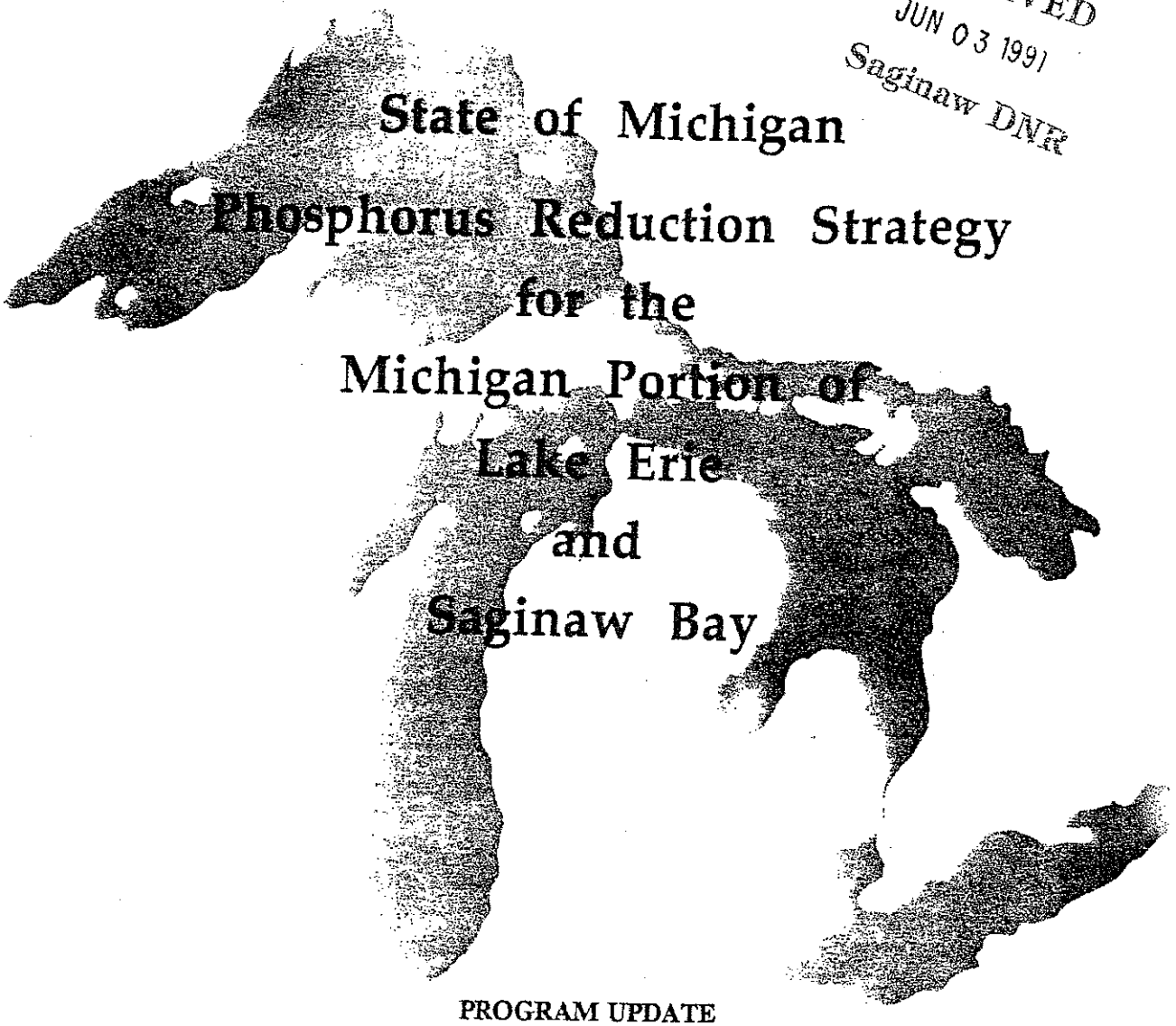

State of Michigan Phosphorus Reduction Strategy for the Michigan Portion of Lake Erie and Saginaw Bay

PROGRAM UPDATE

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Michigan Department of Agriculture
USDA - Agricultural Stabilization and Conservation Service
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SUMMARY

This report updates Michigan's Phosphorus Reduction Strategy, dated August, 1985. It identifies the progress made to date in meeting the phosphorus reduction goals established in Annex 3 of the Great Lakes Water Quality Agreement. Although 1990 was the year in which the goals of the strategy were to be met, only the goals for Saginaw Bay have been achieved. Therefore, this update also includes recommendations.

Michigan's Phosphorus Reduction Strategy was developed to address phosphorus-related water quality problems in Lake Erie and Saginaw Bay. Phosphorus-related algae blooms impaired recreational, navigational, commercial and industrial uses of both Lake Erie and Saginaw Bay. Reclamation of these waters required reductions in phosphorus loads.

As shown in Table 1, below, there are two primary types of sources of phosphorus to Lake Erie and Saginaw Bay. The first type is discharges from municipal and industrial wastewater treatment facilities or "point" sources. The second type is "nonpoint" sources such as agricultural soil erosion, improper home and commercial fertilizer use, and construction site erosion.

Table 1. Sources of Phosphorus to Lake Erie and Saginaw Bay.

Point Sources, including:
- Municipal Wastewater Treatment Facilities
- Industrial Wastewater Treatment Facilities
- Combined Sewer Overflows

Nonpoint Sources, including:
- Urban Land Uses:
  - Soil Erosion
  - Surface Washing (of streets and parking areas)
- Agricultural Land Uses:
  - Soil Erosion (by wind and water)
  - Nutrient Runoff from improper animal waste and fertilizer management
- Atmospheric Deposition

In Lake Erie, the majority of the phosphorus originates from point source discharges. In Saginaw Bay, the relative contributions from point and nonpoint sources are about equal.

When the Phosphorus Reduction Strategy was developed in 1985, limitations restricting the amount of phosphorus discharged from

municipal and industrial wastewater treatment facilities had already been established in discharge authorization permits. These limits required municipalities and industries to make large financial investments in wastewater treatment facility expansions.

An effort to control nonpoint sources of phosphorus was also being made. The Soil Conservation Service (SCS), the Agricultural Stabilization and Conservation Service (ASCS), the Michigan State University Cooperative Extension Service (CES), and the Michigan Department of Agriculture (MDA) have on-going programs to reduce nonpoint sources of phosphorus from agricultural areas. Significant phosphorus reduction was anticipated from the programs underway in these agencies.

As shown in Table 2, the 1985 strategy projected that the point and nonpoint source control programs ongoing in 1985 would not achieve the phosphorus goals by 1990. Because of this, additional nonpoint programs were proposed to accelerate the attainment of this goal.

Table 2. Projected Phosphorus Reductions from Existing and Additional Programs.

Programs	Michigan Portion of Lake Erie (Metric Tons)	Saginaw Bay (Metric Tons)
Existing Point and Nonpoint Programs	165	147
Additional Nonpoint Programs	26	82
Total P Reduction	191	229
Phosphorus Reduction Goals	185	225

"Existing Point and Nonpoint Programs" indicated in Table 2 included those programs underway in 1985 that addressed point or nonpoint sources in Michigan. The point source program included a 1 mg/l phosphorus discharge limit for all major municipal and industrial dischargers. Combined sewer overflows (CSOs) were also beginning to be addressed. The nonpoint source program included efforts underway by agricultural agencies to reduce phosphorus inputs on agricultural land. These programs included residue management, resource management systems, fertilizer management, accelerated soil savings, and animal waste management. "Proposed Nonpoint Programs" consisted of programs which would accelerate phosphorus reductions in agricultural

areas by increasing the number of best management practices implemented, and by providing technical assistance to farmers in both basins.

Table 3 summarizes the progress made to date in meeting the Michigan phosphorus reduction goals for Lake Erie and Saginaw Bay.

Table 3. Summary of Actual Phosphorus Reduction Goals and the Progress Toward Meeting the Goals.

	Michigan Portion of the Lake Erie Basin		Saginaw Bay	
	Progress to Date (MT)	Projected Reductions*	Progress to Date (MT)	Projected Reductions*
Point Source				
Municipal	2.9	0.9	35.5	4.5
Industrial	0	0	32.5	6.9
Nonpoint Source				
Residue Management	77.2	147.1	120.5	182.2
Resource Mgt.**	34.8	-----	60.1	-----
Fertilizer Mgt.	4.0	40.3	25.0	30.8
Accelerated Soil Savings	8.9	-----	16.4	-----
Animal Waste Mgt.	5.3	3.4	10.9	4.4
TOTAL	133.1	191.7	300.9	228.8
GOAL		185		225

*Projected phosphorus reductions from the 1985 strategy
**A series of practices which are implemented permanently to protect the land.

PURPOSE OF THE STRATEGY UPDATE

The State of Michigan Phosphorus Reduction Strategy for the Michigan portion of Lake Erie and Saginaw Bay was presented to the U.S. Environmental Protection Agency (EPA) in August, 1985. In response to Annex 3 of the 1978 Great Lakes Water Quality Agreement, EPA used the information in the Strategy to develop a coordinated United States approach to the Great Lake phosphorus reduction goals in the Annex.

This report is the third of three updates to the Michigan Phosphorus Reduction Strategy. Other updates were developed in 1987 and 1988. This report identifies the progress made since the 1988 Update in addressing the 1990 phosphorus reduction goals established in Annex 3. The methods for determining reductions in phosphorus loadings to Lake Erie and Saginaw Bay in this update were based on methods used in updating the strategy in 1987 and 1988, and are explained in detail in the Technical Supplement to the strategy.

INTRODUCTION

Twenty percent of the fresh water in the world fills the five Great Lakes. Michigan, as the focal point of the Great Lakes drainage basin, leads the nation with 3,251 miles of freshwater shoreline, and approximately 39,000 square miles of four of the Great Lakes is within its political boundaries. The Great Lakes provide a source of water, recreation and navigation for Michigan's 9.2 million residents, and supports industry and tourism which is important to the State's economic health. The water quality of the Great Lakes deserves to be one of Michigan's major environmental priorities.

Accelerated eutrophication (enrichment of waters with plant nutrients), resulting from phosphorus additions due to human activities, is generally regarded as one of the major causes in the deterioration of Great Lakes water quality. Controlling phosphorus was the principal means adopted under a 1978 Great Lakes Water Quality Agreement between the United State and Canada for attempting to reverse or prevent the symptoms of eutrophication. Water quality problems associated with excessive inputs of phosphorus to the Great Lakes include increased turbidity, nuisance algal growths, oxygen depletion in lake waters, and water supply problems. These water quality problems decrease the recreational (swimming, fishing, boating, etc.) navigational, industrial, and commercial values of the Great Lakes.

BACKGROUND

With the signing of the 1978 Great Lakes Water Quality Agreement and the amended 1987 Agreement, the United States and Canada reaffirmed their intentions to restore and maintain the chemical, physical and biological integrity of the Great lakes basin ecosystem. As part of this agreement, the two parties established tentative total phosphorus target loads for each of the Great Lakes. In October, 1983, the U.S. and Canada agreed on

a supplement to Annex 3 of the 1978 Agreement which confirmed the target loads for the Great Lakes

The United States responded to the 1983 supplement by creating the Great Lakes Phosphorus Task Force through the Great Lakes National Program Office, U.S. EPA. The task force was given the responsibility of developing the reduction plan for meeting the United States' phosphorus target loadings. The United States' approach involved having each state included in the drainage basins of Lake Erie, Lake Ontario and Saginaw Bay (Michigan, Indiana, Ohio, Pennsylvania, and New York) develop state phosphorus reduction plans for meeting the target load reductions allocated to each state by the task force. Lake Superior, Lake Huron (except Saginaw Bay) and Lake Michigan did not require phosphorus reduction strategies because existing programs were expected to result in the attainment of the necessary phosphorus loads to protect the quality of the lakes.

The Michigan Department of Natural Resources (MDNR) was the lead state agency in the Great Lakes Phosphorus Task Force. The MDNR was charged with the development of the State of Michigan strategy for the reduction of phosphorus in the Michigan portion of Lake Erie and Saginaw Bay. The Department was assisted by the following agencies: the Michigan Department of Agriculture, the Michigan State University Cooperative Extension Service and Agricultural Experiment Station, the U.S.D.A Soil Conservation Service, and the U.S.D.A. Agricultural Stabilization and Conservation Service.

Prior to initiation of this effort in Michigan, the agencies involved in implementing rural nonpoint source control programs signed a Memorandum of Understanding stating their mutual concern for the abatement of rural nonpoint sources of pollution, and agreed to develop and implement a strategy for rural nonpoint source control. All agencies involved agreed that development of a phosphorus reduction strategy fell within in the purview of agreements made in the Memorandum of Understanding.

TARGET LOADS FOR THE MICHIGAN PORTION OF LAKE ERIE AND SAGINAW BAY

The target phosphorus loads to Lake Erie and Saginaw Bay were based on water quality considerations and the effects of annual loadings on the mean phosphorus concentrations in the Lake and Bay. For Lake Erie, Michigan's portion of the target phosphorus load reduction was determined by estimating the relative contribution of the state to the overall loading to the lake. Because Saginaw Bay is entirely within the Michigan jurisdictional boundaries, the entire phosphorus load was allocated to the state. Total phosphorus loadings, target

loadings, and required Michigan load reductions for Lake Erie and Saginaw Bay are shown in Table 4, below.

Table 4. Total Phosphorus Loadings, Target Loads, and Load Reduction Goals for Lake Erie and Saginaw Bay

	Total P Load (metric tons)	Target Load (metric tons)	Michigan Target Load Reduction* (metric tons)
Saginaw Bay	665	440	225
Lake Erie: (Michigan's portion)	1,705	1,520	185
U.S. Total	13,000	11,000	2,000

*Needed beyond the 1 mg/l municipal discharge requirements.

The loadings given in Table 4 are considered to be average loadings. Actual loadings vary significantly from year to year. Achieving the target loads was expected to result in improved quality and enhanced uses of Lake Erie and Saginaw Bay. Note: For purposes of this update, previous updates and the original strategy, no attept has been made to separate total phosphorus into components according to their availability for algal growth. All references to phosphorus concentrations or loadings should be understood to mean total phosphorus unless otherwise noted.

MICHIGAN'S PHOSPHORUS LOAD REDUCTION STRATEGY

The State of Michigan's strategy for the attainment of the phosphorus reduction goals, established in the Supplement to Annex 3, consists of two basic elements. The first element is the reduction of phosphorus from point source discharges. This element includes a determination of expected phosphorus reduction from on-going point source programs and an analysis of additional program initiatives that might be implemented to reduce point source phosphorus loadings. This includes phosphorus reductions from municipal wastewater treatment facilities, industrial dischargers, and combined sewer overflows.

The second element of the strategy is the reduction of phosphorus through nonpoint source control. The nonpoint source element focused on agricultural sources because several agency programs

were underway which offered cost-effective agricultural management practices--such as fertilizer management, residue management, and animal waste management. These practices are available for reducing nonpoint source phosphorus loadings without significant adverse impacts on crop yields or farm income. Due to the significance of nonpoint phosphorus loadings to Saginaw Bay and Michigan's portion of Lake Erie, a major portion of Michigan's strategy is devoted to the reductions in phosphorus through improved nonpoint source controls in agricultural areas.

Following is a summary of the point and nonpoint components of the strategy.

POINT SOURCE COMPONENTS OF THE STRATEGY

In Lake Erie, approximately 75 percent of the phosphorus load is from point sources. In Saginaw Bay, approximately 50 percent of the load is from point sources. All point source discharges are regulated through National Pollution Discharge Elimination System (NPDES) permits issued by the Michigan Water Resources Commission. Municipal and industrial point source dischargers are required to obtain NPDES permits which have discharge limitations for pollutants, including phosphorus, if appropriate.

Municipal Wastewater Treatment Facilities

To control eutrophication of the Great Lakes, Michigan, through NPDES permits, has required all major and minor municipal dischargers (except lagoons) to attain 1 milligram of phosphorus per liter of water discharged (mg/l). Between 1972 and 1982 federal, state and local agencies invested about $3.4 billion dollars in upgrading and improving municipal treatment facilities in Michigan. A significant portion of this expenditure went toward controlling phosphorus in the discharges.

Municipal wastewater treatment facilities are major sources of phosphorus to Lake Erie and Saginaw Bay. However, most municipal dischargers are in compliance with the phosphorus goal of 1 mg/l and many are discharging concentrations less than 1 mg/l.

Combined Sewer Overflows and Wet Sanitary Sewer Overflows

Many municipalities within both the Lake Erie and Saginaw Bay drainage basins have combined sewers which collect and convey both sanitary wastewater and, during rain events, stormwater runoff. During a storm event or periods of wet weather, the portion of the combined sewage flow which exceeds the collection system or treatment plant capacity receives only partial or no treatment and is discharged directly into the receiving water. The 1988 Update indicated that Michigan's portion of the Lake Erie drainage basin receives approximately 26.9 billion gallons

per year in combined sewer overflows, while the Saginaw Bay basin receives approximately 2.4 billion gallons per year.

Industrial Point Sources

Industrial wastes contribute to the phosphorus loadings of Lake Erie and Saginaw Bay. Michigan's Strategy indicated that if a 1 mg/l phosphorus discharge limit were imposed, major industrial point sources would account for approximately 2 percent and 20 percent of the total phosphorus target load reductions for Lake Erie and Saginaw Bay, respectively.

Point Source Control Implementation

Due to significant previous investments in point source discharges and the high cost of additional treatment, the Michigan Strategy recommended continuing to enforce the 1.0 mg/l phosphorus limitation for all municipal dischargers. The strategy also included a recommendation that additional reductions from CSOs, and industrial and municipal discharges with existing treatment facilities capable of discharging a phosphorus concentration less than 1.0 mg/l be required, where feasible.

NONPOINT SOURCE COMPONENTS OF THE STRATEGY

The nonpoint source element of the Michigan Phosphorus Reduction Strategy involves the use of best management practices for agricultural activities. These activities include tillage practices (residue management), nutrient application (fertilizer management), and the handling of animal wastes (animal waste management). The best management practices for both fertilizer management and animal waste management reduce phosphorus availability. Residue management prevents detachment of soil particles during rainfall and wind storm events, and interrupts the transport of sediment and attached nutrients to surface waters.

The strategy for the reduction of phosphorus from nonpoint sources consists of two basic elements: 1) expected reduction from existing programs, and 2) proposed "accelerated" programs involving a cooperative, multi-agency approach.

Residue Management

Much of the land in both the Michigan portion of the Lake Erie and the Saginaw Bay basins is unprotected from wind and water erosion during the critical periods for spring runoff and wind erosion events. The eroded soil carries with it phosphorus adsorbed to the soil particles. According to the 1982 National Resource Inventory (NRI), approximately 6.6 and 9.0 million tons

of soil eroded from croplands in the Michigan portion of the Lake Erie and Saginaw Bay basins, respectively.

Residue management entails the management of crop residue left on fields after crops have been harvested. Crop residues are effective in reducing erosion, especially during the late winter and early spring. Proper management of crop residues can result in decreased soil erosion, and in turn reduce phosphorus delivered to surface waters. Residue management broadly refers to conservation tillage practices, including no-till, ridge till, and chisel disk systems, provided there is at least 30 percent ground cover after planting. Erosion control structures, diversions, waterways, vegetative barriers, windbreaks, strip cropping and cover crops may be needed with residue management to complete an effective resource management system.

Although conventional tillage--fall and/or spring plowing with little residue coverage--is still the predominant practice in both basins, according to the Soil Conservation Service (SCS) Conservation Tillage Report, in 1990 approximately 24 percent of the cropland in Michigan's portion of the Lake Erie basin was under conservation tillage, while 19 percent was conservation tilled in Saginaw Bay.

The existing residue management programs are carried out by the Soil Conservation Service, Agricultural Stabilization and Conservation Service, Soil Conservation Districts, the Michigan Department of Agriculture, and the Michigan State University Cooperative Extension Service. There are approximately 41 conservationists and technicians in the Lake Erie and Saginaw Bay drainage basins. There are also two special projects, the Saline Valley Rural Clean Water Program Project and the Bean Creek Land Treatment Watershed Project, both in the Michigan portion of the Lake Erie watershed.

Resource Management

Resource management is implementing a series of practices to prevent erosion and runoff from the land. For example, cover crop, no-till and a windbreak may be implemented together to protect erodible soils. Resource management systems are implemented on a permanent basis and are an integral part of Soil Conservation District programs.

Fertilizer Management

As phosphorus levels increase in the soil due to excessive fertilizer application, the amount of phosphorus moving off the land through soil erosion increases, resulting in increased loadings to surface waters. Also, once the soils reach their maximum phosphorus absorption capacity--which in these areas ranges from 90 to 200 pounds of phosphorus per acre, depending on

soil texture and organic matter content--there will be a significant amount of downward movement of phosphorus to groundwater. The groundwater will eventually flow to surface waters and contribute to the phosphorus loads to Saginaw Bay and Lake Erie.

The available soil phosphorus levels in the Michigan portion of the Lake Erie and Saginaw Bay drainage basins have remained relatively constant over the last 10 years. In 1982-83, the average median phosphorus level for the counties within the Saginaw Bay basin was 94 pounds per acre, while the average median level for 1990 was 85.6 pounds per acre. In 1982-83 the average median phosphorus level for the counties within the Lake Erie basin was 88 pounds per acre, while the average median level for 1990 was 89.9 pounds per acre.

In 1985, farmers were, on the average, applying twice the amount of phosphorus that is recommended by the Michigan State University Soil Testing Lab for crop production. The Soil Testing Lab recommends 25 pounds of P_2O_5 per acre as a starter fertilizer for corn on soils testing 93 pounds of phosphorus per acre. Farmers in 1985 were generally applying an average of 50 pounds per acre.

The following recommendations regarding fertilizer management were included in Michigan's Phosphorus Reduction strategy. These recommendations not only were expected to reduce the amount of phosphorus being applied, but were also expected to be economical for the agricultural producers:

1. The amount of phosphorus being applied to the soil should be reduced to the rates recommended by the Michigan State University (MSU) Soil Testing Lab, or current Agricultural Stabilization and Conservation Service (ASCS)-approved laboratories.

2. Phosphorus fertilizer should be applied as close to the time of maximum plant uptake as possible and should not be applied to frozen or snow-covered ground.

3. Phosphorus fertilizer should be banded (applied to the plants in small bands) instead of broadcast over the entire field, when possible.

4. Soil-conserving practices should be employed to reduce the detachment and transport of the soil particle.

Accelerated Soil Savings

Because it was anticipated that the existing nonpoint source program would not enable the state to meet the established goals, the strategy included an accelerated soil savings program. This

program consisted of expanding the cost-sharing, technical assistance and education available to the agricultural community to decrease the amount of soil and therefore phosphorus eroding from the land.

Animal Waste Management

Animal waste is a significant contributor to the phosphorus loadings of both basins. In 1985 there were almost 500,000 animals (milk and beef cattle, sheep and lambs, and hogs and pigs) within the Michigan portion of the basins. Many of the animals are located close to surface waters. Animal waste from pastures, confinement facilities , and indiscriminate manure spreading contribute to nonpoint source phosphorus loading. Animal waste production in the two basins totals over 3.7 million metric tons annually.

The Agricultural Stabilization and Conservation Service administers the Agricultural Conservation Program (ACP) which provides cost-share assistance for animal waste systems. The Soil Conservation Service provides technical assistance for the planning and installation of animal waste management systems and assists the landowners in planning proper application of waste to the land. The Cooperative Extension Service provides: the latest research results on animal waste management through the development of resource materials; training meetings for field staff; educational programs for agencies, animal industry groups, and associations; and information to the media.

Nonpoint Source Control Implementation

To assure the attainment of the phosphorus reduction goals for the Saginaw Bay and Lake Erie drainage basins, implementation of the agricultural practices described above required participation by all of the agencies involved in nonpoint source control programs. Emphasis was placed by all agencies and groups on promoting the use of conservation tillage, fertilizer management, and animal waste management for residue cover, runoff control and phosphorus reduction. Programs and areas having the greatest impact on water quality were given highest priority.

In order to maximize phosphorus reduction, priority counties were selected to receive greater consideration in the development and implementation of accelerated fertilizer and residue management programs. Selection of the priority counties was based on such factors as total cropland acreage and their proximity to the affected water body. Priority management counties for the Michigan portion of the Lake Erie basin were Hillsdale, Lenawee and Washtenaw. The priority management counties in the Saginaw Bay basin were Bay, Huron, Saginaw and Tuscola.

ACHIEVEMENTS TO DATE

The base year for determining progress towards achieving the phosphorus reduction goals was 1982. All point and nonpoint source accomplishments after the 1982 base year were credited towards meeting the goals. Below are phosphorus reduction accomplishment since the base year.

POINT SOURCES

Municipal Wastewater Treatment Facilities and Industries

As shown in Table 5, below, total reductions in point source phosphorus loadings since the 1982 base year are 68.0 metric tons for Saginaw Bay and 2.9 metric tons for Michigan's portion of Lake Erie. The Table shows that Michigan exceeded the goals established for reducing phosphorus from point sources.

The calculations included in Table 5 are from the 1988 Update. The only changes in phosphorus loadings that may have occurred since the 1988 update would be as a result of changes in the Ypsilanti Community Utilities Authority (YCUA) permit. The 1983 permit, which expired June, 1988, included a phosphorus limit of 1 mg/l. The reissued permit included a 1 mg/l limit from time of issuance to October 1, 1989 and then 0.6 after October 1, 1989. It also included a phosphorus limit for a new outfall to the Rouge River to alleviate additional loadings to Belleville Lake. The Rouge River outfall is seasonal and has not yet been completed. Loading calculations were not determined for these changes.

Table 5. Total Reductions in Point Source Loadings.

	Progress to Date (metric tons)	Point Source Goal (metric tons)
Lake Erie		
Municipal	2.9	0.9
Industrial	0	0
Total	2.9	0.9
Saginaw Bay		
Municipal	35.5	4.5
Industrial	32.5	6.9
Total	68.0	11.4

CSOs in the Lake Erie Basin: The Rouge River is a tributary of the Detroit River, which empties into Lake Erie. Approximately 7.8 billion gallons of combined sewage are estimated to be discharged annually to the Rouge River by over 150 CSOs. To

date, all appropriate communities in the Rouge River basin have been issued CSO permits and all permits have been contested. Although no CSOs have been eliminated in the Rouge basin, phosphorus reductions are expected for the following CSO projects:

1. The city of Farmington expects to be fully separated by the end of 1991, thereby eliminating the CSOs from this area.

2. A new pump station will be built in Dearborn which will reduce flows to the Rouge. It is scheduled to be in operation by April 30, 1992. The city of Dearborn recently put telemetry in all of its CSOs. The telemetry has shown that the city has some dry weather discharges. These discharges are currently being addressed.

3. Construction of the First Hamilton Relief and Pump Station 2A is expected to be complete July 1, 1993. These projects are expected to reduce system surcharges and, therefore, CSO flows.

4. The North Huron Valley-Rouge Valley project will reduce CSO discharges in the Middle Branch of the Rouge River. This project is expected to be complete July 1, 1993.

5. The Western Townships Utility Authority (WTUA) project will augment flows to not only relieve CSOs in the Middle Branch of the River, but also mitigate impacts.

Sanitary sewer overflow (SSO) corrections are also expected to result in reduction in phosphorus loading to the Rouge River:

1. Several SSOs in the Evergreen-Farmington area have been corrected, and the remaining ones are expected to be corrected when the project is complete in September 1, 1992.

2. A "wet" sanitary sewer in Canton has been corrected. No known bypasses have occurred in this area in the last two years.

3. In February of 1989, the city of Dearborn Heights developed a proposal to eliminate 10 SSOs. Implementation of their proposal is underway.

4. An outfall in Melvindale that was originally classified as a CSO was found to be a wet SSO pump station. Although this SSO hasn't flowed in two years, the city of Melvindale is working to eliminate it.

CSOs in the Saginaw Bay Basin: To date, all appropriate communities have been issued CSO permits, one of which is being contested. Minor sewer separation has occurred in several communities in the basin.

NONPOINT SOURCES

The major funding sources for implementing nonpoint source control were the Conservation Reserve Program, ASCS cost-sharing, and the Michigan Energy Conservation Program (MECP). Starting in 1988, the state of Michigan received $16.5 million state-wide for the MECP to provide energy saving techniques and management practices to Michigan farmers and foresters to help them reduce their energy costs. The three-year program is administered by the Michigan Department of Agriculture, Michigan State University Cooperative Extension Service and Agricultural Experiment Station, Soil Conservation Districts, and the USDA Soil Conservation Service. MECP provided farmers and forest product producers with direct one-on-one assistance in the following program areas: conservation tillage, irrigation management and scheduling, fertilizer management, integrated pest management, livestock facility management, forest management, and wood energy. Besides conserving energy, these practices also reduced nonpoint source pollution and contributed significantly to meeting the phosphorus reduction goals.

Below are summaries of the phosphorus reduction accomplished through implementation of fertilizer management, residue management, and animal waste management.

Residue Management/Resource Management Systems

Michigan exceeded the goals set for Saginaw Bay and nearly met the goals set for Lake Erie for reducing phosphorus through implementing residue management and resource management systems. In addition, accelerated soil savings were made in both basins due to programs included in the Conservation Reserve Program. Table 6, below, shows the phosphorus savings from residue management, resource management and accelerated soil savings.

Fertilizer Management

Table 7 shows the progress to date in meeting the goals established for both basins for reducing phosphorus inputs with proper fertilizer management. The primary means of reducing phosphorus loadings due to fertilizer management came through the Michigan Energy Conservation Program. Table 7 does not include phosphorus reductions that may have resulted due to Cooperative Extension Service field trials and demonstration plots, Irrigation and Tillage Days, and educational meetings with SCS

and the agri-business community on fertilizer management practices for different soils and conditions.

Table 6. Total Phosphorus Reduction from 1988 to 1990 due to Residue Management, Resource Management and Accelerated Soil Savings.

LAKE ERIE	Progress to Date (metric tons)	Goal (metric tons)
Residue Management	77.2	147.1
Resource Management	34.8	--
Accelerated Soil Savings	8.9	--
Total	120.9	147.1
SAGINAW BAY		
Residue Management	120.5	182.2
Resource Management	60.1	--
Accelerated Soil Savings	16.4	--
Total	197.0	182.2

Source: Soil Conservation Service.

Table 7. Total Reductions in Phosphorus Loadings Due to Fertilizer Management*

	Progress to Date (metric tons)	Goal (metric tons)
Lake Erie	4.0	40.3
Saginaw Bay	25.0	30.8

*Reductions from the Michigan Energy Conservation Program, MDA from 1988-1990.

Table 8 (see next page) shows that the median phosphorus soil test values in both the Lake Erie and Saginaw Bay basins have not decreased significantly from the 1982-83 first year data.

Animal Waste Management

With approximately 500,000 animals in the Lake Erie and Saginaw Bay basins combined, animal waste systems played a significant role in the phosphorus reduction program. The Michigan strategy anticipated that before 1990, 40 and 64 animal waste facilities would be installed with ACP cost sharing in the Lake Erie and

Saginaw Bay basins, respectively. Table 9, below, identifies the actual number of facilities that have been cost shared to date, and the tons of phosphorus that were reduced.

Additional phosphorus savings occurred as a result of Livestock Management practices implemented in Saginaw Bay and Lake Erie under the Michigan Energy Conservation Program. Between 1988 and 1990, 7,926 and 3,483 acres of livestock management was implemented in the Saginaw Bay and Lake Erie basins, respectively. Phosphorus loading reductions for this data were not calculated.

Table 8. Median Phosphorus (Bray P-1)* Soil Test Values (lbs/acre) for the Counties in the Michigan Portion of the Lake Erie and Saginaw Bay Drainage Basins.

LAKE ERIE County	1982-83	1983-84	1984-85	1985-86	1986-87	1990
Hillsdale	95	98	129	116	87	97
Lenawee	76	69	96	88	89	87
Macomb	87	104	89	68	81	79
Oakland	127	119	122	97	82	95
Sanilac	74	83	69	70	80	81
St. Clair	67	99	65	66	70	62
Washtenaw	90	67	85	87	100	70
Wayne	92	108	158	103	135	131
Average	88	93	102	87	90	87.8
SAGINAW BAY County						
Arenac	102	119	108	90	108	67
Bay	147	194	182	222	170	132
Clare	76	66	61	60	83	60
Genesee	98	98	80	62	76	79
Gladwin	61	40	67	67	53	46
Gratiot	107	124	131	100	122	102
Huron	104	95	109	90	97	92
Iosco	67	85	57	78	68	65
Isabella	106	109	94	92	97	95
Lapeer	62	80	68	72	68	64
Livingston	96	98	114	80	90	92
Midland	128	165	130	99	204	127
Ogemaw	74	56	49	60	67	65
Shiawassee	97	90	100	63	80	81
Tuscola	93	112	97	117	96	94
Average	94	102	96	90	99	85.6

Warnke, D. D. Median Soil Test Values for Mineral Soils in Michigan Counties. Michigan State University.

*Laboratory procedure used to analyze the samples.

Table 9. Animal Waste Facilities in the Saginaw Bay Basin and Michigan's portion of the Lake Erie Basin, and the amount of phosphorus reduced from these facilities.

	Progress to Date	Goal
LAKE ERIE		
Facilities constructed to date	34	40
Phosphorus Saved (metric tons)	5.3	3.4
SAGINAW BAY		
Facilities constructed to date	78	64
Phosphorus Saved (metric tons)	10.9	4.4

Source: ASCS

ESTIMATED PHOSPHORUS REDUCTION TO DATE

As shown in Table 3, Michigan exceeded the phosphorus reduction goals set for Saginaw Bay and made good progress toward meeting the goals established for Lake Erie. Total phosphorus loadings have been reduced in Lake Erie by 159.4 metric tons, while in Saginaw Bay, phosphorus loadings have been reduced by 398.1 metric tons.

FUTURE EFFORTS TO REDUCE PHOSPHORUS

Michigan is committed to continuing current efforts to reduce phosphorus inputs to Lake Erie and Saginaw Bay. Point Sources will continue to be regulated with NPDES permits, with all municipal discharges limited to 1 mg/l. Significant phosphorus reductions are expected in the next several years due to CSO improvements.

The Nonpoint Source portion of the strategy will continue to be implemented, though possibly at a reduced effort since funding for the Michigan Energy Conservation Program ended in December, 1990. If the ongoing SCS programs continue to be implemented at the same rate as in the past, it is expected that the Lake Erie goals will be met no later than the end of 1992.

On October 1, 1990, the Soil Conservation Service was awarded a two-year grant funded under Section 319 of the Clean Water Act to accelerate the implementation of best management practices (BMPs) in the Lake Erie basin. The project will concentrate on implementing BMPs within 1/2 mile of streams located in Monroe, Washtenaw and Wayne Counties. Installation of BMPs funded under this grant will include: grassed waterways, conservation

tillage, permanent vegetation cover, filter strips, nutrient management and field windbreaks. This project is expected to reduce phosphorus loads to Lake Erie by 11.1 tons (10.1 metric tons).

RECOMMENDATIONS

Although Michigan has exceeded the phosphorus reduction goals for Saginaw Bay and will likely meet the goals for Lake Erie in the next two years, it is unknown what changes in water quality have occurred in either waterbody. The following are recommendations which will determine the impact of the phosphorus reductions on the basins and help come up with new goals for improving conditions in the basins.

1. **Determine nutrient budgets for Lake Erie and Saginaw Bay.** In order to determine if new phosphorus reduction goals need to be established to meet the desired uses of the waters, nutrient budgets should be established for both basins.

2. **Determine new phosphorus reduction goals.** Based on the nutrient budget, new goals should be developed. Nonpoint source goals should be based on the additional information and knowledge gained since the 1986 base year. Point source calculations should include estimates of the CSO loading reductions and the resultant increase in loadings to the wastewater treatment plants.

ADDITIONAL INFORMATION

Additional information regarding the State of Michigan Phosphorus Reduction Strategy for the Michigan portion of Lake Erie and Saginaw Bay may be obtained from:

Michigan Department of Natural Resources
Surface Water Quality Division
P.O. Box 30028
Lansing, Michigan 48909
517-373-1949