules which regulate water quality standards provide the foundation for water permit conditions. Permit writers in the IDEM Office of Water Management incorporate provisions of the water rules (327 IAC) into permits for facilities who discharge into, or otherwise affect, waters of the state. Water quality standards have three components: use designations; antidegradation policy; and water quality criteria. The Indiana Administrative Code contains provisions regulating each of these provisions. For a violation of a permit condition, enforcement begins when the commissioner sends a notice of violation to the alleged violator. This notice must either require the alleged violator to take specific action to correct the problem, or assess a civil penalty, or both.

a. Use Designations

The Clean Water Act (Clean Water Act) Section 131.10 requires states to specify the water uses to be achieved and protected and prohibits removal of existing uses. Under 327 IAC 2-1-3, the East Branch of the Grand Calumet River is "designated for full-body contact recreation", shall "be capable of supporting a well-balanced warm water aquatic community". This designation did not change under the Great Lakes Initiative Rulemaking.

b. Antidegradation Policy

The Indiana Water Pollution Control Board adopted the following general policy of nondegradation under the Great Lakes Initiative. "For all waters of the state within the Great Lakes system, existing instream uses and the level of water quality necessary to protect existing uses shall be maintained and protected. Where designated uses of the waterbody are impaired, there shall be no lowering of the water quality with respect to the pollutant or pollutants that are causing the impairment." 327 IAC 2-1.5-4(a).

The Great Lakes Initiative added a provision to the antidegradation standard. This provision, 327 IAC 2-1.5-4(d), states that Outstanding National Resource Waters shall be maintained and protected in their present high quality without degradation. Currently, no waters in Indiana are designated as Outstanding Natural Resource Waters. However, the IDEM Office of Water Management has begun a rulemaking to evaluate the various types of special designation waters. If any waters in Indiana are designated Outstanding Natural Resource Waters, this rule would protect that status by not allowing degradation due to any pollutant or pollutants.

c. Water Quality Criteria

Indiana's water quality criteria, adopted in 1990, apply to the Grand Calumet River are primarily based on the EPA Ambient Water Quality Criteria Documents published in the early and mid 1980's. They reflect the most up to date scientific thinking concerning the criteria necessary to adequately protect

aquatic life and human health. These criteria are generally implemented through the NPDES permitting program to ensure that discharges of the various substances requiring limitations do not cause exceedences of the water quality criteria. At the present time, only a few of the dischargers in the Area of Concern have received NPDES permits with limitations based on these criteria.

2. Implementation of Permits

As stated above, violations of permits generally provide the basis for enforcement actions. IDEM issues water permits under the NPDES. IDEM classifies discharges as either point sources or nonpoint sources, and issues NPDES permits to point source discharges. A "point source" is a discernible, confined, and discrete conveyance, usually associated with a pipe, ditch, or channel. A nonpoint source means all other discharges. A violation of either a point source or a nonpoint source discharge under 13-7-11-2 is also a violation of 325 IAC 5.

a. Point Source Discharges

Section 402 of the Clean Water Act provides for the National Pollutant Discharge Elimination System (NPDES) to regulate the type and amount of pollutants entering a water body from a point source. Indiana incorporated this provision into 327 IAC 5. This section also authorizes each state to develop its own NPDES program, subject to approval by the Administrator of the U.S. EPA. The state may also require the remediation of sediments through enforcement actions, for an NPDES permit violation, brought in accordance with IC 13-7-11-2.

327 IAC 2-6-2 requires " a person who owns, operates, controls, or maintains any... industrial, municipal or commercial facility... to immediately communicate a spill report on said spill to the Office of Environmental Response...." The Indiana Water Pollution Control Board has final adopted another rule, 327 IAC 2-6.1-1, to cover spills which do not directly enter the waters of the state. Under 327 IAC 2-6.1-1, the spill would not have to directly enter a water of the state, but it must occur in a location where it may damage state water. Dischargers covered by these provisions must clean up the spill.

b. Nonpoint Source Discharges

While IDEM does not issue permits to nonpoint source discharges, IDEM has the authority to regulate the impacts on water quality from nonpoint sources. The federal Clean Water Act includes provisions for a non-regulatory, resource management approach to nonpoint source pollution remediation. The Clean Water Act also provides federal funding through Section 319 for nonpoint source activities. Section 314 Clean Lakes Program, Section 104(b)(3) Watershed Management Program, and Section 604(b) Water Quality Planning Program also fund nonpoint source-related activities administered statewide through the nonpoint source Program.

One of the major goals of the Nonpoint Source Section has been to look at a watershed as a whole as it relates to nonpoint source water pollution sources and any other sources that may be contributing to water pollution within the watershed. This view mirrors the U.S. EPA's views toward water regulations. By looking at the watershed as a whole, all users in the watershed may become involved in the planning and implementation practices which are designed to prevent pollution.

IDEM is working with the U.S. EPA to fund projects that will reduce or eliminate water quality impacts from nonpoint sources. Several projects of this nature have been completed or are still ongoing in the Area of Concern. The many nonpoint source projects in the Area of Concern funded through Section 319, Section 314, Section 604(b), and Section 104(b)(3) are a combination of local and regional efforts sponsored by various public and not-for-profit organizations. The emphasis of these projects has been on local, voluntary implementation of nonpoint source water pollution controls. These include the adoption of best management practices, watershed restoration activities, pollution prevention activities, and education and technical assistance. The funding provided has been used for such projects as urban runoff controls, cost-share programs for the installation of water quality improvement practices, atmospheric deposition monitoring, lake management planning, and hydrologic unit area mapping in the Area of Concern. More detailed descriptions of these projects can be found in chapter 5, Actions to Attain Goals.

IDEM has the authority to regulate impacts to water quality from the discharge of storm water runoff. The rules supporting this authority are found at 327 IAC 15-5 (Rule 5) for construction sites, and at 327 IAC 15-6 (Rule 6) for industrial sites, and 327 IAC 5-4-6, individual storm water permits. The purpose of Rule 5 is to minimize the erosion of soil caused by precipitation events and its runoff into surface waters. Rule 5 requires the development and implementation of an erosion control plan at construction sites where five acres or more of land surface will be disturbed. The purpose of Rule 6 is to reduce the water quality impacts that would result from storm water runoff from improper land use activities, such as outdoor storage of raw materials. This includes storage of salt, ores, metals, or other supplies needed by such industries as foundries, mills, contractors, and highway departments. Rule 6 requires certain types of industrial activities to develop and implement pollution prevention / minimization plans. Industrial facilities are also required to periodically sample and analyze their storm water discharges and submit these results to IDEM.

Compliance is voluntary in instances where sites are greater than one acre but less than five acres. Each person or company that falls under these categories must develop a storm water management plan and provide a notice of intent as a

condition of proceeding with activities.

Other state agencies also help control nonpoint source pollution. The State Soil Conservation Board, established by statute under IC 13-3-1-4 within the Indiana Department of Natural Resources, consists of nine members appointed by the governor and is authorized to hold public hearings, adopt rules (IC 13-3-1-4(a) and IC 13-3-1-4(d)(9)), and perform any functions which promote the use of sediment and erosion controls. This Board offers assistance to supervisors of the county soil and water conservation districts (established under IC 13-3-1-8, Soil and Water Conservation District Act), secures the cooperation and assistance of the federal and state agencies which work in such districts, disseminates information throughout the state concerning activities and programs of the districts, and administers the funding for the Indiana Department of Natural Resource's Lake and River Enhancement Program. Its major purpose is to reduce erosion in order to prevent the loss of soil. Therefore, voluntary pollution prevention and assessment through watershed management planning are promoted by the Board throughout the state as well as in the Area of Concern.

3. Maintaining Water Quality Standards

IDEM has numerous mechanisms available to maintain the integrity of the waters of the state and to uphold the water quality standards. Once all applicable water quality criteria and pollutant parameters have been established, the waters and the sediment must be monitored and tested to ensure that accumulation of sediments causes no impairment of designated or beneficial uses. Various rules authorize IDEM to incorporate biomonitoring, sediment testing provisions, and toxicity testing in NPDES permits. The instream biological monitoring and sediment monitoring provisions in the NPDES Permit are designed to provide assurances that the problems of past accumulation of contaminated sediments are not repeated.

a. Instream Biomonitoring

Instream biomonitoring is necessary to determine if effluent discharges adversely impact the development of a well-balanced aquatic community in the Grand Calumet River. Pollutants from a permittee's effluent may remain in the water column, be ingested or absorbed by aquatic life, accumulate in sediments, or enter the benthic community. Comprehensive biomonitoring provisions in all NPDES permits will provide a means to measure each of these parameters and the quality of water. Biomonitoring provisions may require a permittee to sample the fish community, fish tissue, the benthic community, sediment chemistry and sediment toxicity.

Under 327 IAC 5-1-3, a permittee shall "install, use, and maintain such monitoring equipment or methods (including, where appropriate, biomonitoring methods); ... sample such effluents, ... or other material ... at such locations, at

such times, and in such a manner as the commissioner may reasonably prescribe." See 327 IAC 5-1-3(a)(3). Furthermore, 327 IAC 15-1-3, the General Permit Rule Program, states that "any person... subject to this article shall... install, use, and maintain such monitoring equipment or methods (including, where appropriate, biomonitoring methods... at such locations, at such times, and in such a manner, as the commissioner may reasonably prescribe." See 327 IAC 15-1-3(a)(3).

Another purpose of the instream biomonitoring condition is to determine if the thermal effluent requirements contained in an NPDES Permit are adequate to protect the aquatic life of the Grand Calumet River / Indiana Harbor Ship Canal. Extremely high temperatures, such as those which may result from a discharge of non-contact cooling water, stress the aquatic community and also may cause degradation of fish and wildlife populations; the growth of undesirable algae; and a loss of fish habitat. 327 IAC 2-1-6(b)(4) provides conditions for surface water temperature to ensure conditions necessary for the maintenance of a well-balanced aquatic community. "There shall be no abnormal temperature changes that may adversely affect aquatic life unless caused by natural conditions. The normal daily and seasonal temperature fluctuations that existed before the addition of heat due to other than natural causes shall be maintained. The maximum temperature rise at any time or place above natural temperatures shall not exceed ... 5°F." See 327 IAC 2-1-6(b)(4). Monthly maximum water temperatures are also established in this rule.

b. Sediment Monitoring

In addition to biomonitoring authority, IDEM may monitor the effluent to assure that a discharge does not contain substances that will settle to form objectionable deposits. In the Great Lakes Initiative rulemaking, water quality based effluent limitations were implemented specifically for the Great Lakes Basin, in NPDES permits using the procedures in 327 IAC 5, which are based upon the water quality criteria contained in 327 IAC 2-1 and 327 IAC 2-1.5. "When the water quality based effluent limitation for any substance is less than the limit of quantification normally achievable and determined by the commissioner to be appropriate for that substance in the effluent, the permit... may contain... other requirements, as appropriate, such as engineering assessments or sediment analyses." A pollutant may exist in a permittee's effluent in amounts that cannot be measured using current technology. Even though this pollutant cannot be measured, it still may contaminate sediment after traveling through the water column. Sediment monitoring enables IDEM to detect these pollutants before they accumulate to an extent such that uses become degraded.

A second provision, 327 IAC 15-4-1, states that persons regulated under the NPDES general permit program shall allow IDEM to... sample or monitor, at

reasonable times, for the purposes of assuring compliance with the applicable general permit rule conditions or as otherwise authorized by the Clean Water Act. any substances or parameters at any location. *See 327 IAC 15-4-1(l)(4).*

c. Whole Effluent Toxicity Testing

Pursuant to the Great Lakes Water Quality Guidance, Indiana adopted whole effluent toxicity provisions that account for chemical interactions and for data gaps regarding individual pollutants in an effluent. These provisions apply to all facilities, measure both acute and chronic toxicity, and limit the toxic effects on aquatic life from the effluent as a whole. On October 16, 1995, the U.S. EPA adopted the whole effluent toxicity analytical methods in 40 CFR Part 136 to determine the toxicity of each dischargers effluent. Indiana adopted these analytical methods in the Great Lakes Initiative rulemaking.

d. Construction of Wastewater Treatment Plants

Any person who causes or allows the construction, installation, or modification of any water pollution treatment/control facility or sanitary sewer, without a valid permit issued by the commissioner of IDEM, may be forced to take remedial measures pursuant to IC 17-11, or IC 13-7-12, emergency provisions. 327 IAC 3-2 regulates permit applications for construction of a treatment plant. Applications must be made in accordance with the procedures established by the commissioner in 327 IAC 3-2-2.

The United States Supreme Court recently held that a state department may enforce broad water quality standards by conditioning certification of a plant upon compliance with them. Northwest Environmental Advocates v. City of Portland, 1995 WL 336001 (9th Cir.(OR.)), *petition for rehearing denied*, No. 92-35044 (9th Cir. Jan. 24, 1996); PUD No.1 of Jefferson County and City of Tacoma v. Washington Department of Ecology, 114 SCT 1900 (1994).

D. Pretreatment Rules

This provision implements 40 CFR Part 403 and related provisions of the Clean Water Act, and applies to the discharges of industrial pollutants into publicly owned treatment works. Any violation of these rules may result in an enforcement action requiring remediation. Indiana's pretreatment program at 327 IAC 5-11-1 et seq. has three general objectives:

- (1) to prevent the introduction of pollutants into Publicly Owned Treatment Works which will interfere with the operation of a Publicly Owned Treatment Work, including interference with the use or disposal of municipal sludge;
- (2) to prevent the introduction of pollutants into Publicly Owned Treatment Works which will pass through the treatment works without receiving effective treatment or otherwise be incompatible with such works; and
- (3) to improve opportunities to recycle and reclaim municipal and industrial

waste waters and sludges.

D. Combined Sewer Overflows

A combined sewer system is a wastewater collection system that conveys sanitary waste waters and storm water through a single-pipe system to a Publicly Owned Treatment Works treatment plant. A combined sewer overflow is the discharge from a combined sewer system at a point prior to the Publicly Owned Treatment Works treatment plant. Three Publicly Owned Treatment Works lie within the Area of Concern, one in each of the following cities: East Chicago, Gary, and Hammond. Combined Sewer Overflows are point sources subject to NPDES permit requirements, including both technology-based and water quality-based requirements of the Clean Water Act. Montgomery Environmental Coalition v. Costle, 646 F.2d 568 (D.C. Cir. 1980).

IDEM's current Combined Sewer Overflow strategy has three required objectives: to ensure that if Combined Sewer Overflow discharges occur, they are only as a result of wet weather; to bring all wet weather Combined Sewer Overflow discharge points into compliance with the technology-based and water quality-based requirements of the Clean Water Act; and to minimize water quality, aquatic biota, and human health impacts from Combined Sewer Overflow. *Indiana Register, Volume 18, Number 12, September 1, 1995*. While none of these objectives specifically list prevention of impairment of beneficial uses in the Area of Concern, both sets of goals are compatible. The Combined Sewer Overflow strategy is coordinated with the State Water Quality Program. All waters of the State have a designated use of fishable / swimmable, and must meet a daily maximum bacteria standard for E. Coli, the main pollutant of concern during Combined Sewer Overflow discharges. Prevention of exceedences of the maximum numerical standard for E. Coli will enable permittees to comply with the requirements of the Clean Water Act and the IDEM's goal of all State surface waters meeting Indiana's water quality standards.

327 IAC 3 and 327 IAC 4 regulate wastewater treatment facilities by prescribing requirements for construction and operation, authorizing requests for data, and also by regulating overflows during both wet and dry weather. Enforcement of these provisions, in addition to implementation of the Combined Sewer Overflow strategy provided in the Indiana Register, will reduce the accumulation of non-natural sediments in the Grand Calumet River.

F. Unlawful Acts in the Floodway

Where IDEM shows that the accumulation of sediments on the bottom of the Grand Calumet River and Indiana Harbor Ship Canal increases costs of shipping materials in the canal, or causes fish deformities, such as those listed in the Habitat Component of the Stage II RAP, the IDNR may bring an enforcement action for the remediation of that transect of the Grand Calumet River and the Indiana Harbor Ship Canal. The IDNR regulates the floodways of Indiana under IC 14-28-1-20-2.

This statute states that a person may not erect, make, use or maintain in or on any

floodway, or suffer or permit the erection, making, use, or maintenance in or on any floodway, a structure, an obstruction, a deposit, or an excavation that will do any of the following:

- (A) Adversely affect the efficiency of or unduly restrict the capacity of the floodway.
- (B) By virtue of its nature, design, method of construction, state of maintenance, or physical condition do any of the following:
 - (I) Constitute an unreasonable hazard to the safety of life or property.
 - (ii) Results in unreasonably detrimental effects upon the fish, wildlife, or botanical resources. IC 14-28-1-20.

IC 14-28-1-21 declares any structure, obstruction, deposit, or excavation described in section 20(2) to be and to constitute a public nuisance.

G. Obstruction of Navigable Waters

Under this statute, IC 14-29, a person, other than a public or municipal water utility, may not: place, fill, or erect a permanent structure in; remove water from; or remove material from a navigable waterway without a permit from IDNR. IC 14-29-1-8(a). Failure to receive a permit when required under either IC 14-28 (above) or IC 14-29 prior to commencing a designated activity may result in the issuance of a restoration order. Additionally, the Indiana Department of Natural Resources commonly issues restoration orders as part of the permit. Typically these orders require a party to restore affected wetlands and mitigate harmful effects on surrounding wetlands, fish, wildlife, and botanical resources. Where a party dredges or fills a waterway without a permit, the IDNR or the U.S. ACE may issue a restoration order to return the waterway to its previous state.

IV. Water Resources Development Act of 1992

While this Act, 102 Public Law 580, creates no sediment enforcement authority, it does provide a mechanism for seeking private-public partnerships for sediment cleanup. The Act states that whenever necessary to meet the requirements of the Clean Water Act, the Secretary of the Army, in consultation with the U.S. EPA Administrator, may remove, as part of operation and maintenance dredging of a navigation project, contaminated sediments outside the boundaries of and adjacent to the navigation channel. The U.S. ACE may remove contaminated sediments from navigable waters for the purpose of environmental enhancement and water quality improvement if such removal is requested by a non federal sponsor and the sponsor agrees to pay 50 percent of the cost of such removal.

V. Waste Management Programs

IDEM's Office of Solid and Hazardous Waste Program and Office of Environmental Response implement the state's waste management program. The Office of Solid and Hazardous Waste, and the rules governing the program are divided into two sections, one for hazardous waste and one for solid waste. Generally, there are no federal counterparts for

Indiana's solid waste rules. Indiana's hazardous waste rules incorporate provisions from the federal rules governing hazardous waste. For example, the Resource Conservation and Recovery Act and the federal Comprehensive Environmental Response, Compensation, and Liability Act authorize the state to develop a framework for managing hazardous waste. Under this regulatory framework, IDEM may issue permits, conduct inspections, institute cleanup activities, and conduct enforcement actions with minimal oversight by U.S. EPA. IDEM has the authority to remediate contaminants in the environment under its enforcement at IC 13-7-11-2.

IDEM uses a combined regulatory and non-regulatory approach for prevention and remediation of land and groundwater environmental contamination. Under the existing regulatory framework, IDEM uses information from the waste management and remediation programs to develop activities in the Area of Concern. In some cases, IDEM and U.S. EPA work as partners to improve environmental management in selected programs and sites.

The sediments underlying the Grand Calumet River and the Indiana Harbor Ship Canal may be classified as waste under both state and federal regulations. The types and levels of contaminants in the sediments vary both within and between reaches. Additionally, large concentrations of pollutants such as lead, arsenic, and PCBs exist in certain areas. Petroleum can also be found in the sediments, as well as floating on top of the water. The regulations discussed below define the sediments in the Grand Calumet River / Indiana Harbor Ship Canal as waste, and provide mechanisms for their removal from the riverbed. This portion of the chapter begins with a discussion of the two primary federal regulations which may be used to remediate these sediments, their state counterparts, and then concludes with the state cleanup provisions.

A. Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)

The guiding policy of the Comprehensive Environmental Response, Compensation and Liability Act of 1980 as amended (CERCLA), 42 USC Section 9601-9675 is to achieve private party cleanup. This act covers both hazardous and nonhazardous substances, and imposes strict liability for a violation. CERCLA provides the authority to: gather information; obtain private party sediment cleanup; receive reimbursement for U.S. EPA cleanup costs; and provide compensation to natural resource trustees for damages to natural resources affected by contaminated sediments. Although its primary purpose is to clean up leaking hazardous waste disposal sites, CERCLA may also be used to compel remediation of pollutants found in other areas of the environment.

The primary enforcement provision under CERCLA, Section 107, provides a means of obtaining natural resource damages that may be used to clean up contaminated sediments and restore the beneficial uses of the stream. Section 107(f)(1) provides that "[i]n the case of injury to destruction of, or loss of natural resources ... liability shall be to the United States Government and to any State for natural resources within the State." To the extent that these damages are not inconsistent with the National Contingency Plan, generators and transporters of

hazardous substances, as well as owners and operators of the disposal, or treatment facilities receiving such substances shall be liable for: all removal costs incurred by the governmental entity; all other necessary response costs incurred by other parties; and damages to natural resources resulting from the release. These provisions have been codified under IDEM's state cleanup statute. Therefore, where contaminated sediments can be linked to an injured natural resource, natural resource damages may be used to obtain remediation of the sediment and restoration of the beneficial uses.

B. Resource Conservation and Recovery Act (RCRA)

The U.S. EPA may use several provisions under the Resource Conservation and Recovery Act of 1976 (RCRA), as amended by the Hazardous and Solid Waste Amendments of 1984, 42 USC 6901-6992k (1982 and Supp. III 1985), to address contaminated sediments associated with a RCRA-regulated hazardous waste treatment, storage or disposal facility. These authorities are found in 42 USC Sections 6928(h), 6924(u), and 6924(v). Article 3.1 of the Indiana Administrative Code incorporates many of these provisions by reference, and establishes a hazardous waste management program for Indiana consistent with the requirements and regulations promulgated pursuant to RCRA.

C. State Waste Programs

Responsibility for developing and implementing land and groundwater protection lies with the Office of Solid and Hazardous Waste Management. This office issues solid and hazardous waste facility permits; assures compliance of permitted/approved facilities and generators; tracks disposal of solid, hazardous, and special wastes; facilitates cleanup of RCRA-regulated facilities; and investigates illegal tire and open dumps. The Office of Environmental Response responds to environmental incidents such as chemical spills, and conducts investigation, scoring, and site management (including cleanup and oversight of cleanup activities) of contaminated waste sites through the state and federal Superfund process. The Office of Environmental Response also investigates groundwater contamination and the impact of underground storage tanks upon the surrounding environment.

1. Indiana's Solid Waste Program

Different state rules govern solid wastes and hazardous wastes. Solid wastes are governed under 329 IAC 2. Solid waste facilities are governed by these rules and permit provisions. Either a violation of the rule itself, or a provision in the solid waste permit may trigger IDEM's enforcement mechanism.

There are both private and municipal landfills in Northwest Indiana. Private landfills are governed largely by state rules with no federal counterparts. In 1991, the U.S. Environmental Protection Agency published revised municipal waste landfill standards, referred to as Subtitle D (40 CFR Part 248) of the Resource Conservation and Recovery Act. These standards went into effect in October 1993 for large landfills and April 1994 for small landfills. The Subtitle D standards for landfills are comprised of six categories: location restrictions; operation; design; groundwater monitoring and

corrective action; closure and post-closure; and financial assurance.

Subtitle D is a self-implementing set of federal standards. This means that landfills are required to abide by the federal regulations. However, each state has the option to obtain authorization for partial or full approval to enforce the Subtitle D standards. A state which has authorization is allowed some flexibility in the standards. For example, the groundwater monitoring standards can be modified to be applicable to the local aquifer characteristics and potential hazards.

Indiana's final approval for Subtitle D authorization was published in the May 1, 1996 Federal Register. IDEM has recently upgraded the standards for the design and operation of municipal solid waste landfills through a revision of the solid waste rules, 329 IAC 10. These changes went into effect in April 1996. Full Subtitle D authorization became effective in Indiana on December 9, 1996.

2. Indiana's Hazardous Waste Program

IC 13-7-8.5 declares that IDEM shall regulate and require the proper and safe transportation, treatment, storage, and disposal of any hazardous waste that is generated in or transported into this state. IDEM regulates hazardous materials pursuant to 329 IAC 3.1. IAC Indiana's hazardous waste permitting program is modeled after the federal RCRA program. All generators and transporters of hazardous waste, and owners and operators of hazardous waste facilities must be permitted under 329 IAC 3.1-1-1. Violations of these permits provide the basis for enforcement actions pursuant to IC 13-7. The statute also authorizes the commissioner to order the responsible party to perform corrective action beyond the boundaries of the facility from which the release occurred.

In January 1986, Indiana received authority to issue permits and closure plans for hazardous waste treatment, storage, and disposal facilities under RCRA Subtitle C. Hazardous waste permits also address the six categories listed for Subtitle D facilities.

In 1995, the hazardous waste permit program has participated in developing a document entitled "The Organization and Management Improvement Plan for the Hazardous Waste Permitting Program". This document is an in-depth assessment of the hazardous waste permit program and was developed to improve the efficiency and effectiveness of the program. During fiscal year 1996, staff began implementing these recommendations.

3. Office of Environmental Response

Spills and releases which threaten the waters of the State (including both surface and ground water) are monitored by IDEM's Emergency Response program. A comprehensive emergency plan has been developed which addresses response issues across the entire county and lays a groundwork for coordination of response mechanisms throughout Lake County.

4. **Compliance and Enforcement**

IDEM has spent considerable time and resources to improve its compliance and enforcement efforts in Northwest Indiana, including the establishment of a Northwest Indiana Regional Office. During the past two years the number of solid and hazardous waste staff assigned to the Northwest Indiana Regional Office has been increased from one inspector to five inspectors. In addition, the Office of Environmental Response has assigned a full-time inspector in the Northwest Indiana Regional Office to investigate any underground storage tank problems.

The emphasis on a greater presence in Northwest Indiana has resulted in better cooperation between state and local agencies. For example, IDEM worked with local agencies to clean up over 900,000 tires from illegal dumps and tire piles in Lake County during the past year. IDEM is also conducting community-based initiatives to assess the impact of hazardous waste management practices on the Grand Calumet River through increased inspections and other outreach mechanisms. IDEM will continue to develop new and improved tools for facilitating compliance with the State's environmental laws.

IC 13-7-8.5.5.5, the state clean up provision states that whenever there has been a release of a hazardous waste, or a constituent of a hazardous waste, into the environment from a facility authorized to operate under state law, the commissioner must take steps to protect human health and the environment. Options the commissioner has include: issuing an order requiring corrective action or another response measure; or commencing a civil action to compel corrective action. The corrective action may be ordered to extend beyond the boundaries of the facility from which the release occurred.

Corrective Action Orders allow the regulatory agency to order clean up on a much broader scale than a RCRA closure. Constituents that would not normally fall under RCRA closure may now be addressed. Off site migration of a hazardous substance or its constituents may now be remediated. This means that if constituents of a hazardous substance contaminate sediment, the facility can be held responsible for the remediation. Contaminated sediments can affect aquatic life, human health, the environment, drinking water supplies, and recreational uses.

IDEM has a variety of programs to identify contaminated sites and assist with the remediation of these sites in order to protect human health and the environment. IDEM works with existing facilities to remediate contaminated sites at RCRA-regulated hazardous waste facilities through the RCRA Corrective Action program. IDEM identifies other contaminated sites from the National Priorities List (NPL), the federal CERCLIS list, and other state and local investigations. These sites are then assigned to the IDEM's Immediate Removals, State Cleanup or Superfund programs for remedial action. IDEM received authorization in October 1996 for the Corrective Action program. These programs develop remediation strategies to protect human health and

the environment. IDEM is examining ways to improve data collection and analysis to identify better measures of performance of the activities in the Area of Concern.

D. Non-Regulatory Approaches

IDEM works with businesses, industry, and local governments to reduce environmental hazards and encourage practices that go beyond compliance by using a variety of tools. These include outreach education campaigns and non-regulatory site inspections. These efforts help facilities to better understand environmental rules and statutes and to identify opportunities for waste minimization and waste reduction. In addition, efforts are underway to streamline reporting requirements and further explore electronic submission of reports, thus reducing paperwork. Voluntary efforts to cleanup sites that may be of concern, but may not score high enough to facilitate immediate federal and state cleanup efforts (due to limited resources), may be recognized under the Voluntary Remediation Program.

1. Voluntary Remediation

The IDEM Voluntary Remediation Program (authorized under IC 13-7-8.9) provides a mechanism for site owners or operators to voluntarily enter an agreement with IDEM to cleanup contaminated property. When the remediation activity is successfully completed, IDEM will issue a Certificate of Completion and the Governor's office will issue a Covenant Not to Sue to the property owner. These documents provide assurance that the remediated areas will not become the subject of future IDEM enforcement action.

2. Brownfields

Brownfields are previously used commercial or industrial sites that may possess low-levels of contamination or are perceived to be contaminated. Incomplete information about the environmental condition of abandoned urban industrial land can be an impediment to redevelopment activities. Local communities often do not have the expertise or resources to accurately evaluate these properties. IDEM assists in the identification and characterization of these sites under the Brownfields Program.

The IDEM was awarded \$150,000 by U.S. EPA Region V, pursuant to its CERCLA Site Assessment Cooperative Agreement, to fund brownfield environmental assessments in Northwest Indiana (and in the city of Indianapolis). IDEM's Site Investigation Section has been working cooperatively with the Northwest Indiana Brownfields Redevelopment Project, which consists of representatives from the communities of Gary, Hammond, and East Chicago. Presently, one site has been sampled in each of the represented cities in Northwest Indiana. The Site Investigation Section has developed a Brownfields Environmental Assessment Application to facilitate the cities with their site selection and to assist IDEM in determining the sites on which to conduct the brownfield environmental assessments. The environmental assessments will include: researching the site history; a review of available file information; a site reconnaissance; and the collection of environmental samples, if

necessary. A report will be completed, which will provide sufficient information to enable prospective buyers to ascertain any potential liability, evaluate the risks, and encourage them to purchase the sites for redevelopment and reuse.

With the remaining funds in the pilot and the restructuring of the U.S. EPA/IDEM cooperative agreement, the Site Investigation Section plans to conduct at least one additional environmental assessment in each of the cities represented by the Northwest Indiana Brownfields Redevelopment Project, and is currently offering assistance to other communities across the State.

VI. Toxic Substances Control Agreement

In 1986, the governors of the eight Great Lakes States signed the Great Lakes Toxic Substances Control Agreement. The purpose of the Agreement was to establish a framework for coordinated regional action in controlling toxic substances entering the Great Lakes System; to further the understanding and control of toxic substances; and to develop common goals, management practices and control strategies for toxics to ensure a cleaner and healthier Great Lakes Basin ecosystem. As a result of this agreement, the states agreed to jointly develop a program for coordinating the control of toxic releases in the Great Lakes System. In 1989, the states and U.S. EPA began working on the Great Lakes Water Quality Initiative to address these concerns. This initiative, now called the Great Lakes Water Quality Guidance, was finalized March 23, 1995. The Office of Water Management completed revisions to the water quality and implementation rules consistent with the guidance, and on December 16, 1996, the Water Board final adopted the rules. Governor Bayh signed the rules into law on January 9, 1997. These new criteria and implementation procedures will be applicable to the Grand Calumet River and Indiana Harbor Ship Canal.

VII. OPA - Oil Pollution Act of 1990

The Oil Pollution Control Act, 33 USC 2701-2761, also provides enforcement authority for the remediation or removal of oil and attached sediments caused by a discharge of oil into navigable waters. Each responsible party for a vessel or a facility from which oil is discharged, or which poses the substantial threat of a discharge of oil, into or upon the navigable waters or adjoining shorelines is liable for the removal costs and damages specified under this act. IC 13-7-20.1-8 authorizes the IDEM to issue an order requiring an owner or operator or a responsible party to remove or remediate a petroleum release.

VIII. Intermodal Surface Transportation Enforcement Act

Established in 1991, this provides authorizations for highways, highway safety, and mass transportation. The purpose of the Act is "to develop a National Intermodal Transportation System that is economically efficient, environmentally sound, provides the foundation for the Nation to compete in the global economy and will move people and goods in an energy efficient manner." The environmental aspect of this Act provides highway funds for activities that

enhance the environment, such as wetland banking, mitigation of damage to wildlife habitat, historic sites preservation, activities that contribute to meeting air quality standards, a wide range of bicycle and pedestrian projects, and highway beautification. For all future public construction projects funded by the Intermodal Surface Transportation Enforcement Act within the Area of Concern, except publicly funded best management practices which are installed according to an approved watershed management plan, the following are required as a part of this Act:

1. A quantification and characterization of the nonpoint source pollution to be generated both during and after construction;
2. An assessment of their ecological impact upon water bodies and groundwater within the Area of Concern; and
3. The alternatives available for preventing and reducing those impacts.

An environmental assessment or environmental impact statement that contains this information in an understandable format is sufficient for purposes of fulfilling this requirement. The IDEM furnishes any public information that it has available to help in the preparation of these assessments or impact statements.

IX. Regulations Affecting Air Quality

In Indiana, responsibility for developing and implementing air programs is located within the IDEM, Office of Air Management. IDEM has the authority, through the Air Pollution Control Board, to develop state rules and programs to improve air quality and to carry out requirements of the Clean Air Act. Indiana's air pollution control rules are contained in Title 326 of the Indiana Administrative Code.

Two cities within the Area of Concern, Gary and Hammond, operate local air pollution control agencies. These agencies work with IDEM to develop and implement air programs within their specific jurisdictions and have varying responsibilities for permitting and compliance activities.

A. State Implementation Plan

The Clean Air Act requires the states to develop and implement a State Implementation Plan to attain and maintain the National Ambient Air Quality Standards. Indiana's State Implementation Plan consists in part of rules and policies that have been established to limit the emission of pollutants into the air. In addition, the State Implementation Plan contains information and analysis, such as summaries of emissions inventories or modeling data to demonstrate the effectiveness of the rules as well as contingency measures in case projected emission reductions and attainment are not achieved. The State Implementation Plan is a living instrument, each time Indiana promulgates a rule intended to contribute to attainment or maintenance of a particular air quality standard, IDEM submits a notice concerning the State

Implementation Plan to U.S. EPA. Upon U.S. EPA's approval of the rule, it becomes part of Indiana's State Implementation Plan.

Development of the State Implementation Plan is a very public process. The Indiana rulemaking statute provides several opportunities for public input and comment, both in writing and at two public hearings held before the board. In addition, U.S. EPA must publish notice of its intent to approve or disapprove a State Implementation Plan submittal and provide an opportunity for the public to comment. State Implementation Plan documents are available for public inspection.

B. Federal Programs

The Clean Air Act requires U.S. EPA to develop certain national rules and programs such as National Emission Standards for Hazardous Air Pollutants and New Source Performance Standards. U.S. EPA is also required to perform ongoing research on complicated air pollution issues and to develop national policy for issues that are not bound by jurisdictional boundaries (acid rain, long-range transport of pollution). IDEM is active in efforts with other states and U.S. EPA to develop regional and national approaches to addressing air pollution issues. Most of the responsibility and authority for implementing federal rules and programs are delegated to IDEM.

C. Permits

The Clean Air Act Amendments of 1990 include provisions for a new operating permit program to develop comprehensive operating permits to be issued for an entire source. On March 10, 1994, the Indiana Air Pollution Control Board adopted new rules establishing this program. IDEM is currently in the process of implementing this program, which is also known as the Title V program. An estimated 62 sources in Lake County may eventually be affected by this program. Sources statewide that have the potential to emit greater than 100 tpy of any regulated pollutant, 10 tpy of a single hazardous air pollutant, or 25 tpy of a combination of hazardous air pollutants are required to obtain a Title V operating permit unless they agree to enforceable limits on their actual emissions that keep them below these thresholds. In Lake County, sources with the potential to emit 25 tpy or more of volatile organic compounds or nitrogen oxides are also required to obtain a Title V operating permit. Additionally, Title V operating permits are required for other sources such as those subject to the prevention of significant deterioration program or the major new source review program in non attainment counties. The Title V operating permit program imposes no new substantive requirements such as emission limits, but rather enhances IDEM's permitting, compliance, and enforcement capabilities with respect to sources located in Lake County. IDEM is identifying priority sources for issuance of Title V operating permits based on environmental priorities, such as location in a non attainment area or a history of compliance problems.

D. Compliance

IDEM has spent considerable time and resources to improve its compliance and

enforcement efforts in Lake County. A Northwest Indiana Regional Office has been established to help focus these efforts in the region. The number of air program staff has been increased to ten with further increases projected in the future. The Air Compliance Section has developed a targeted inspection model and enforcement referral ranking system that focus resources on the sources that have the most serious air pollution impacts.

The Office of Air Management's Compliance Branch is presently drafting detailed "Steel Mill Action Plans" for each of the major steel mills. These plans will set out inspection targets for each facility, modes of compliance verification and compliance history and context of each steel mill facility. The plans will also contain a meaningful reporting mechanism so that the public will have a means to assess the success of our efforts. Additionally, the Office of Air Management is working with sources subject to Lake County's PM₁₀ (particulate matter) plan requirement to ensure that the plans as submitted are sufficient to accomplish the goal of improving air quality to meet the NAAQS and then to maintain good air quality in Lake County. Since Lake and Porter Counties are designated for ozone, Office of Air Management has initiated an effort to strategically target major sources of volatile organic compounds for special attention. The Compliance Branch is presently screening source lists to choose a number of the largest industrial sources of volatile organic compounds as candidates for "Site-Specific Action Plans." These plans will incorporate allocation of additional compliance resources, multi-media and multi-agency approaches as well as an emphasis on pollution prevention.

The Northwest Indiana Regional Office relies on IDEM's main office in Indianapolis for support (e.g., training, enforcement, technical assistance). Recent efforts have helped to greatly improve communications and coordination. Northwest Compliance staff have recently begun attending Office of Air Management Compliance Branch meetings on a regular basis and Office of Air Management continues to emphasize consistency by holding weekly Compliance Branch manager meetings in order to enhance communications.

X. Public Nuisance

The nuisance statute states, "[w]hatever is injurious to health, or indecent, or offensive to the senses, or an obstruction to the free use of property, so as to interfere with the comfortable enjoyment of life or property, is a nuisance, and the subject of an action." IC 34-1-52-1. The State may bring a public nuisance claim under IC 34-1-52-1. IC 34-1-52-2 defines those persons who may bring an action under the nuisance statute:

Sec.2. (a) An action to abate or enjoin a nuisance may be brought by any person whose property is injuriously affected or whose personal enjoyment is lessened by the nuisance.

(b) A civil action to abate or enjoin a nuisance may also be brought by an attorney representing the county in which a nuisance exists or by the attorney of any city or town in which a nuisance exists.

The State of Indiana alleged a nuisance cause of action in a cross-claim filed June 6,

1994, in U.S. v. The Sanitary District of Hammond, et al.

XI. Regulations Affecting Natural Resources

Various laws, statutes, policies and agreements are available which, if properly utilized, can contribute to the protection, conservation, restoration or enhancement of wetlands and aquatic habitats. Several authorities have been outlined by Dodge and Kavetsky, 1995 and Votteler and Muir, 1996. Some are listed below.

A. International/Binational

Authority	Legal Citation	Species or Target Habitat
North American Waterfowl Management Plan (1986)		Conservation of waterfowl habitat
Migratory Bird Convention		Migratory birds
Great Lakes Water Quality Agreement		Wetlands preservation
Strategic Plan for Great Lakes Fisheries Management		Binational management for fish species and their habitats
RAMSAS Convention on Wetlands of International Importance		Important wetlands identified and protected through legislation
B. UNITED STATES		
National Wildlife Refuge System Administration Act	16 USC 668dd-668jj	Fish and wildlife on all US Fish and Wildlife Service lands
Fish and Wildlife Coordination Act	16 USC 661-667e	Fish and wildlife, must be federal project
Great Lakes Fisheries Act	16 USC 931-939c	Fish habitat, sea lamprey control
Endangered Species Act	16 USC 1531-1543	Any listed or candidate species habitat
Migratory Bird Treaty Act and Migratory Bird Conservation Act	16 USC 701-718i	Migratory birds
Emergency Wetlands Resources Act	P.L. 99-645	Wetlands

Fish and Wildlife Act of 1956, as amended	16 USC 742a-742j	Fishery and Wildlife Resources
Natural Resource Damages - Comprehensive Environmental Response, Compensation and Liability Act of 1980 (CERCLA), as amended by SARA (1986)	42 USC 9601 et seq. Assessment rule at 43 CFR 11	Construct habitat projects to restore or replace injured resources
Airport and Airway Development Act	49 USC 1701-1742; 84 Stat. 219	Habitat
Anadromous Fish Conservation Act	16 USC 757a-757g; 79 Stat. 1125	Andromous fishery resources
Bankhead-Jones Farm Tenant Act	7 USC 1000.1006,1010-1012; 50 Stat.522	"..Land conservation and utilization in order to correct maladjustments in land use..."
Estuary Protection Act	16 USC 1221-1226; 82 Stat. 625	Pre-acquisition study and inventory of estuaries of the United States, including land and water of the Great Lakes
Federal Power Act	16 USC 791a-825r; 31 Stat. 1063	Fish and wildlife resources
Lacey Act of 1900	16 USC 701,702; 31 Stat. 187, 32 Stat. 285	Fish and wildlife, also injurious species controls
Sikes Act	USC 670a-670o; 74 Stat. 1052	Fish and wildlife, esp. Military and tribal lands
Watershed Protection and Flood Prevention Act	16 USC 1001-1009; 33 USC 701b; 68 Stat. 666	Fish and wildlife
Federal Water Project Recreation Act	16 USC 4601-21	Facilities for fish and wildlife at all reservoirs under the control of the Secretary of Interior except those within National Wildlife Refuges

Federal Aid in Sport Fish Restoration Act of 1950 (Dingell-Johnson) and (Wallop-Breaux)	16 USC 777-777k	Funding to States for management of sport fish (land acquisition, research, development and management projects)
Wildlife Restoration Act (Pittman-Roberson)	16 USC 669-669i	Funding to States for land or water adaptable as feeding, resting, or breeding places for wildlife
Coastal Zone Management Act	16 USC 1451-1464	Assist State programs to protect, develop and enhance coastal resources
Federal Water Pollution Control Act Amendments	33 USC 1251-1365, 1281-1292, 1311-1328, 1342-1345, 1361-1376	Water quality which provides for protection of fish, shellfish, and wildlife; Bay/Estuary programs
Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990	16 USC 4701-4741	Unintentional introduction of nonindigenous aquatic species
North American Wetlands Conservation Act of 1989	16 USC 4401-4412	Wetland ecosystems and other habitats for migratory birds and other fish and wildlife
Great Lakes Fish and Wildlife Restoration Act of 1990	16 USC 941a-941g	Fish and wildlife resources and their habitats of the Great Lakes basin
Federal Water Pollution Control Act (Clean Water Act) Section 404	PL 92-500	Regulates activities of dredge and disposal - impacts wetlands and fish & wildlife habitat
Rivers & Harbors Act of 1938	52 Stat. 802	"du regard" given fish & wildlife conservation in Federal project planning
Rivers & Harbors Appropriation Act of 1899, Section 10	30 Stat. 1151	prohibited unauthorized obstruction of or alteration of navigable waters
Watershed Protection and Flood Prevention Act	68 Stat. 666	investigation of fish & wildlife conservation on NRCS watershed projects

Wild & Scenic Rivers Act	PL 90-542	protects designated river segments
Land & Water Conservation Fund Act	PL 88-578	funds to acquire wildlife areas
Migratory Bird Hunting & Conservation Stamps	Ch. 71, 48 Stat. 452)	acquire wetland easements from fees for hunting birds
Surface Transportation Revenue Act of 1991	PL 102-240)	funding for wetland mitigation banks for State DOT
US Tax Code Tax Reform Act of 1986	PL 99-514	deductions for donation of wetlands to some non-profit groups
Water Bank Act	PL 91-559	wetland leases for 10 year period
Wetlands Loan Act	PL 87-383	interest-free loans for wetland acquisition & easements
Executive Order 11990, Protection of Wetlands (1977)		Federal Agencies minimize impacts of Federal activities on Wetlands
Executive Order 11988, Protection of Floodplains (1977)		Federal Agencies minimize impacts of Federal Projects on floodplains
Federal Noxious Weed Act (1975)	PL 93-629	control of noxious weeds on Federal Lands
Food, Agriculture, Conservation, and Trade Act of 1990	PL 101-624	Wetland Reserve Program - perpetual nondevelopment easements on farmed wetlands
Food Security Act of 1985	PL 99-198	"Swampbuster" - suspends agricultural subsidies to farmers who converts wetlands to cropland & Conservation Easements protect wetlands
Oil Pollution Act of 1990	PL 101-380	enhance response to oil spills & requires natural resource damage assessments

Tax Deductions for Conservation Easements	Section 6 PL 96-541)	deduction for property interest contributed to conservation organization for conservation
US Tax Code Reform Act of 1986	PL 99-514	Eliminated incentives for clearing land - deductible conservation expenditures for wetland protection
Water Resources Development Act of 1976, 1986, 1988, 1990	PL's 94-587, 99-662, 100-676, 101-640	Future mitigation plans for federal water projects should include "in kind" mitigation for bottom-land hardwood forests.

C. Natural Resource Damage Assessments

Natural Resource Damage Assessment rules established at 43 CFR 11 for the release of hazardous substances and 15 CFR 900 for the release of oil provides a framework for conducting sound natural resource damage assessments that achieve restoration of the environment and make the public whole for injuries suffered to natural resources and natural resource services. These restoration actions supplement response and remedial procedures established under the National Oil and Hazardous substances Pollution Contingency Plan (NCP) at 40 CFR part 300 and Section 1006(e)(1) of the Oil Pollution Act of 1990 and Title I (Sections 101 - 127) of the Comprehensive Environmental Response, Compensation, and Liability Act (as amended). The Clean Water Act Section 311 also contains provisions for Natural Resource Damages.

1. Process

The process for addressing natural resource damages is divided into three parts: a pre-assessment screen; restoration planning / assessment phase; and restoration implementation / post-assessment phase. Non governmental groups and organizations, including potentially responsible parties, are encouraged to commit resources to developing and implementing restoration plans. *See 43 CFR Part 11; 15 CFR Part 990; 40 CFR Section 300.185.* Additionally, the statutes allow for settlement at any time during the restoration process. With the involvement of responsible parties and the public, restoration of natural resources will be achieved more quickly, transaction costs will decrease, and litigation will be avoided. *43 CFR Part 11; 15 CFR 990.*

Part I - The Pre-assessment Screen

To date, the natural resource trustees, as authorized under 43 CFR 11 and 15 CFR 990, have completed a pre-assessment screen and have determined to perform a natural resource damage assessment on the Grand Calumet River and Indiana Harbor Ship Canal. The trustees determined that a release of a hazardous substance or oil has occurred; the natural resources for which the trustees may assert trusteeship have been or are likely to be adversely affected by the release; the quantity and concentration of the

released hazardous substances are sufficient to potentially cause injury to natural resources for which the trustees may assert trusteeship; data sufficient to pursue natural resource damage assessment are available or likely to be obtained at a reasonable cost; and currently implemented and planned response actions have not and will not remedy the injury to natural resources without further action.

Part II - Restoration Planning / Assessment Stage

The extent of injury and damage to natural resources is determined during the restoration planning / assessment phase. The goal of the injury assessment is to evaluate the nature, degree, and spatial and temporal extent of injuries to natural resources and services. The information gathered here will provide a technical basis to determine the need for and scale of restoration action.

Assessments brought under 43 CFR Part 11 divide these procedures into three phases: the injury determination phase; a quantification phase; and a damage determination phase. Additionally, the trustees, with recommendations from potentially responsible parties and the public, must decide whether to perform a Type A or Type B Assessment under 43 CFR Part 11. A Type A procedure is a simplified assessment of damage in coastal and marine environments which examines the pathway of contamination; natural resource injury; and an economic damage model. The Type B procedure is more complex, and includes the injury to the resource caused by the release; a quantification of baseline level of reduction in sources; alternatives such as restoration; rehabilitation, replacement, and / or acquisition of equivalent resources.

Restoration of natural resources and services under 15 CFR Part 990 consist of an injury assessment and the selection of a restoration plan. The injury assessment procedure, like those for Type A and Type B above, consists of determining the pathway linking the incident to the exposed and injured natural resources and an injury quantification stage. Further, the selection of a restoration plan occurs after an evaluation of a reasonable range of restoration alternatives. The trustees may choose to use all or parts of existing Regional Restoration Plans. These restoration plans must be consistent with the Oil Pollution Control Act's requirement that damages recovered be used solely to restore, replace, rehabilitate, or acquire the equivalent of injured natural resources and services.

Part III - Post Assessment / Restoration Phase

Post assessment procedures consist of a report of assessment with the administrative record, an accounting, and the publication of the restoration plan. The administrative record contains the body of information supporting the trustees' decisions through restoration planning. The restoration plan describes how the monies will be used to address natural resources, and specifically identifies what restoration, rehabilitation, replacement, or acquisition of the equivalent resources will occur. Modifications may be made to the plan where necessary as the plan proceeds.

2. Data Collection

The Natural Resource Damage Assessments Final Rules specifically requires that the trustees perform each of the phases listed above before implementing a Final Restoration Plan. According to 15 CFR Section 990.42, trustees must conduct data collection to assess injuries and determine whether to conduct restoration planning. Under 43 CFR Section 11.62, trustees must determine if and the extent of injuries to natural resources using the methodologies and guidance provide under Section 11.64. The rule does not place any limitations on how the trustees may collect the data but do provide acceptance criteria which data must meet to produce injury to resources. However, the rules limit the types of data the trustee may collect and states that the collection of data must be coordinated with response actions such that collection and analysis do not interfere with response actions.

The National Contingency Plan provides procedures for the response and remediation of release of hazardous substance or oil and establishes requirements for the performance of a remedial investigation and feasibility studies (RI/FS). The procedures for hazardous substances may be found at 40 CFR 300.430. The data collected must assist in accelerating the response actions and begin to identify the need for treatability studies. Coordination of trustee's natural resource damage assessments with response and/or remedial activities will enhance data needs and eliminate duplicative efforts.

3. Adoption of a Restoration Plan

Natural Resource Damage Assessment rule developed under the Oil Pollution Act (15 CFR 900) provides for the potential development of a "Regional Assessment Plan". Such a plan would have to be developed following all NEPA guideline established in the final rule (15 CFR 900). Once approved, the plan or parts of it could be implemented to address natural resource damages caused by the release of oil without the necessity of site specific restoration planning. The final rules developed under CERCLA for the release of hazardous substances do not contain provisions for the development of or the use of a regional restoration plan. However, components of the RAP which meet the requirements of restoration plan(s) developed under 43 CFR 11 can and should be utilized by the Natural Resource Trustees.

