Appendix C

Nonpoint Source Phosphorus Reduction Plan for the Macatawa Watershed

The Macatawa Watershed Project

Nonpoint Source Phosphorus Reduction Plan for the Macatawa Watershed
1999-2009

Macatawa Area Coordinating Council

October 21, 1999

Sue Higgins, Executive Director

Beth McDonald, Watershed Project Manager

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Table of Contents

Executive Summary iv

Figures v

Tables vi

Acknowledgements vii

Chapter 1: Introduction to The Macatawa Watershed and The MACC 1

The Macatawa Area Coordinating Council 1

The Macatawa Watershed: Location and Current Status 2

Dredging Activities in Lake Macatawa 3

MDEQ Water Quality Designation 4

History of Water Quality Studies in the Macatawa Watershed 5

Chapter 2: Development of the Macatawa Watershed Project Study 6

MDEQ and MACC Partnership 6

Other Pollutant 7

Community Participation/Coordination (Task 1 7

Macatawa Watershed Project Committees 7

Community Education and Involvement 8

Educational/Promotional Materials 9

Problem Identification and Prioritization (Task 2) 10

Tools Used to Perform Quantitative Analysis 11

Water Quality Analyses and Conclusions 15

Phosphorus Reduction Implementation Plan and Implementation Plan Development (Task 3) 15

Development of the Draft Phosphorus Reduction Strategy 15

Municipal/ Residential/ Commercial 16

Drain & Road Commissions and Builders & Developers 16

Agriculture 16

Development of the Watershed Implementation Plan 17

Chapter 3: 19

Residential/Commercial Nonpoint Source Implementation Plan 19

Residential/Commercial Best Management Practices (BMPs) 20

Residential/Commercial Sources of Phosphorus 22
Residential/Commercial Watershed Areas 23
Priority BMPs 23
Proposed Demonstration Activities 24
Information and Education 24
New and Emerging Methods/Technologies 25
Sources of Funding 25

Chapter 4: 26

Agricultural Nonpoint Source Implementation Plan 26

Background and Goals 27
Agricultural Best Management Practices (BMPs) 27
Agricultural Sources of Phosphorus 29
Agricultural Watershed Areas 30
Priority BMPs 30
Proposed Demonstration Activities 31
Information and Education 31
New and Emerging Methods/Technologies 32
Sources of Funding 32

Chapter 5: 33

Road/Drain/Construction Nonpoint Source Implementation Plan 33

Recommended Road/Drain/Construction Best Management Practices (BMPs) 34
Road/Drain/Construction Sources of Phosphorus 37
Road/Drain/Construction Watershed Areas 38
Priority BMPs 38
Proposed Demonstration Activities 39
Information and Education 40
New and Emerging Methods/Technologies 41
Sources of Funding 41

Chapter 6: Schedule and Project Logistics 42

Project Schedule 42
Evaluation 44

National Pollutant Discharge Elimination System (NPDES) Phase II Stormwater Regulations 45
Recommended Next Steps 45
Macatawa Watershed Priority Areas Map (with roads and streams) 45.1
Macatawa Watershed Priority Areas Map (with subwatershed boundaries delineated) 45.2

Appendix A 46
Analysis of Water Quality Results versus Land Use, Soils and Slopes 48
Universal Soil Loss Equation (USLE) 48
Generalized Watershed Loading Functions (GWLF) 50
Combining Results from USLE and GWLF to Find Phosphorus Load from Land Uses 53

Appendix B 55
Original Matrix of 44 Methods to Reduce Phosphorus in the Macatawa Watershed

Appendix C 60
Best Management Practice Glossary

Appendix D 69
List of Watershed Project Partners

Appendix E 71
Summary Cost and Effectiveness Table

Appendix F 73
Maps of Subwatershed Classifications

Appendix G 77
Priority Best Management Practices by Subwatershed

Appendix H 82
Potential Funding Sources

Executive Summary

Lake Macatawa, in southern Ottawa County, Michigan, is an 1800-acre (2.75 mi^2) drowned river mouth which empties into Lake Michigan. The Macatawa Watershed (HUC 04050002) is the area of land from which water will drain to Lake Macatawa. The Macatawa Watershed extends into Ottawa and Allegan Counties, covers approximately 110,000 acres (175 mi^2), and includes Lake Macatawa, the Macatawa River, and numerous small tributaries.

The Macatawa Area Coordinating Council (MACC) is an area wide association comprised of units adjacent to Lake Macatawa including the Cities of Holland and Zeeland and the Townships of Fillmore, Holland, Laketown, Olive, Park, Port Sheldon and Zeeland. Researchers from Hope College, state and national environmental agencies, and public and private local groups and individuals have studied the quality of water in Lake Macatawa, the Macatawa River, and their tributaries for over a century. In 1996, the Macatawa River, the South Branch of the Macatawa River, and Pine Creek were recorded on the Michigan Department of Environmental Quality's (MDEQ) 303(d) list due to poor aquatic habitat and aquatic organism communities.

In 1996, MDEQ and the MACC formed a partnership to develop a phosphorus reduction plan for the Macatawa Watershed. The MACC took the lead to assemble local community support and develop the Implementation Plan for reducing phosphorus in the Macatawa Watershed.

The MACC accepted responsibility for four tasks specifically related to developing the Implementation Plan. The MACC developed community support and participation by holding regular Watershed Project committee meetings, creating educational materials, and hosting Watershed Project presentations and workshops. Task Two involved identifying the problem and prioritizing methods to address the problem. The MACC developed analytical tools such as Geographic Information System (GIS) capabilities and phosphorus reduction method information. Developing an Implementation Plan for reducing phosphorus in the Macatawa Watershed was the main objective stated in Task Three. Task Four will then consist of carrying out the Implementation Plan developed in Task Three.

In order to develop the Implementation Plan, Watershed Project staff and committees analyzed the data produced by the MDEQ, used GIS and water quality models to predict the amount of phosphorus coming from various land uses, and researched and placed priority on methods available for reducing the impacts of phosphorus loads, erosion, and concentrated flows in the Macatawa Watershed. Analysis of the MDEQ data revealed that the phosphorus load is distributed throughout the Macatawa Watershed, and that the nonpoint sources (runoff from all other land areas) account for ninety-one percent of the annual average phosphorus load. Therefore, the solutions proposed in this Implementation Plan focus on the nonpoint sources with the understanding that all areas of the watershed are targeted equally due to the distributed nature of the loads.

Watershed Project committees developed an initial list of forty-four methods for reducing phosphorus, erosion and concentrated flows in the waters of the Macatawa Watershed. The methods were analyzed for cost, effectiveness, prior use, and potential for acceptance in this watershed. This Implementation Plan contains a strategy to implement approximately thirty methods in the Macatawa Watershed, and places priority on five to ten methods in each of three various land use classes (Residential/.Commercial Nonpoint Sources, Agricultural Nonpoint Sources, Road/.Drain/Construction Nonpoint Sources) according to their measured cost effectiveness.

The goal of this Implementation Plan is to lower the nonpoint source phosphorus loads in the watershed from approximately 126,000 pounds per year to 35,000 pounds per year. The methods proposed in this Implementation Plan will allow the Macatawa Watershed to achieve this goal over a ten year period upon successful implementation.

Figures

Figure 1. Macatawa Area Coordinating Council Boundaries 1

Figure 2. Macatawa Watershed Location and Boundaries 2

Figure 3. Shipping Channel for Dredging Activities in Lake Macatawa 3

Figure 4. Current Dredge Disposal Site, 120th Avenue and Lakewood Boulevard 4

Figure 5. Coincidence of MACC Boundaries with the Macatawa Watershed Boundary 6

Figure 6. Macatawa Watershed MDEQ Sampling Sites 10

Figure 7. Land Use Map Derived from 1997 Landsat 30 Meter Satellite Image 12

Figure 8. United States Department of Agriculture, Natural Resources Conservation Service, STATSGO Soils in the Macatawa Watershed 13

Figure 9. United States Geological Survey Digital Elevation Model for the Macatawa Area 14

Figure 11. Plot of Land Uses versus Phosphorus Levels for 38 Subwatersheds and Associated Regression Lines and Coefficient of Determination Values 47

Figure 12. USLE Phosphorus Load Predictions for the Macatawa Watershed 50

Tables

Table 1. Land Uses in the Macatawa Watershed 3
Table 2. Proposed Priority BMPs 24
Table 3. Summary of Costs of Priority Activities for Agricultural Implementation Plan 30
Table 4. Summary of Costs of Priority Activities for Road/Drain/Construction Implementation Plan 39
Table 6. Land Uses and Associated USLE C Values for the Macatawa Watershed 49
Table 7. n_k Values, Nutrient Accumulation Rates for the Macatawa Watershed 51
Table 8. Precipitation Summary for Holland for the 30 Year Period 1951-1980 52
Table 9. N Values, Curve Numbers, for the Macatawa Watershed. 53
Table 10. Initial and Secondary Adjustments made to Model Predicted Phosphorus Contributions 54
Table 11. Priority Urban BMPs 78
Table 12. Priority Urbanizing BMPs (I) 78
Table 13. Priority Urbanizing BMPs (II) 79
Table 14. Priority Agricultural BMPs (I) 80
Table 15. Priority Agricultural BMPs (II) 81

Acknowledgements

This Implementation Plan was developed by many members of the Macatawa Area who recognize the value of the waters in the Macatawa Watershed. The cooperation of local residents, business, industry and municipal leaders, the Michigan Department of Environmental Quality (MDEQ), and the U.S. Environmental Protection Agency (EPA) has made this project truly unique. The following groups and individuals deserve distinguished recognition.

Thanks first go to all members of the Macatawa Area Coordinating Council (MACC) Policy Committee, Executive Committee and Watershed Project committees who demonstrated diligence, patience, and insight in support of the Project and its goals. In particular, the Technical Committee members, who met at least monthly for nearly three years, have brought indispensable knowledge, expertise, and history to this first phase of the Watershed Project.

Past and present Watershed Project Executive Committee members, including Ted Bosgraaf, Lee Dell, Carol Quinn, Robert DenHerder, Bruce Rabe, and Charamy Butterworth, provided the Project with the necessary and invaluable leadership to ensure its acceptability and success.

The MDEQ has taken a bold step in a new direction by working in partnership with communities to develop locally driven strategies for tackling water quality issues. Bill Creal deserves special recognition for securing the initial grant from the U.S. EPA and approaching the Macatawa Area Coordinating Council to host the project. Mike Walterhouse and Doyle Brunson organized and executed one of the most extensive sampling efforts ever to be conducted for a watershed in Michigan.

Finally, the first phase of this project would not have been possible without the financial backing of local contributors. The support of the following contributors enabled project staff and committee members to assemble the most comprehensive, scientific, and meaningful study and Implementation Plan possible.

Aves, John and Melanie
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Frey Foundation
Haworth, Inc.
Heinz HJ CO
Herman Miller
Holland Board of Public Works
Holland Country Club
Mead Johnson
Miller, Jack
Parke-Davis
Slikkers Foundation
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The Louis and Helen Padnos Foundation
Uniform Color Co
Zeeland Waste Water Fund

This Implementation Plan will be effective because these groups and individuals have worked long and hard to ensure that it is scientifically sound, applicable and achievable. The true reward will be realized in the coming years when Lake Macatawa and all waters in the Macatawa Watershed improve to make the Macatawa Area an even better place than it is today.

Chapter 1: Introduction to the Macatawa Watershed and the MACC

The Macatawa Area Coordinating Council

The Macatawa Area Coordinating Council (MACC) is an area wide association comprised of the Cities of Holland and Zeeland and the Townships of Holland, Zeeland, Fillmore, Laketown, Park, and Port Sheldon. (see Figure 1). The MACC Policy Committee consists of representatives from each of these governmental units along with representation from the county commissions and road commissions of Ottawa and Allegan counties, the Michigan Department of Transportation, and five representatives from local businesses and residents for a total of 17 Policy Committee members.

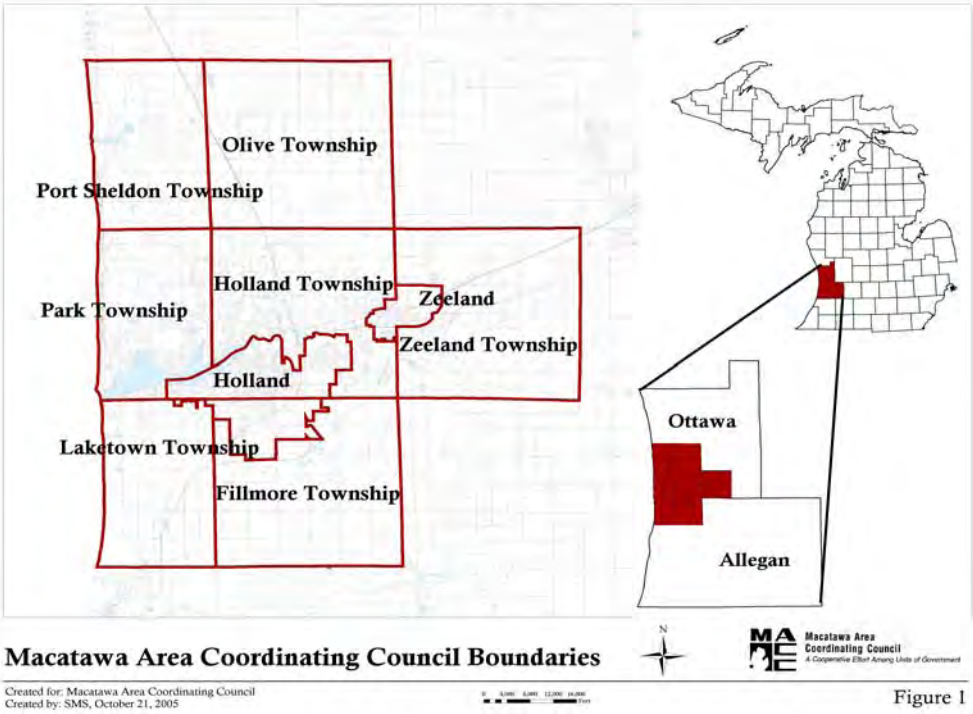


Figure 1. Macatawa Area Coordinating Council Boundaries

The MACC serves as a forum for decision-making among seven units of local government in Ottawa and Allegan counties. It facilitates consensus building in public policy decisions that impact the greater Holland, Michigan, community. The MACC is specifically charged to "encourage cooperation among neighboring governmental units on all matters that would have community impact, which shall include but not be limited to the following: land use, traffic, recreation, parks, transportation, public safety, zoning, the environment, housing, social concerns, and historical/cultural activities".

The MACC began as a voluntary association in 1988. However, in 1993 it gained official status as a Metropolitan Planning Organization (MPO). The MACC is currently involved with numerous community projects. Besides being the host agency for the Macatawa Watershed Project, the MACC participates in other issues with community impact such as transportation planning, Ozone Action! Day, Lake Macatawa harbor dredging, regional airport planning, and more.

The Macatawa Watershed: Location and Current Status

Lake Macatawa, in southern Ottawa County, Michigan, is an 1800-acre (2.75 mi^2) drowned river mouth which empties into Lake Michigan (see Figure 2). The Macatawa Watershed extends into Ottawa and Allegan counties, covers approximately 110,000 acres (175 mi^2), and includes Lake Macatawa, the Macatawa River and numerous small tributaries. The watershed is representative of many other coastal watersheds on Michigan's southwestern shore, such as the Pere Marquette, White, Galien, Black, Betsie, Jordon, Big Sable, and Paw Paw watersheds.

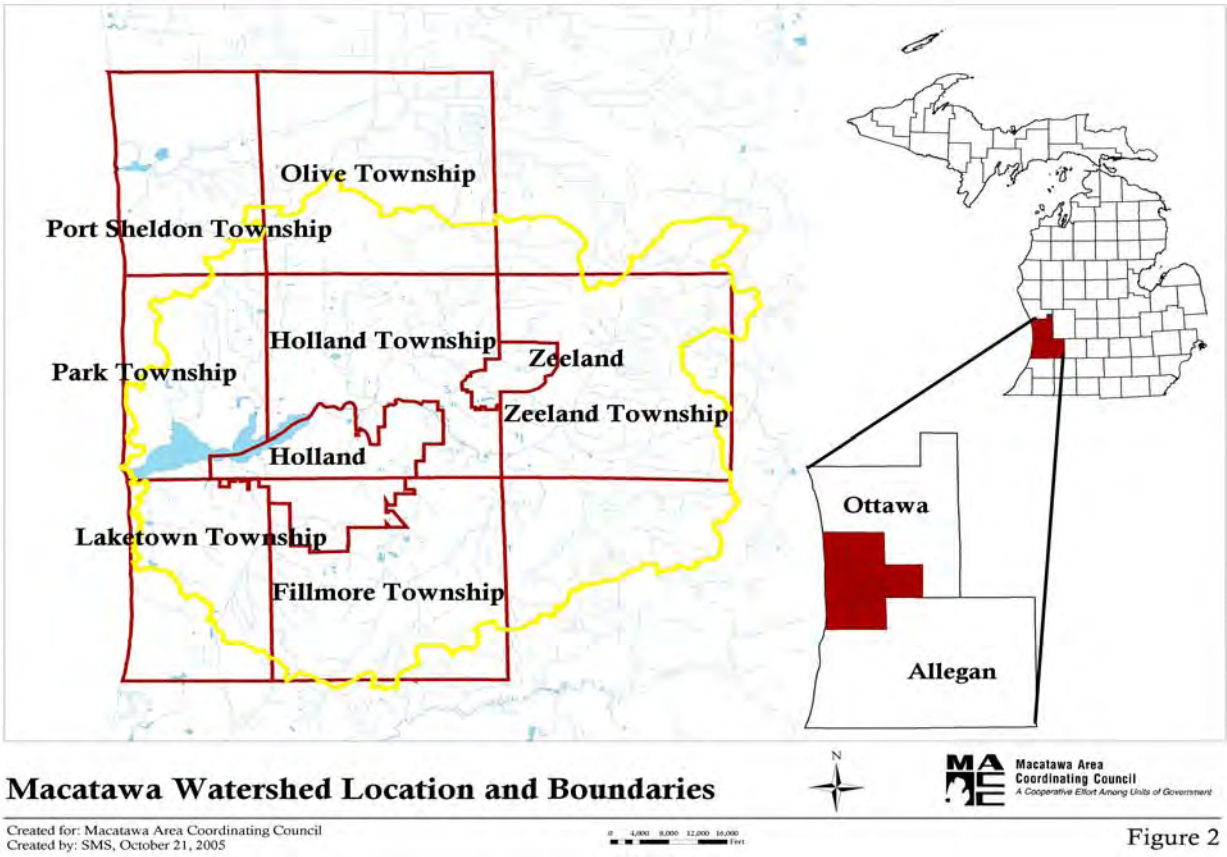


Figure 2. Macatawa Watershed Location and Boundaries

The prevalent land use in the watershed is agriculture. However, the landscape is quickly changing due to growth and development pressures. From 1990 to 1996, Ottawa County had the third largest increase in population in the State of Michigan[1]. Land use changes from forest to agricultural, and more recently from agricultural to residential, have changed the makeup of the landscape during the last century. The following table gives an approximate breakdown of land uses and their relative presence in the watershed based on 1997 satellite imagery.

Land Use	*Percent of Land Use In Watershed*
Barren	1
Residential	9
Commercial/Industrial	5
Roads	3
Cropland	68
Deciduous Forest	9
Coniferous Forest	1
Water	3
Wetland	1

Table 1. Land Uses in the Macatawa Watershed

Dredging Activities in Lake Macatawa

Lake Macatawa requires occasional dredging to maintain a shipping channel from the Lake Michigan inlet to the bridge at River Avenue. The Army Corps of Engineers oversees all dredging activities in Lake

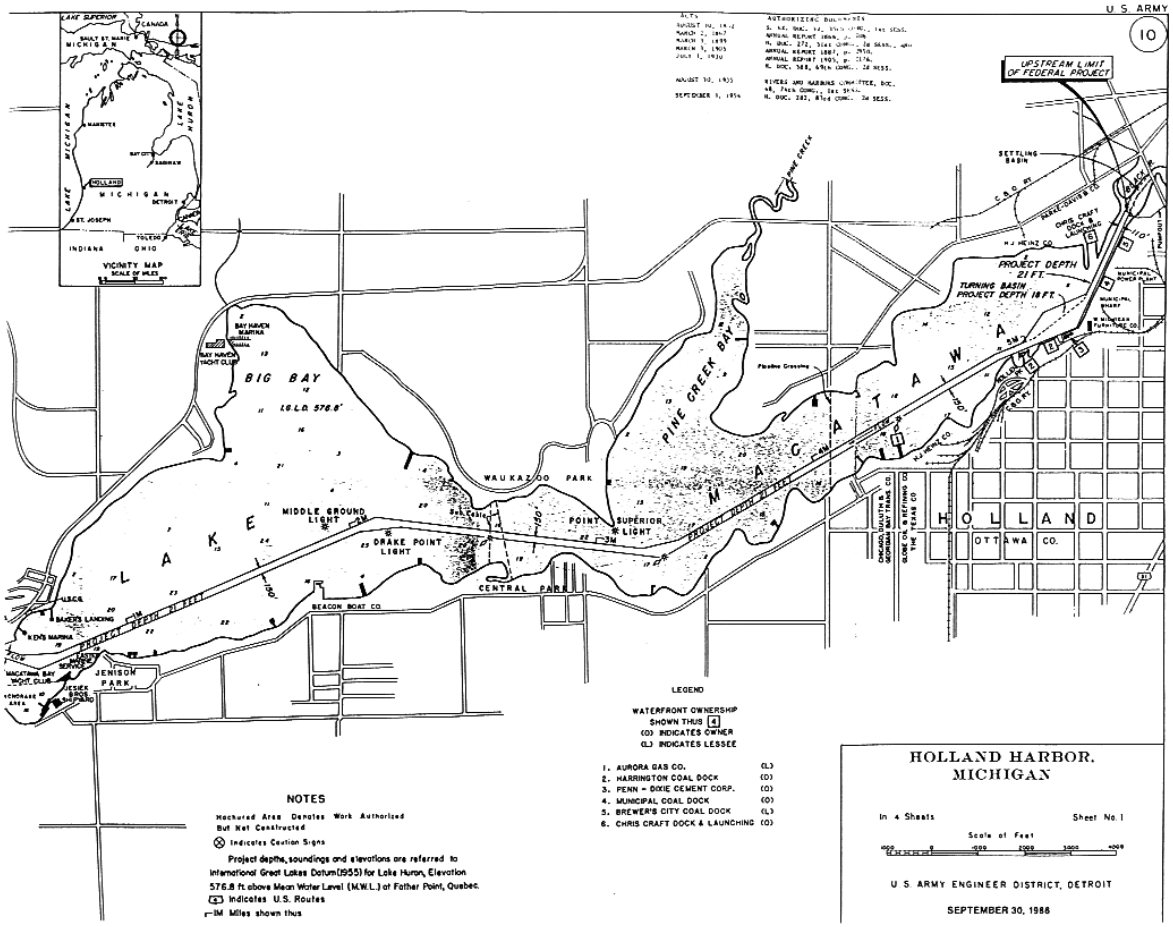


Figure 3. Shipping Channel for Dredging Activities in Lake Macatawa

Figure 4. Current Dredge Disposal Site, 120th Avenue and Lakewood Boulevard

Macatawa. The Lake Michigan inlet is dredged once every year. The portion of Lake Macatawa from the River Avenue Bridge west to the "narrows" of Lake Macatawa requires dredging approximately once every two years. The western portion of the Lake (west of the "narrows") requires dredging approximately once every ten years in order to maintain depths necessary for the shipping channel.

The spoils from the in-lake dredging activities are currently deposited in a confined retention facility located near Lakewood and 120th Avenue. Historically, Windmill Island and the former sanitary landfill (currently part of the Window on the Waterfront Park) were locations where dredging spoils were deposited.

MDEQ Water Quality Designation

According to the MDEQ, the waters of the Macatawa Watershed are not meeting several water quality standards (WQS of Rules 323.1050, Physical Characteristics, 323.1060, Plant Nutrients, and 323.1100, Designated Uses.)

Rule 323.1050 states:

> "The waters of the state shall not have any of the following unnatural physical properties in quantities which are or may become injurious to any designated use:
>
> (a) Turbidity
> (b) Color
> (c) Oil films
> (d) Floating Solids
> (e) Foams
> (f) Settable solids
> (g) Suspended solids
> (h) Deposits"

Turbidity, Color, Settable solids, Suspended solids, and Deposits were all identified as properties which contributed to Lake Macatawa's possible non-attainment of its designated uses.

Rule 323.1100- Designated Uses, states that: "At a minimum, all surface waters of the state are designated for, and shall be protected for, all of the following uses:

a) Agriculture
b) Navigation
c) Industrial water supply
d) Public water supply at the point of intake
e) Warmwater fishery
f) Other indigenous aquatic wildlife
g) Partial body contact recreation

All surface waters of the state are designated for and shall be protected for total body recreation from May 1 to October 31.

According to MDEQ, the water quality of the Macatawa watershed is being impaired by phosphorus*. MDEQ listed the Lake Macatawa watershed on the 303(d) list in 1998 for nutrient enrichment and nuisance algae blooms. **NOTE: * This is the opinion of the MDEQ and not necessarily the applicant.**

History of Water Quality Studies in the Macatawa Watershed

Researchers from Hope College, state and national environmental agencies, and local public and private groups and individuals have studied the quality of water in Lake Macatawa, the Macatawa River, and their tributaries for over a century. Research on biological communities, sediment quality, waste discharges, nutrients, and toxic measurements in the Lake Macatawa Watershed signals the presence of water quality impairments well before the current study was undertaken.

The majority of studies performed since the mid-1960's indicate that Lake Macatawa and its tributaries have struggled for decades with high levels of sediment and nutrients, indicating highly trophic (hypereutrophic) conditions.

Don Williams, Ph.D., Hope College, submitted a report of water quality observations taken from 1966-1974[2]. Williams worked with the Hope College Institute for Environmental Quality and volunteers from the Macatawa Bay Yacht Club to collect weekly lake water samples from June through September. One of the group's conclusions was that an erosion and overabundance of organic matter problem existed in the waters, evidenced by high coliform counts.

As early as 1965, the Michigan Department of Conservation made various reports of fish kills. Each report contains suggestions that the cause was low oxygen levels, caused by various waste discharges to the tributaries. The low oxygen levels again suggest hypereutrophic conditions. In 1971, the Michigan Water Resources Commission conducted a biological survey of the Black River and Lake Macatawa. The survey indicated poor water quality due to the number and types of aquatic life observed[3].

In 1996, the Clean Water Committee of the Lake Macatawa Shoreline Association assembled a document containing communications and background information on water quality studies performed on Lake Macatawa[4]. Much of the information contained in that document points to excessive sediments and nutrients as sources of the Lake's historical problems.

In 1995, the Michigan Department of Environmental Quality (MDEQ) performed a study of the waters in the East Basin of Lake Macatawa[5]. The Department concluded that the dissolved oxygen levels in the lake were unsatisfactory, and that a probable cause of the low levels was nutrient overenrichment. This study by the MDEQ contained the findings that led to the development of the current Macatawa Watershed Project.

A consultant for The Lake Macatawa Shoreline Association, Water Quality Investigators, completed a study of the Lake Macatawa Watershed in 1999. The report includes historical information, water quality and sediment analyses, discussion and recommendations for remedial action in the Macatawa Watershed. A Water Quality Index was used to rank the overall water quality in Lake Macatawa. The Index was comprised of scores for temperature, dissolved oxygen, chlorophyll-a, secchi disk depth, nitrate, alkalinity, pH, specific conductivity, and total phosphorus.

Scores for the index follow an academic letter-grading scheme, A, B, C, D, and E, from highest quality to lowest. Lake Macatawa was tested over sixty times from 1993 to 1997. Scores for all dates, with the

exception of five, were E (poorest water quality). The Water Quality Investigators found an average of 101 micrograms per liter phosphorus concentration over their five year sampling period.

Chapter 2: Development of the Macatawa Watershed Project Study

The Michigan Department of Environmental Quality (MDEQ) is required by section 303(d) of the U.S. Environmental Protection Agency's (EPA) Clean Water Act to list waters in the State which are not in compliance with water quality standards after technology-based controls are implemented. In 1996, the Macatawa River, the South Branch of the Macatawa River, and Pine Creek were recorded on the MDEQ's 303(d) list due to poor aquatic habitat and organism communities.

In 1996, MDEQ and the MACC formed a partnership to develop a phosphorus reduction plan for the Macatawa Watershed. The MACC took the lead to assemble local community support and develop the Implementation Plan for reducing phosphorus in the Macatawa Watershed.

MDEQ and MACC Partnership

The boundaries of the MACC coincide with the boundaries of the Macatawa Watershed (see Figure 5). Therefore, the MACC is an ideal host for a project to enact change in the Macatawa Watershed. Communities outside the MACC boundaries, which have land inside the Macatawa Watershed, are included in the process through presentations and discussions. Two townships lie outside the boundaries of the MACC but inside the boundaries of the watershed. They are: Olive, and Overisel.

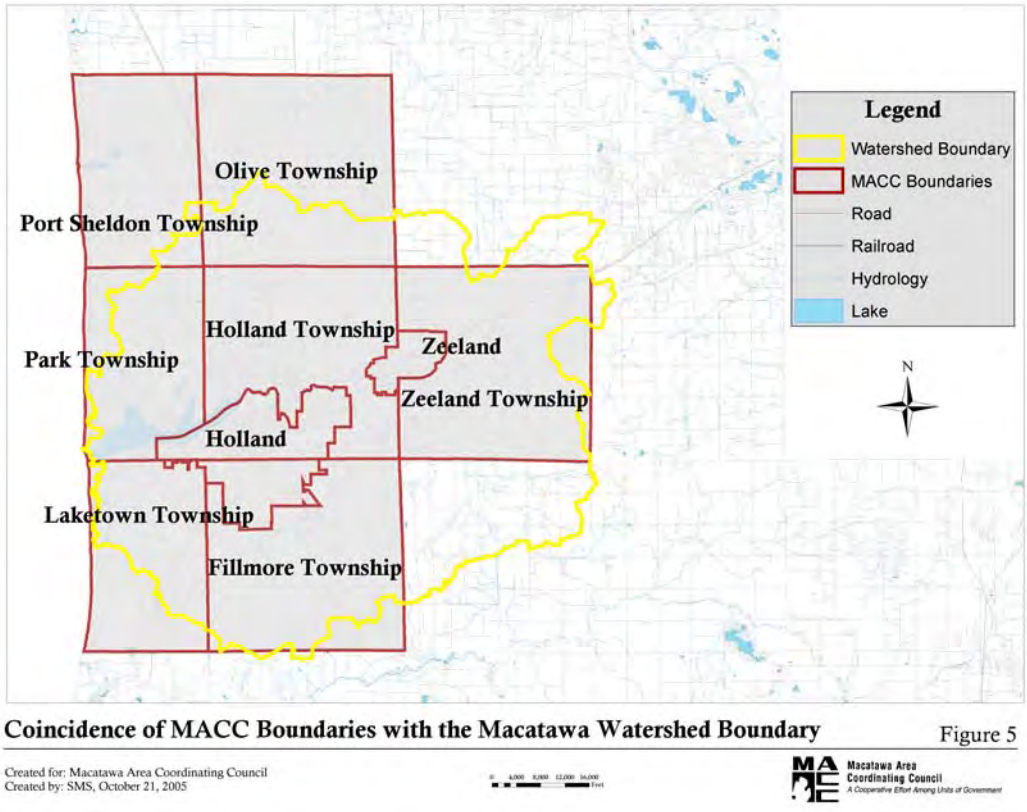


Figure 5. Coincidence of MACC Boundaries with the Macatawa Watershed Boundary

The MACC agreed to carry out the local portion of the project for nonpoint sources including organizing community support and participation through education and involvement in meetings, workshops, and other events. The MACC also assumed responsibility for creating the Implementation Plan for reducing phosphorus in the Macatawa Watershed.

The MDEQ agreed to sample the waters in the Macatawa Watershed for one year to provide the necessary background information on phosphorus levels in the watershed. The MDEQ was also an active participant in the Watershed Project committee structure, attending technical, coordinating and stakeholder meetings.

The MACC, working partially with a grant from the MDEQ, also developed a local budget for completing the first phase of the project and pursued additional private and public funds to fulfill the budget goals.

In order to assure a comprehensive and workable Implementation Plan for lowering phosphorus in the Macatawa Watershed, an official agreement was developed by members of the MDEQ and the MACC. The agreement contains four main tasks. Each agency assumed responsibility for parts of each task. The following chapters describe the first three tasks included in the agreement between the MDEQ and the MACC and the results from carrying out each task. The fourth task in the agreement is the Implementation Stage, and will follow the acceptance of this Implementation Plan.

Other Pollutants

Early in the development of the Macatawa Watershed Project, members learned that in order to effectively address phosphorus, other water quality phenomenon needed to be addressed as well. Early studies as well as the comprehensive water quality analysis conducted by the MDEQ point to a variety of factors contributing to the low water quality status of the Macatawa Watershed. Factors such as low dissolved oxygen levels and secchi disk depths and high chlorophyll-a, nitrate, suspended solids, and phosphorus readings all contributed to Lake Macatawa's hypereutrophic classification.

Phosphorus was chosen as the focus element for the purposes of this project due to its usual nature as a limiting agent in a hypereutrophic condition. However, other water quality elements were considered while focusing on phosphorus. Watershed Project members learned that phosphorus, as an element, does not easily dissolve in water and instead tends to travel through the watershed bound to soil particles. Therefore, erosion control methods were also considered important potential solutions. Members also learned that concentrated overland or instream flows of water will encourage the detachment of soil particles and move them (and the attached phosphorus) through the watershed. Accordingly, methods that slow or reduce flow on land or in the waterways will also help reduce the amount of phosphorus ending up in the waters in the Macatawa Watershed.

Chapters three through five contain the Watershed Implementation Plans for nonpoint source stakeholder groups. Each Plan contains methods that slow the phosphorus, erosion, or flow from any given sub-basin in the Macatawa Watershed.

Community Participation/Coordination (Task 1)

To develop a successful Implementation Plan for reducing the amount of phosphorus in the Macatawa Watershed, it was necessary to build community support and participation.

Macatawa Watershed Project Committees

A foundation of watershed committees was built and the committee members were charged with carrying out the tasks of the first phase. Committee meetings were held on a regular basis. Following is a description of the Macatawa Watershed Project Committees, their functions, and membership.

1. Macatawa Area Coordinating Council (MACC) Policy and Executive Committees

The two top decision-making groups in the MACC committee structure originally agreed to host the Watershed Project and have provided oversight and guidance of the project and its

objectives. The MACC Policy Committee consists of representatives from each of the seven MACC governmental units along with representation from the county commissions and road commissions of Ottawa and Allegan Counties, the Michigan Department of Transportation, and five representatives from local businesses and residents for a total of 17 Policy Committee members. The five business representatives comprise the MACC Executive Committee which oversees all MACC activities.

2. Macatawa Watershed Project Executive Committee

Key members of the community, Macatawa Watershed Project staff, and one representative from the Michigan Department of Environmental Quality (MDEQ) comprise the Watershed Project Executive Committee. The committee is responsible for general oversight of the Watershed Project and final approval of items to be presented to the MACC Policy Board.

3. Macatawa Watershed Project Coordinating Committee

The Executive Committee meets occasionally with additional MDEQ staff who are involved with the Macatawa Watershed Project. The coordinating committee serves as a forum for discussion of the partnership and overall project goals and progress.

4. Macatawa Watershed Project Technical Committee

At the end of the first phase of the Macatawa Watershed Project, over 60 community members actively participate in the Technical Committee. Participants include industry representatives, environmental engineers, environmental activists, local and county municipal leaders, wastewater treatment plant operators, residents, farmers, extension agents, and others. The Technical Committee meets monthly to discuss project progress. Working subcommittees were formed from the Technical Committee when needed.

5. Macatawa Watershed Project Stakeholder Committee

Over 350 members of the Macatawa community expressed interest in the Watershed Project in some form, and together constitute the Stakeholder Committee. The Stakeholder Committee members receive quarterly newsletters and participate in Stakeholder meetings held approximately annually.

Community Education and Involvement

Watershed Project staff and committee members extended the foundation of the formal committee structure by actively educating and involving the broader Macatawa community. Staff and Watershed Project Committee members organized workshops, field trips, and presentations to local civic groups.

Two key workshops were coordinated for Watershed Project participants. The first, early in the project development, was organized to walk participants through a hypothetical watershed project scenario. The second, near the end of the first phase of the project, offered participants a chance to review and discuss methods which were proposed for inclusion in the Phosphorus Reduction Implementation plan, and to contribute additional information about the methods. That information was then used to assign priorities to the methods when developing the Implementation plan.

Members of the Watershed Project committees organized and attended several field trips during the first phase of the Watershed Project. The field trips allowed participants to learn, first hand, where phosphorus was coming from in the watershed, and what was currently being done to improve water quality in the watershed. Field trips included visits to many locations including the following:

- MDEQ Sampling Locations
- Dredge Containment Facility
- Wastewater Treatment Plants
- Detention Basins and Dams
- Regional Composting Facility
- Construction and Residential Subdivision Sites
- Environmentally Sensitive Golf Club

Presentations were given to all township boards and city councils within the watershed as well as civic groups in an attempt to educate citizens about several key pieces of information regarding the Watershed Project. Staff and committee members attempted to answer questions such as “What is a Watershed?”, “What is Phosphorus?”, “Why Study Phosphorus?”, and “What is the Macatawa Watershed Project” during the presentations. Watershed Project staff and committee members gave presentations to numerous groups including the following:

- League of Women Voters
- Hope Academy of Senior Professionals
- Holland and Zeeland Rotary Clubs
- Holland and Zeeland Chambers of Commerce
- High School and College Science Groups

A partnership with Hope College has enabled three specific educational activities. In the fall of 1997, an Advanced Environmental Seminar was begun and two groups of undergraduate students performed independent research projects related to the Macatawa Watershed Project. The seminar was repeated with new students in 1998, and is slated to continue in upcoming years. Their results are reported to the Macatawa Watershed Project Technical Committee and links to their reports are posted on the Macatawa Watershed Project website.

The MACC matched funding supplied by Hope College to support two undergraduate interns during the summer of 1998. The interns again performed independent research and developed methods for collecting and analyzing water quality samples from the Macatawa Watershed. Another student intern began an independent project with the Watershed Project in the summer of 1999 and will continue her study through the summer of 2000.

Also during the summer of 1998, a teacher training workshop was conducted. Seven teachers from local middle and high schools spent one week and earned up to two graduate credits learning about the Macatawa Watershed, phosphorus, and other water quality issues.

The Watershed Project enjoyed thorough media coverage which promoted education of the broader watershed community. Watershed Project Stakeholder meetings and MACC Policy Committee meetings were videotaped and broadcast on the local Macatawa Area Cable TV station which has a viewing audience of over 20,000 residents. The newspapers also covered many Technical Committee meetings and carried announcements of important events.

Educational/Promotional Materials

Educational materials were developed for community information as well. A brochure was prepared and distributed to all units of government within the watershed and to local civic groups. A professional video was developed to enhance presentations about the Watershed Project. A website was activated on the homepage of the Macatawa Area Coordinating Council. The website contains current information about the Watershed Project and links to other internet locations with watershed information. A quarterly newsletter was used to inform stakeholders about current Watershed Project activities.

Problem Identification and Prioritization (Task 2)

To best understand where the phosphorus problem was originating, the first phase of the project included an extensive one-year watershed sampling program. As part of the agreement, the MDEQ tested forty-four (44) sites twice monthly for phosphorus, sediment, flow levels, and other trophic state indicators (See Figure 6). The testing was carried out from November of 1996 to November 1997. The results of the testing are compiled in a report delivered to the MACC in March 1998[6].

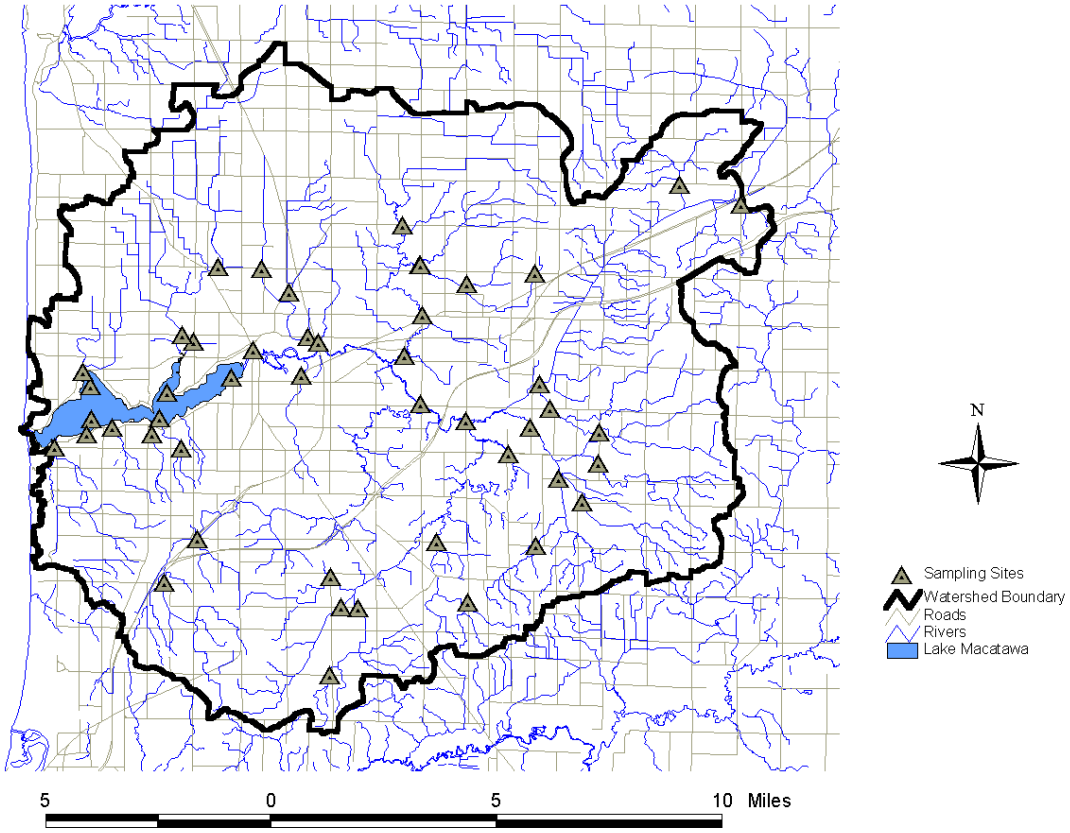


Figure 6. Macatawa Watershed MDEQ Sampling Sites

Lake ecosystems are sometimes characterized by trophic levels. Three common trophic levels are oligotrophic, mesotrophic, and eutrophic. An oligotrophic lake is one with little plant growth and clear water. At the other end of the scale, a eutrophic lake has much plant growth, algae blooms, and murkier water. Lake Macatawa currently falls into the hypereutrophic (beyond eutrophic) category of lake health due to its nutrient overenrichment, low oxygen levels, and high suspended solid measurements. The average level of phosphorus in the Macatawa Watershed in 1996/1997 was 127 µg/l.

Several analyses were carried out by Macatawa Watershed Project staff and committees which allowed for a scientific understanding of phosphorus overenrichment in Lake Macatawa. Three main questions were answered by the quantitative analyses of phosphorus levels and best management practices (BMPs).

1. The MDEQ collected thorough data on the presence of phosphorus in the Macatawa Watershed[7]. That data provided valuable information on the spatial and temporal phosphorus load patterns. However, the recommendation of specific methods for reducing phosphorus in

the watershed would require base knowledge regarding the present contributions of phosphorus from various land uses. Therefore, Watershed Project members needed to know "Where is the phosphorus coming from?"

2. Although the preferred best management practices were known, the Watershed Project members needed to know "How effective will each phosphorus reduction method be?"
3. Finally, knowing the relative contributions of phosphorus from each land use, Watershed Project members needed to find out how much phosphorus would be removed from the system using various combinations of best management practices. Watershed Project members needed to know "What combination of methods will achieve the goal of 35,000 pounds of phosphorus per year for nonpoint sources?"

The MDEQ data report included observations which were used to guide further analyses of the phosphorus problem. The MDEQ reported that the total amount of phosphorus contributed to the Macatawa Watershed by nonpoint sources was ninety one percent of the total phosphorus load. The nonpoint sources include water reaching the waterways from diffuse sources such as lawns, rooftops, fields, and forests.

Therefore, the majority of the reduction in phosphorus load needed to be realized through a reduction in nonpoint sources. The quantitative analysis focuses on determining the nonpoint source contributions and best solutions.

Tools Used to Perform Quantitative Analysis

Computing tools have allowed water quality scientists to perform increasingly more accurate assessments of watershed conditions and predictions of water quality response to watershed alterations. Participants in this project benefited from the use of several computer programs and data sets which allowed a thorough analysis of the current and predicted Macatawa Watershed conditions. A description of the computer tools follows.

1. Geographic Information Systems (GIS)

GIS can be 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[8]. GIS allows researchers to analyze traditional data in a geographic context. Watershed Project staff and committee members used GIS to display and analyze relationships between water quality data, land uses, soils, and slopes. The GIS was used in conjunction with water quality models. ESRI ArcView (plus Spatial Analyst) and Data Automation Kit software was used for these analyses.

2. Geographic Data Sets

Various data sets were used to perform the analyses described below. EOSAT Landsat 30 meter TM images from 1986 and 1997 were purchased and converted into land use maps following a modified Anderson Level I class system[9].

STATSGO soils were obtained online from the United States Department of Agriculture, Natural Resources Conservation Service. The STATSGO data came with extensive ancillary data, which described various soil properties such as erodibility, permeability, and organic content[10].

United States Geological Survey one degree Digital Elevation Model (DEM) data, again obtained online, was used to derive slope information. Watershed boundary data was created by the MDEQ and subwatershed delineation, as well as GIS data set assembly, was performed by Macatawa Watershed Project staff.

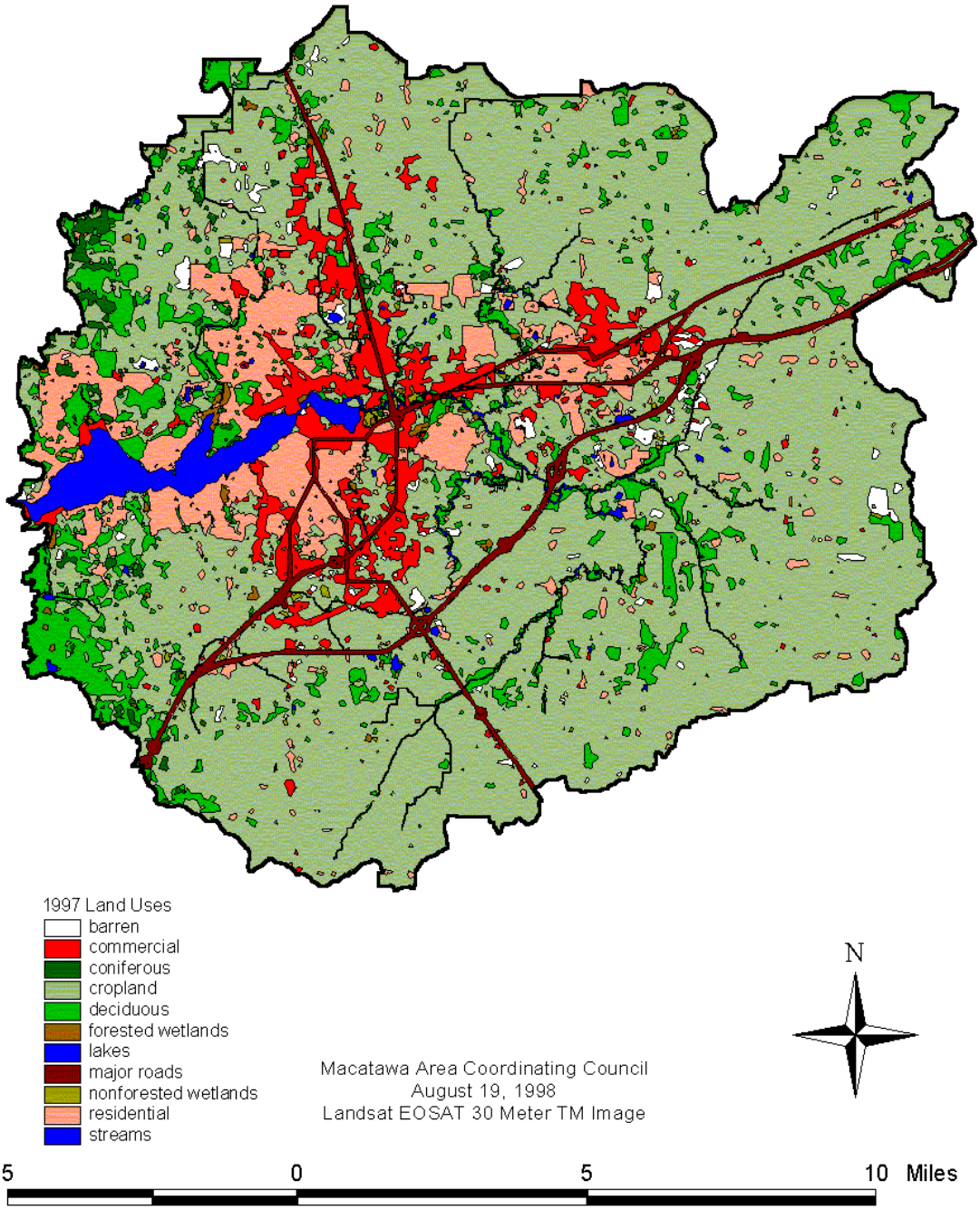


Figure 7. Land Use Map Derived from 1997 Landsat 30 Meter Satellite Image

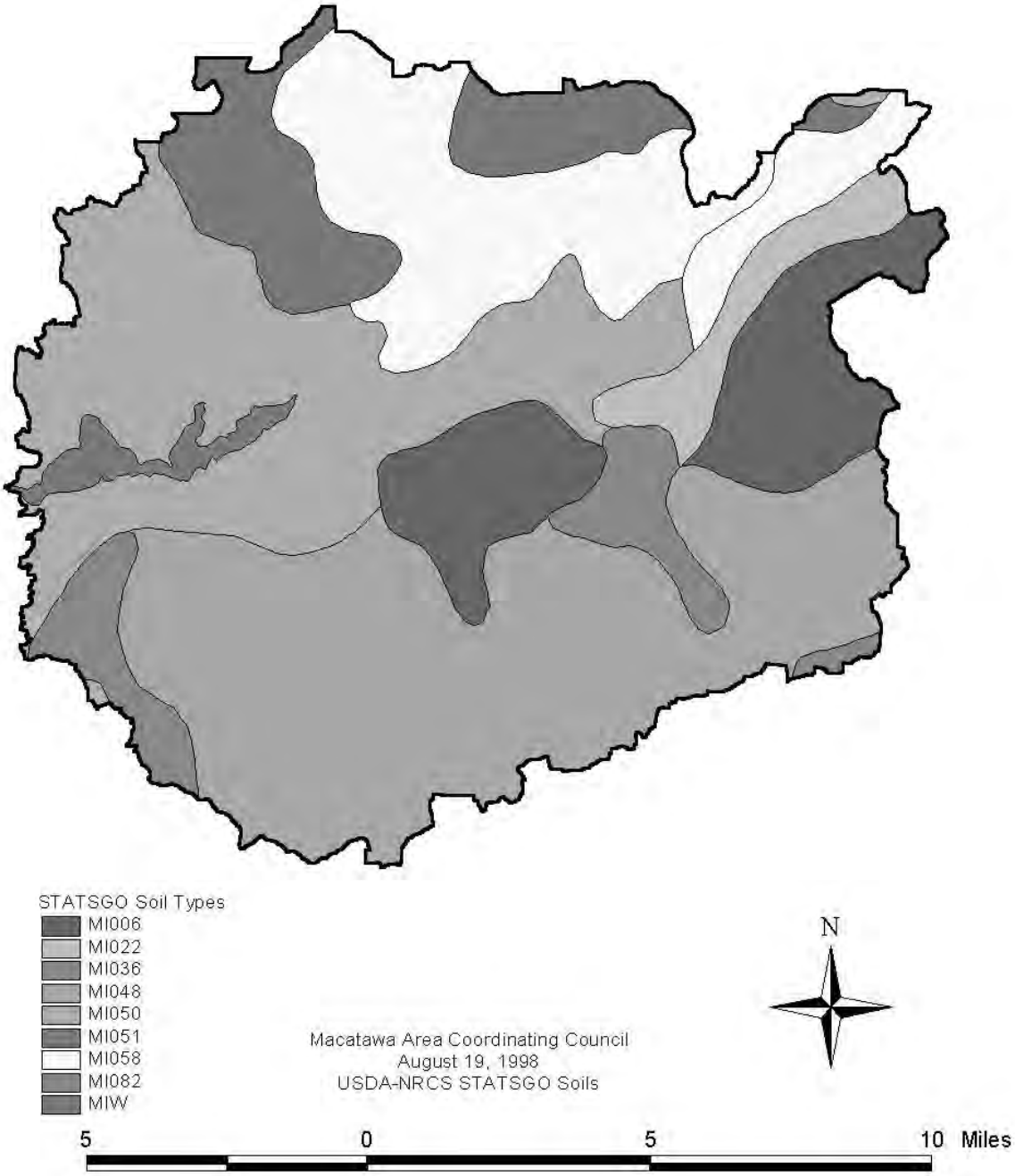


Figure 8. United States Department of Agriculture, Natural Resources Conservation Service, STATSGO Soils in the Macatawa Watershed

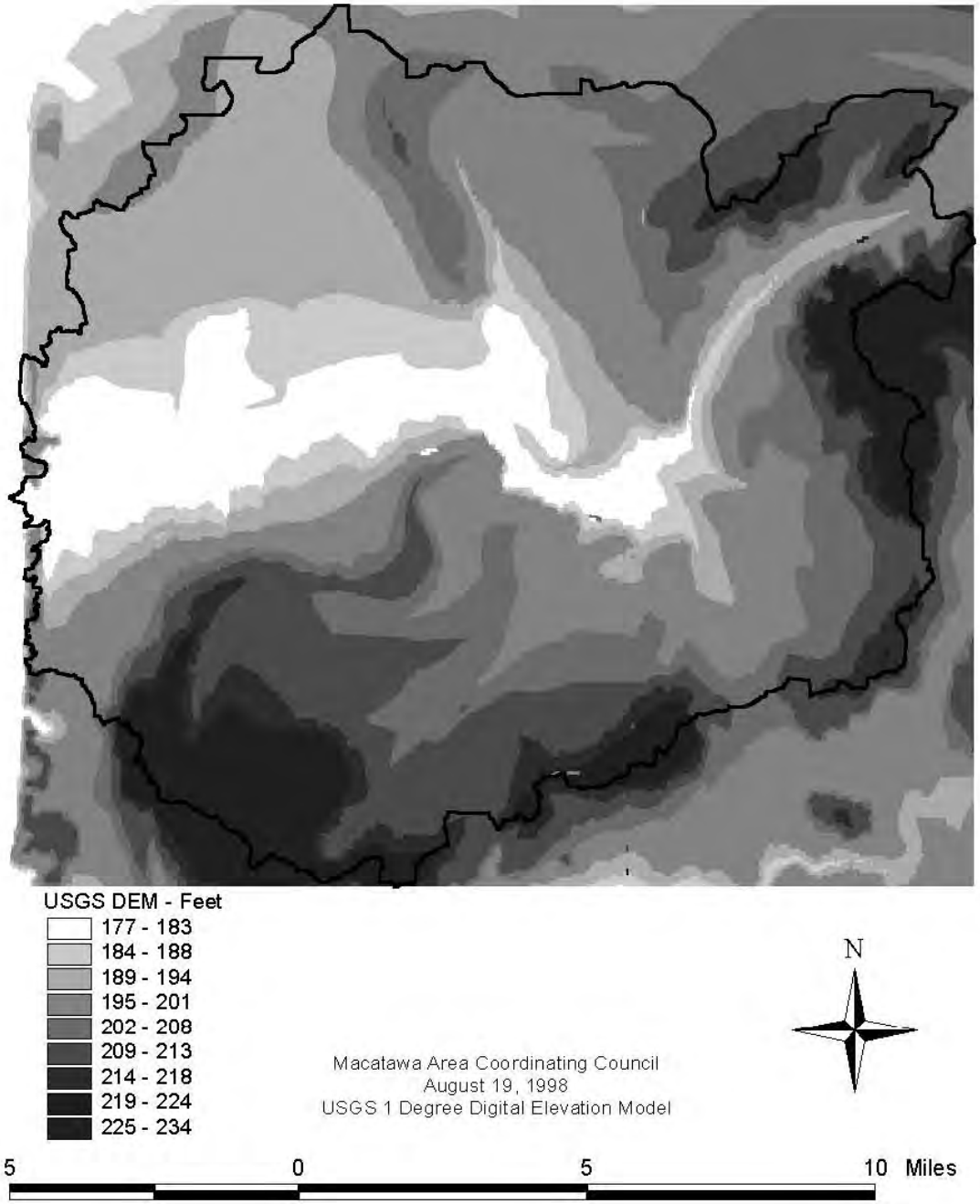


Figure 9. United States Geological Survey Digital Elevation Model for the Macatawa Area

3. ***Spreadsheet Programs***

   Spreadsheets enabled staff and committee members to analyze tabular data resulting from the GIS analyses in an efficient manner. Microsoft Excel spreadsheet was used to perform all tabular calculations.

Water Quality Analyses and Conclusions

In order to determine how land uses as well as soils and slopes may affect phosphorus levels, Macatawa Watershed Project staff and committee members analyzed the results from the MDEQ sampling. Statistical and spatial analyses were completed using the tools described above. For a complete description of the water quality analysis, see Appendix A.

The water quality analyses were aimed at determining how much phosphorus was contributed from each land use. Results from the statistical and spatial analyses support the assumption that phosphorus contributions are distributed, not only geographically throughout the watershed, but among land uses as well. Therefore, all members of the Macatawa Watershed must contribute to the solution in order to achieve the previously stated phosphorus reduction goals.

Phosphorus Reduction Implementation Plan and Implementation Plan Development (Task 3)

The development of an Implementation Plan to reduce phosphorus in the Macatawa Watershed was accomplished in two steps. First, a Draft Phosphorus Reduction Strategy was created to illustrate the types of best management practices chosen to accomplish the goals of the project. Macatawa Watershed Project staff and committee members then used the Strategy as a foundation to create the Watershed Implementation Plan. This Implementation Plan contains information about where, and in what amounts, the best management practices, or best management practices (BMPs) will be implemented in the watershed.

Development of the Draft Phosphorus Reduction Strategy

The first step in writing the Draft Phosphorus Reduction Strategy was to create an inventory of all potential best management practices. The watershed project's Technical Committee formed a Phosphorus Reduction Methods Subcommittee and reviewed all known best management practices. The subcommittee compiled a list of potential methods for inclusion into the Draft Phosphorus Reduction Strategy.

The subcommittee consisted of representatives of the following groups: engineering, agriculture, municipal wastewater treatment, residential and commercial landscaping, local government, drain commission, and home builders/developers. The subcommittee summarized research and evaluations of currently used best management practices found in literature or in the practices of similar watershed projects. The subcommittee tapped various sources when researching the methods. Examples of sources used are:

- Internet publications regarding best management practices
- MDEQ Guidebook of Best Management Practices for Michigan Watersheds
- Academic papers
- Networking with experts
- Implementation strategies developed by other watershed groups

The subcommittee successfully developed a matrix of potential methods (See Appendix B). The matrix included the following information about each method: Cost, Current Usage, Barriers to Implementation, and Resources Available for Implementation. Appendix C contains a glossary of the best management practices contained in the matrix.

A Watershed Workshop was then held to gather community input on the prioritization of the methods to be included in the phosphorus reduction Implementation Plan. Workshop attendees were divided into groups that represented similar water or land uses such as: Municipal/ Residential/ Commercial, Drain & Road Commissions and Builders & Developers, Point Sources, and Agriculture. Each group produced approximately three to six methods to be given priority as the Implementation Plan was developed. Following are the three non-point source groups and the methods given priority by each group. Definitions for many of the methods are contained in the Phosphorus Reduction Method Glossary, Appendix C.

Municipal/ Residential/ Commercial

1. Education: Storm drain stenciling, use of peer pressure by creating awards for individuals, businesses or industry which implement watershed friendly practices, soil testing and related watershed-friendly management of lawn (mowing, fertilizing, etc.), high profile demonstration projects
2. Public Policy Changes: Changes to the drain codes, require all new developments to have stormwater detention systems; improve multiple jurisdiction coordination; improve ability to enforce erosion prevention regulations; restrict development on places identified as potential wetland areas; increase amount of wetland areas in the watershed
3. Buffer Zones

Drain & Road Commissions and Builders & Developers

1. Education
2. Promotion of Better Management Practices: use of new plants or plantings, proper maintenance on basins and traps, silt traps, buffer strips
3. Maintain Green Spaces around Waterways

Agriculture

1. Soil Testing
2. Conservation Tillage/No-Till Practices
3. Encourage Buffer Strips and Sod Waterways
4. Education
5. Manure Management: including manure storage, composting, and general farm management plans
6. Detention/Wetland Creation

In order to determine how much reduction in phosphorus levels could be expected from implementation of any given method, effectiveness ratings were assigned to each method. Effectiveness information was obtained from literature values. Three main sources of information were used to research effectiveness of the methods[11,12,13]. All sources derived the effectiveness information from field observations of best management practices.

The literature sources typically gave effectiveness information in terms of percent phosphorus reduction which could be achieved by implementing each method. In order to remain consistent with developing the plan using the most conservative estimates possible, most effectiveness values were chosen as the lower end of the range of possible values.

Watershed Project staff made an initial approximation of how much effort would need to be spent on the implementation of the proposed best management practices by summarizing the best management practices with their effectiveness information. The approximation of required effort of methods and corresponding phosphorus reductions indicated that the required nonpoint source phosphorus reductions could be achieved through significant nonpoint source implementation activities.

Development of the Watershed Implementation Plan

With the foundation of the Draft Phosphorus Reduction Strategy in place, staff and committee members next addressed the questions such as "Where will we begin implementation of these preferred best management practices", and "How much will it cost". McNamee, Porter and Seeley, Inc. and Dell Engineering were hired as consultants to assist in producing answers to those questions. The consultants proposed an analysis to evaluate the cost effectiveness of various combinations of Best Management Practices (BMPs) in the watershed.

The analytical procedure used to determine the cost-effectiveness of the BMPs is detailed in the consulting team's final report[14]. The consultants utilized a method that accounted for each BMP's cost and effectiveness and its potential serial or parallel interaction with other BMPs in the watershed. The process was iterative, and involved both computer analysis and consultation with community experts to define real-world constraints. For the duration of the development of the Implementation Plan, five workgroups and a steering committee provided the community expertise needed to make the plan realistic and implementable.

Independent Implementation Plans (Chapters 3, 4, 5)

The work of the consultants, workgroups, and steering committee members is shaped into three distinct Implementation Plans. Each Plan is applicable for a particular nonpoint source stakeholder group. The following three chapters spell out the individual Implementation Plans:

Chapter 3. Residential/Commercial Nonpoint Source Implementation Plan

A list of 15 Best Management Practices (BMPs) designed for all stakeholders involved in the management of land currently in residential, commercial, industrial, or municipal use (not under construction or transition).

Chapter 4. Agricultural Nonpoint Source Implementation Plan

A list of 16 BMPs designed for all stakeholders involved in the management of agricultural (crops or livestock) lands.

Chapter 5. Road/Drain/Construction Nonpoint Source Implementation Plan

A list of 21 BMPs designed for all stakeholders involved in the management of roads, drains, or land under construction or transition

Each chapter also contains the following information:

- A map of recommended areas in which the BMPs will be located
- A list of priority BMPs and associated cost and effectiveness information
- Several Demonstration Activities, or actions which are determined to be feasible and implementable upon the beginning of the Implementation Phase of the Watershed Project
- Key Information and Education activities to support the implementation of BMPs
- Comments on New and Emerging Technologies
- Information on specialized funding sources

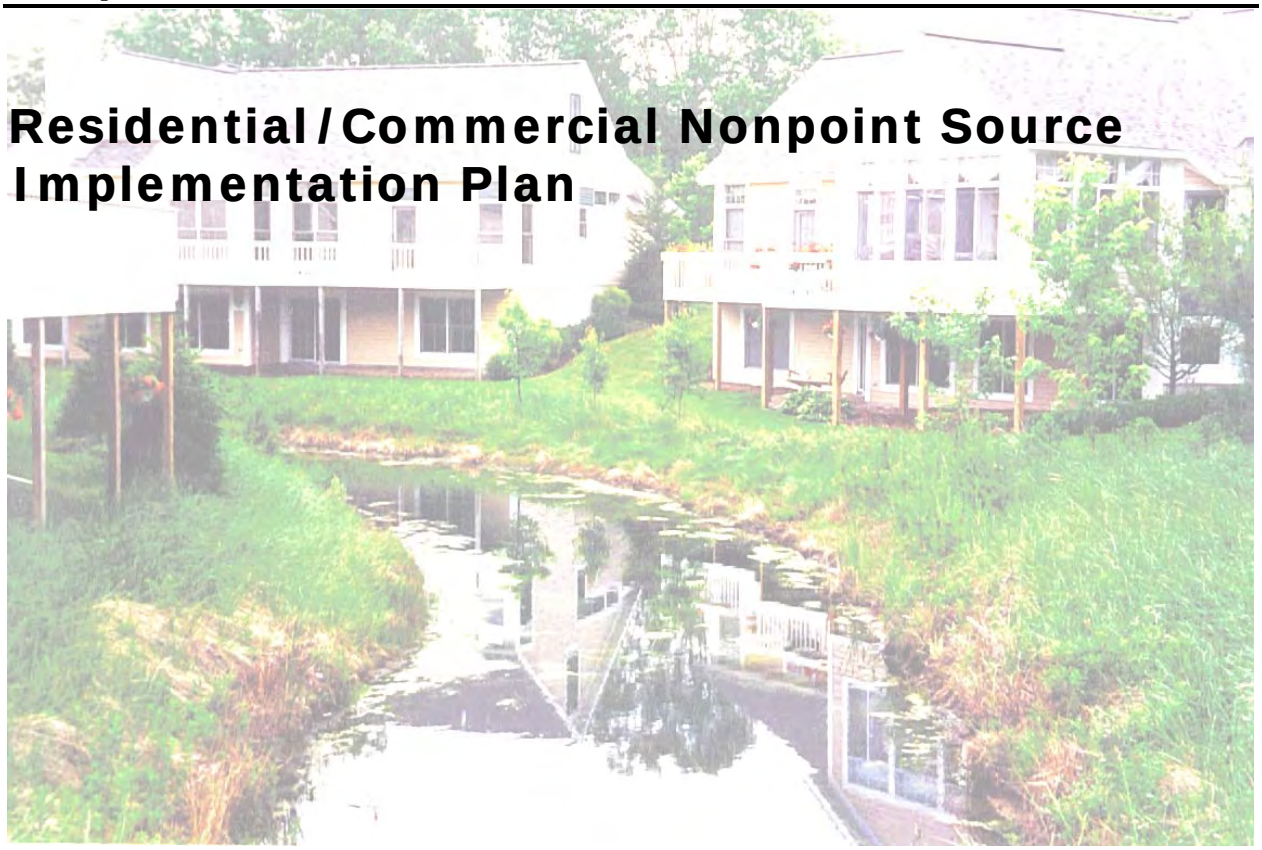
For the purpose of developing this plan, the watershed and its subwatersheds were broken down into three general land use categories. This breakdown was performed by analyzing the land use map created from satellite imagery (see chapter 2, page 11) for the most prevalent land use in each subwatershed. The land use categories used for the purpose of this analysis include:

1. Urban: Land which is categorized by typical urban characteristics such as high population density, high percentage of impervious surfaces (blacktop, pavement, rooftops, etc.), and little green or open space
2. Urbanizing: Land which is in a transitional phase, consisting of some green or open space and some high density areas, tending toward the growth of high density/high impervious surface areas.
3. Agricultural: Land which is used for agricultural production, or large tracts of fallow or open space land

Maps of each of these subwatershed classifications may be found in Appendix F.

Chapter 3:

Residential/Commercial Nonpoint Source Implementation Plan



Background and Goals

The following plan for improving water quality in the Macatawa Watershed is based on three years' research and planning by Macatawa Watershed Project committees and community members. The goal of the Macatawa Watershed Project is to reduce phosphorus in Lake Macatawa Watershed by nearly seventy percent during the years 1999-2009. In 1996 through 1997, the approximate nonpoint source phosphorus load to Lake Macatawa was 126,000 pounds. The goal is to reach 35,000 pounds per year by the year 2009.

The following methods are aimed at reducing phosphorus, erosion, and flow (three closely related problems in the watershed) and were selected by community members and assembled into a quantitative plan by Watershed Project committees and consulting engineers. Any questions or comments about the plan may be directed to the agency listed on the cover of this Plan document.

Summary information regarding total Implementation Plan costs, effectiveness, and a list of all Priority Best Management Practices may be found in Appendix E.

Residential/Commercial Best Management Practices (BMPs)

1. Buffer/Filter Strips

A buffer/filter strip is an area of vegetation used to filter sediment, organic matter, and other pollutants from surface water runoff. This area may be natural, undeveloped land, or it may be planted with grass or other vegetation. Note that the terms filter strip and buffer strip are used interchangeably.

NOTE: This practice is not a substitute for BMPs in upland areas, rather, it should be used in conjunction with upland BMPs. Upland erosion must be controlled in order to avoid filling the buffer/filter strip with sediment and impairing its function.

2. Catch Basins/Stormwater System Updates/Installation

Catch basins are stormwater inlets to the sewer system which contain a sump to capture solids and thereby prevent sewer blockages.

NOTE: This BMP should not be implemented unless a regular maintenance program is adhered to. Uncleaned catch basins may contribute loads of biological oxygen demand (BOD) and sediment to the receiving stream. If regular maintenance cannot be done, use an alternative to catch basins such as simple inlets (without sediment traps), street sweeping, sewer cleaning, off-line storage, or flow attenuation.

3. Critical Area Stabilization

Critical area stabilization is stabilizing areas which are highly susceptible to erosion by implementing one or more vegetative or structural BMPs. For the purpose of this BMP, critical areas include areas with highly erodible soils, long or steep slopes, droughty soils, excessively wet soils, soils that are very acidic or alkaline, slopes immediately adjacent to waterbodies or wetlands, fill areas and areas subject to concentrated flows.

4. New Types of Low Maintenance Lawn Grass/ Change in Lawn Maintenance

The use of new types of lawn grass which require little or no traditional mowing, watering, or fertilizing.

5. Permanent Sedimentation Basins

Sediment basins are man-made depressions in the ground where runoff water is collected and stored to allow suspended solids to settle out. They are used in conjunction with erosion control measures to prevent off-site sedimentation. They may consist of a dam, barrier or excavation, a principal and emergency outlet structure, and water storage space. Their primary purpose is to trap sediment and other

coarse material. Secondary benefits can include runoff control and preserving the capacity of downstream reservoirs, ditches, canals, diversions, waterways and streams.

6. Planting Trees, Shrubs, and Ground Cover; Including During/After Construction

This BMP addresses the selection and maintenance of woody plant materials, including trees, shrubs, and ground covers. Trees, shrubs and ground covers can be used on steep or rocky slopes where mowing is not feasible. Once trees, shrubs and ground covers are well established they:

- help stabilize the soil, reducing both wind and water erosion
- reduce stormwater runoff by intercepting rainfall and promoting infiltration
- filter pollutants from the air and produce oxygen
- moderate temperature changes and provide shade
- provide some privacy
- improve aesthetic values and increase property values

In addition, ground covers can provide stabilization in areas which are heavily shaded.

7. Private Septic System Maintenance

Educate septic system users regarding proper and environmentally friendly use of septic systems. This would include proper pumping frequencies, conserving water use, keeping drain field clear of trees, avoiding the use of chemicals, and not using the toilet as a trash can.

8. Slope Stabilization

This BMP addresses structures which stabilize shorelines and slopes that cannot be stabilized with vegetation. Structures included in this BMP are: revetments, gabions, seawalls, bulkheads, groins, breakwaters and retaining walls. Typical applications of each of these structures are included in this BMP. Note that some of these structures are also used to stabilize stream banks.

Permits for the construction of slope/shoreline stabilization practices will be required by the Department of Natural Resources, Land and Water Management Division if the structure is below the ordinary high water mark of a lake (or stream), floodplain or wetland. In some situations, both MDNR and U.S. Army Corps of Engineer permit requirements will need to be met.

9. Soil Testing

Property owners are urged to sample their soils to determine the level of phosphorus. Most soils in Ottawa County have enough phosphorus to maintain crops, turf, etc. Soil testing will indicate when applications of other nutrients are necessary.

10. Stabilized Outlets

Outlets are areas which receive discharge water. Stabilized outlets are outlets which reduce the velocity of discharge water to non-erosive velocities.

11. Stream Crossings

A structure which provides a more confined, safer, and environmentally sensitive means for crossing from one side of a stream to the other. Such crossings may be either above or below the water surface. The type of crossing may vary with respect to length, width, height, and construction design, depending on the purpose of the crossing and the environmental and physical characteristics of the stream.

All crossings require a permit from the MDNR and the local soil erosion enforcing agency, and some may require permits from the U.S. Army Corps of Engineers or the Michigan Department of Transportation.

12.Street Scraping/Sweeping

Street Scraping/Sweeping involves the use of specialized equipment to remove litter, loose gravel, soil, pet waste, vehicle debris and pollutants, dust, de-icing chemicals, and industrial debris from road surfaces. Street sweeping equipment can consist of a truck or truck-like vehicle equipped with multiple

brushes, pick-up deflector, holding bin, water sprayer, vacuum nozzle and filter, or a combination of some or all of these features.

13. Wetland Construction/Greenway Restoration/Development

To maintain and/or enhance existing wetland characteristics such as vegetative composition and cover, flow characteristics of surface and groundwater, hydrology and geochemical characteristics of substrate, and wildlife; to restore wetlands and their range of functions and values where they existed previously by re-establishing the hydrology, vegetation, and other habitat characteristics; to create new farm wetlands which are compatible with agricultural uses.

14. Education/Awards - General Public

15. Use of GIS by Local Planning and Zoning Boards and Watershed Staff and Committees to Implement Methods in Locations with Greatest Impact

16. Successful Planning for, and Inclusion of, Maintenance in Implementation of Methods

Residential/Commercial Sources of Phosphorus

The following is a list of suspected sources of phosphorus in the residential and commercial areas in the Macatawa Watershed.

Streambank or slope erosion

Applicable BMPs:

- Critical Area Stabilization
- Buffer/Filter Strips
- Planting Trees, Shrubs and Ground Cover
- Slope Stabilization
- Stabilized Outlets
- Stream Crossings

Runoff of fertilizer, sediment, and organic material into gutters and storm sewers

Applicable BMPs:

- Catch Basins
- Street Sweeping

Runoff of fertilizer, sediment, and organic material into streams and ditches

Applicable BMPs:

- Buffer/Filter Strips
- Sedimentation Basins
- Planting Trees, Shrubs, Ground Cover
- Wetland Construction

Fertilizer misapplication

Applicable BMPs:

- Low Maintenance Lawn Grass
- Soil Testing
- Planting Trees, Shrubs, Ground Cover

Excessive flow through increased impervious areas

Applicable BMPs:

- Catch Basins/Stormwater System Updates
- Planting Trees, Shrubs, Ground Cover
- Wetland Construction

Residential/Commercial Watershed Areas

The geographic areas over which the preceding methods should be applied include any land currently in commercial, industrial, or residential use (post-construction), especially in the area delineated in the urban and urbanizing maps in Appendix F. It is critical that community members who are responsible for the land which is in stable commercial, industrial, or residential use are following these recommended BMPs to mitigate any negative impact to the area's waterways.

Due to the nature of urban and urbanizing areas, much of the land is in an impervious state. Therefore, the phosphorus/erosion/peak flow reduction methods recommended for urban areas have the function of increasing, wherever possible, the quality and stability of vegetated spaces and creating additional places where water can collect, infiltrate, and allow sediment and nutrients to settle out.

Priority BMPs

The BMPs in Table 2 are being recommended as priority actions. These are the management practices which were able to be quantified as the most cost-effective at present. All other methods are encouraged and should be considered as part of the long-term management plans for existing land currently in stable residential, commercial, or industrial use. Appendix G contains detailed information about the recommended application of these priority BMPs in specific subwatersheds.

The cost for the priority activities listed above are also summarized below. The annual costs are comprised of capital expense amortized over a twenty year period, with interest at 8%, and annual operation and maintenance expenses.

BMP Control Option	Level of Effort	Capital Cost ($)	Annual Cost ($)	Removal (lb/yr)	Unit Cost ($/lb)
Urban					
Landscape Management	4,650 ac	N/A	$ 88,270	1,380	$ 64
Street Sweeping	4 times/yr	$ 400,000	$ 297,450	9,275	$ 32
Urbanizing					
Low Maintenance Lawns	5,390 ac	N/A	$ 4,930	90	$ 55
TOTAL		**$ 400,000**	**$ 390,650**	**10,745**	

Table 2. Proposed Priority BMPs

Note: Landscape Management includes education of the public in urban areas regarding the methods "Planting Trees, Shrubs, and Ground Cover; Including During/After Construction", and " New Types of Low Maintenance Lawn Grass/ Change in Lawn Maintenance"

Proposed Demonstration Activities

Residential/Commercial stakeholders and agency leaders proposed several demonstration projects with which to begin the Implementation Phase of the Macatawa Watershed Project. Following is a list of such projects:

1. **Develop awards for watershed-friendly landscaping techniques used by area residential, commercial and industrial sites.**

   Lead Agency: Holland Area Beautiful

   Details: Holland Area Beautiful will incorporate residential, commercial and industrial awards into an existing landscaping awards program.

2. **Begin Master Composter program**

   Lead Agency: Michigan State University Extension

   Details: Slated to begin September 23, 1999. Homeowners will learn the fundamentals of composting which will reduce the amount of organic matter and nutrients entering the stormwater system in the Macatawa Watershed. MSU Extension will provide each Master Composter class participant with a home composting tumbler.

3. **Evaluate Septic System Status**

   Lead Agency: MACC with assistance from Ottawa and Allegan County Health Departments

   Details: MACC Staff will determine the extent of septic system usage in the Macatawa Watershed (numbers, approximate geographic locations.) Current septic monitoring procedure and requirements will be determined. As necessary, a targeted educational campaign may be appropriate to address the issues of septic system failure.

Information and Education

Information and Education activities will enhance and initiate the implementation of other structural, vegetative, and managerial best management practices. Watershed stakeholders voiced a strong opinion during the development of the Implementation Plan that information and education activities will be the most desirable and important components of the Plan.

One important part of the information and education plan will be a monitoring program to determine the effectiveness of the plan. A preliminary survey will be conducted before the plan is implemented, and a follow-up survey will also be conducted. Therefore, it will be important that all information and education activities are carried out as part of a carefully designed plan. Following is a summary of the Information and Education activities which will be implemented by members of the Residential/Commercial community.

1. Write informational articles for local municipal newsletters highlighting Residential/Commercial Nonpoint Source best management practices.
2. Develop outdoor watershed learning centers for use by local school systems. Encourage area school systems to use the Zeeland Public Schools' wetland learning center as a teaching tool, and develop similar areas in other districts.
3. Develop the Michigan State University Extension/Michigan Groundwater Stewardship Program's Home*A*Syst homeowner education series for the Macatawa Watershed Area. Customize materials to focus specifically on sediment, nutrients, and flow issues.
4. Produce a public education campaign to inform members of the public about the following watershed issues:
    - What is a watershed/the Macatawa Watershed (how do agricultural ditches, storm drains, detention ponds, etc. relate to the watershed)
    - How phosphorus, erosion, and flow affect water quality
    - What members of the public can do to alleviate the phosphorus, erosion, and flow issues.

    The campaign may include activities such as the development of brochures, videos, special mailings, assembly of a watershed festival, or other general public information activities.

New and Emerging Methods/Technologies

The stakeholders of the Macatawa Watershed Project have set an ambitious goal for phosphorus reduction. In an effort to make the best use of available resources now and into the future, new and emerging methods/technologies should be analyzed and tested for inclusion in the Implementation Plan as they become available.

Sources of Funding

Ottawa and Allegan County Soil Conservation Districts offer the Forest Stewardship and Stewardship Incentive Programs. These programs offer cost-sharing opportunities, up to 65 percent, to non-industrial private landowners implementing forest management practices. Stream crossings and establishment of permanent vegetative cover, fencing and mulching are all covered under the programs' Soil and Water Protection and Improvement category.

A summary of examples of potential federal and state funding is contained in Appendix H.

Chapter 4:

Agricultural Nonpoint Source Implementation Plan

Background and Goals

The following plan for improving water quality in the Macatawa Watershed is based on three years' research and planning by Macatawa Watershed Project committees and community members. The goal of the Macatawa Watershed Project is to reduce phosphorus in Lake Macatawa Watershed by nearly seventy percent during the years 1999-2009. In 1996 through 1997, the approximate nonpoint source phosphorus load to Lake Macatawa was 126,000 pounds. The goal is to reach 35,000 pounds per year by the year 2009.

The following methods are aimed at reducing phosphorus, erosion, and flow (three closely related problems in the watershed) and were selected by community members and assembled into a quantitative plan by Watershed Project committees and consulting engineers. Any questions or comments about the plan may be directed to the agency listed on the cover of this Plan document.

Summary information regarding total Implementation Plan costs, effectiveness, and a list of all Priority Best Management Practices may be found in Appendix E.

The Macatawa Watershed consists of nearly seventy percent agricultural land. When the water quality model predictions for phosphorus load per land use were calculated, cropland returned with average phosphorus load per land area results. Due to the sheer amount of cropland in the Macatawa Watershed, however, a significant portion of the total amount of best management practices is proposed for cropland and agricultural areas.

Agricultural Best Management Practices (BMPs)

1. Buffer/Filter Strips

A buffer/filter strip is an area of vegetation used to filter sediment, organic matter, and other pollutants from surface water runoff. This area may be natural, undeveloped land, or it may be planted with grass or other vegetation. Note that the terms filter strip and buffer strip are used interchangeably.

NOTE: This practice is not a substitute for BMPs in upland areas, rather, it should be used in conjunction with upland BMPs. Upland erosion must be controlled in order to avoid filling the buffer/filter strip with sediment and impairing its function.

2. Composting

This method utilizes windrow composting to biologically transform large volumes of yard waste, animal manures and other such materials into a stable and biologically diverse soil conditioner. By employing controlled mechanical mixing and heat retention and moisture control methods to the windrows, the process can function year round - outdoors. Carbon rich (leaves & woody materials) and nitrogen rich (grass clippings) source materials, that can vary in quantity over the course of the year, would be stockpiled for use in maintaining the optimal carbon to nitrogen (C:N) ratios and bulk. Mixing would be done on a regular basis depending on quantities of materials, moisture and temperature.

3. Cover/Green Manure Crop

This BMP is intended to leave a field fallow or plant a cover crop such as clover during regular crop rotation in order to allow increased soil stabilization.

4. Critical Area Stabilization

Critical area stabilization is stabilizing areas which are highly susceptible to erosion by implementing one or more vegetative or structural BMPs. For the purpose of this BMP, critical areas include areas with highly erodible soils, long or steep slopes, droughty soils, excessively wet soils, soils that are very acidic or alkaline, slopes immediately adjacent to waterbodies or wetlands, fill areas and areas subject to concentrated flows.

5. Grass Waterways

A grass waterway is a natural or constructed watercourse consisting of vegetation and designed to accommodate concentrated flows without erosion. Grass waterways are capable of sustaining higher in-channel velocities than bare areas because the vegetation protects the soil by covering it and retarding water velocity. They also provide for the disposal of excess surface water from diversions and natural drainage.

6. Livestock Fencing/Exclusion

Waterbodies adjacent to livestock operations can be negatively impacted by animals which can over-graze adjacent land areas promoting erosion and sedimentation. This method would fence and exclude livestock from these land areas adjacent to waterbodies.

7. No Till/Mulch Till (Crop Residue Management)

Crop Residue Management Systems use plant residue to protect cropland during critical periods of erosion. The plant residue is either the dead mulch left from the previous crop or a live cover crop that has been suppressed.

No-till is a method of planting the crop into existing cover crop, sod, or crop residue, thereby eliminating primary and secondary tillage operations. The soil is left undisturbed from harvest to planting except for nutrient injection. Planting or drilling is accomplished in a narrow seedbed or slot created by coulters, row cleaners, disc openers, in-row chisels or roto-tillers. Weed control is accomplished primarily with herbicides. Cultivation may be used for emergency weed control.

Mulch-till is a method of preparing a seed bed by partially inverting the soil and residue. Tillage tools such as chisels, field cultivators, discs, sweeps, or blades are used. The residue cover remaining after planting is generally a function of the following factors - quantity of residue produced by the previous crop or cover crop, residue handling, winter weather, and tillage intensity.

8. Nutrient Management Plan

Nitrogen, phosphorus, potassium and other nutrients are necessary to maintain optimum growth and stress tolerance of most vegetation. This BMP addresses the proper selection, use, application, storage, and disposal of fertilizers.

9. Permanent Sedimentation Basins

Sediment basins are man-made depressions in the ground where runoff water is collected and stored to allow suspended solids to settle out. They are used in conjunction with erosion control measures to prevent off-site sedimentation. They may consist of a dam, barrier or excavation, a principal and emergency outlet structure, and water storage space. Their primary purpose is to trap sediment and other coarse material. Secondary benefits can include runoff control and preserving the capacity of downstream reservoirs, ditches, canals, diversions, waterways and streams.

10. Slope Stabilization

This BMP addresses structures which stabilize shorelines and slopes that cannot be stabilized with vegetation. Structures included in this BMP are: revetments, gabions, seawalls, bulkheads, groins, breakwaters and retaining walls. Typical applications of each of these structures are included in this BMP. Note that some of these structures are also used to stabilize stream banks.

Permits for the construction of slope/shoreline stabilization practices will be required by the Department of Natural Resources, Land and Water Management Division if the structure is below the ordinary high water mark of a lake (or stream), floodplain or wetland. In some situations, both MDNR and U.S. Army Corps of Engineer permit requirements will need to be met.

11. Soil Testing

Property owners are urged to sample their soils to determine the level of phosphorus. Most soils in Ottawa County have enough phosphorus to maintain crops, turf, etc. Soil testing will indicate when applications of other nutrients are necessary.

12. Stabilized Outlets

Outlets are areas which receive discharge water. Stabilized outlets are outlets which reduce the velocity of discharge water to non-erosive velocities.

13. Wetland Construction/Greenway Restoration/Development

To maintain and/or enhance existing wetland characteristics such as vegetative composition and cover, flow characteristics of surface and groundwater, hydrology and geochemical characteristics of substrate, and wildlife; to restore wetlands and their range of functions and values where they existed previously by re-establishing the hydrology, vegetation, and other habitat characteristics; to create new farm wetlands which are compatible with agricultural uses; to create constructed wetlands to be used as a component of a whole-farm manure management plan. Constructed wetlands are particularly effective reducing odors and nutrient loads, especially phosphorus.

14. Education/Awards - Agricultural Producers

15. Use of GIS by Local Planning and Zoning Boards and Watershed Staff and Committees to Implement Methods in Locations with Greatest Impact

16. Successful Planning for, and Inclusion of, Maintenance in Implementation of Methods

Agricultural Sources of Phosphorus

The following is a list of suspected sources of phosphorus in the agricultural areas in the Macatawa Watershed.

Streambank erosion

Applicable BMPs:

- Buffer/Filter Strips
- Critical Area Stabilization
- Livestock Fencing/Exclusion
- Slope Stabilization
- Stabilized Outlets

Field/crop erosion and runoff of fertilizers, sediment, and organic material into streams and ditches

Applicable BMPs:

- Buffer/Filter Strips
- Cover/Green Manure Crops
- Critical Area Stabilization
- Grass Waterways
- No Till/ Mulch Till
- Sedimentation Basins
- Slope Stabilization
- Wetland Construction

Fertilizer / animal waste / septage misapplication

Applicable BMPs:

- Composting
- Nutrient Management Plan
- Soil Testing

Agricultural Watershed Areas

The geographic areas over which the preceding methods should be applied include any land currently in agricultural production including row crops, horticulture crops, and animal feeding operations, as defined in the agricultural map in Appendix F.

It was estimated, from an analysis of the land use map of the Macatawa Watershed that approximately 70% of the watershed may be considered agricultural. Therefore, it is critical that community members who are responsible for the land which is in agricultural production, are following these recommended Best Management Practices (BMPs) to mitigate any negative impact to the area's waterways.

Priority BMPs

The BMPs in Table 3 are being recommended as priority actions. These are the management practices which were able to be quantified as the most cost-effective at present. All other methods are encouraged and should be considered as part of the long-term management plans for existing agricultural land. Appendix G contains detailed information about the recommended application of these priority BMPs in specific subwatersheds.

The cost for the priority activities listed above are summarized below. The annual costs are comprised of capital expense amortized over a twenty year period, with interest at 8%, and annual operation and maintenance expenses.

BMP Control Option	Level of Effort	Capital Cost ($)	Annual Cost ($)	Removal (lb/yr)	Unit Cost ($/lb)
Agricultural					
Nutrient Management	11,520 ac	N/A	$ 86,410	2,640	$ 33
Livestock Fencing	230 ac	N/A	$ 6,000	140	$ 43
No Till/Mulch Till	19,550 ac	N/A	$ 195,530	5,980	$ 33
Cover/Green Manure Crop	28,040 ac	N/A	$ 168,230	5,150	$ 33
Grass Waterways	90,850 ft	$ 590,410	$ 105,570	16,760	$ 10
Buffer/Filter Strips	538,600 ft	$ 148,370	$ 31,270	4,820	$ 10
TOTAL		**$ 738,780**	**$ 593,010**	**35,490**	

Table 3. Summary of Costs of Priority Activities for Agricultural Implementation Plan

Proposed Demonstration Activities

Agricultural stakeholders and agency leaders proposed several demonstration projects with which to begin the Implementation Phase of the Macatawa Watershed Project. Following is a list of such projects:

1. **Provide Cost-Share Money to Encourage Manure Injection**

   Lead Agency: Ottawa and Allegan County Michigan State University Extension offices, Ottawa and Allegan County Soil Conservation Districts

   Details: Cost-share money will be spent to retrofit existing manure tankers with injection equipment, or purchase draghoses and toolbars to apply manure.

2. **Set up demonstration farm(s)**

   Lead Agency: Ottawa and Allegan County Michigan State University Extension offices, Ottawa and Allegan County Soil Conservation Districts

   Details: Locate one or more farms on which to demonstrate several crop/feedlot best management practices. Incorporate workshops, field trips, water quality testing/evaluation and yield monitoring to determine environmental benefits and economic impact of using proposed methods.

3. **Provide Financial Incentive to Encourage Minimum or No Till Farming**

   Lead Agency: Ottawa and Allegan County Michigan State University Extension Offices, Ottawa and Allegan County Soil Conservation Districts

   Details: Provide cost-share dollars to producers who switch from moldboard plow implements to chisel plow implements to pay for cost of implemention, and start-up annual cost-share to implement practice if necessary.

4. **Establish Comprehensive Nutrient Management Plans**

   Lead Agency: MSU Extension, Nutrient Management Specialist

   Details: Comprehensive Nutrient Management Plans will be established for farms in the Macatawa Watershed.

Information and Education

Information and Education activities will enhance and initiate the implementation of other structural, vegetative, and managerial best management practices. Watershed stakeholders voiced a strong opinion during the development of the Implementation Plan that information and education activities will be the most desirable and important components of the Plan.

One important part of the information and education plan will be a monitoring program to determine the effectiveness of the plan. A preliminary survey will be conducted before the plan is implemented, and a follow-up survey will also be conducted. Therefore, it will be important that all information and education activities are carried out as part of a carefully designed plan. Following is a summary of the Information and Education activities which will be implemented by members of the Agricultural community.

1. Develop 'Cost Savings and Available Resources' informational brochure for Agricultural Producers.
2. Create a set of materials for producers which describe the agricultural best management practices recommended in this Implementation Plan. Materials may include information found in the Conservation Technology Information Center's CORE 4 program, Michigan

Department of Agriculture/Michigan Department of Environmental Quality's Agricultural Pollution Prevention Implementation Plan, the Michigan Animal Agriculture Initiative/MSU Extension Manure Management handbook, and Michigan Agricultural Commission's Generally Accepted Agricultural and Management Practices (GAAMPS) for Manure Management and Utilization manual.

New and Emerging Methods/Technologies

The stakeholders of the Macatawa Watershed Project have set an ambitious goal for phosphorus reduction. In an effort to make the best use of available resources now and into the future, new and emerging methods/technologies should be analyzed and tested for inclusion in the Implementation Plan as they become available. Following are potential methods or technologies which will be implemented on a trial basis in order to assess the efficiency of phosphorus, erosion, and peak flow reduction.

Sources of Funding

Several sources of funding exist for implementation of these methods. The Ottawa County Soil Conservation District works with funding from the United States Department of Agriculture (USDA) which operates a program called the Conservation Reserve Program (CRP). Part of the program is aimed at funding the establishment of grasses and trees as buffer strips and wetlands and the construction of erosion control structures.

An incentive for implementing these methods could be the establishment of an insurance policy available to farmers. A company called Agren worked in conjunction with the USDA to develop an insurance policy to guard farmers against losses realized by reductions in pesticide or herbicide use. The average cost to the farmer for the policy was $4-$5 per acre (savings from reduced pesticide or herbicide application was $12-$15 per acre). A policy could be developed for farmers in the Macatawa Watershed who are considering reducing the use of fertilizers or implementing low or no till crop residue management.

A potential incentive for farmers to implement best management practices could be realized through tax credits. Farmers could count the cost of installation or proper maintenance toward a reduction in annual taxes.

A summary of examples of potential federal and state funding is contained in Appendix H.

Chapter 5:

Road/Drain/Construction Nonpoint Source Implementation Plan

Background and Goals

The following plan for improving water quality in the Macatawa Watershed is based on three years' research and planning by Macatawa Watershed Project committees and community members. The goal of the Macatawa Watershed Project is to reduce phosphorus in Lake Macatawa Watershed by nearly seventy percent during the years 1999-2009. In 1996 through 1997, the approximate nonpoint source phosphorus load to Lake Macatawa was 126,000 pounds. The goal is to reach 35,000 pounds per year by the year 2009.

The following methods are aimed at reducing phosphorus, erosion, and flow (three closely related problems in the watershed) and were selected by community members and assembled into a quantitative plan by Watershed Project committees and consulting engineers. Any questions or comments about the plan may be directed to the agency listed on the cover of this Plan document.

Summary information regarding total Implementation Plan costs, effectiveness, and a list of all Priority Best Management Practices may be found in Appendix E.

Recommended Road/Drain/Construction Best Management Practices (BMPs)

1. Buffer/Filter Strips

A buffer/filter strip is an area of vegetation used to filter sediment, organic matter, and other pollutants from surface water runoff. This area may be natural, undeveloped land, or it may be planted with grass or other vegetation. Note that the terms filter strip and buffer strip are used interchangeably.

NOTE: This practice is not a substitute for BMPs in upland areas, rather, it should be used in conjunction with upland BMPs. Upland erosion must be controlled in order to avoid filling the buffer/filter strip with sediment and impairing its function.

2. Catch Basins

Catch basins are stormwater inlets to the sewer system which contain a sump to capture solids and thereby prevent sewer blockages.

NOTE: This BMP should not be implemented unless a regular maintenance program is adhered to. Uncleaned catch basins may contribute loads of biological oxygen demand (BOD) and sediment to the receiving stream. If regular maintenance cannot be done, use an alternative to catch basins such as simple inlets (without sediment traps), Street Sweeping, sewer cleaning, off-line storage, or flow attenuation.

3. Check Dams/Temporary Sedimentation Basins

Check dams are constructed across drainageways to reduce concentrated flows in the channel and protect vegetation in the early stages of growth. They can consist of stones, sandbags or gravel, and are most commonly used in the bottom of channels that will be stabilized at a later date. Although check dams also collect sediment and hence act as filters, their primary purpose is to reduce erosive velocities.

4. Critical Area Stabilization

Critical area stabilization is stabilizing areas which are highly susceptible to erosion by implementing one or more vegetative or structural BMPs. For the purpose of this BMP, critical areas include areas with highly erodible soils, long or steep slopes, droughty soils, excessively wet soils, soils that are very acidic or alkaline, slopes immediately adjacent to waterbodies or wetlands, fill areas and areas subject to concentrated flows.

5. Permanent Sedimentation Basins

Sediment basins are man-made depressions in the ground where runoff water is collected and stored to allow suspended solids to settle out. They are used in conjunction with erosion control measures to prevent off-site sedimentation. They may consist of a dam, barrier or excavation, a principal and emergency outlet structure, and water storage space. Their primary purpose is to trap sediment and other coarse material. Secondary benefits can include runoff control and preserving the capacity of downstream reservoirs, ditches, canals, diversions, waterways and streams.

6. Planting Trees, Shrubs, Ground Cover

This BMP addresses the selection and maintenance of woody plant materials, including trees, shrubs, and ground covers. Trees, shrubs and ground covers can be used on steep or rocky slopes where mowing is not feasible. Once trees, shrubs and ground covers are well established they:

- help stabilize the soil, reducing both wind and water erosion
- reduce stormwater runoff by intercepting rainfall and promoting infiltration
- filter pollutants from the air and produce oxygen
- moderate temperature changes and provide shade
- provide some privacy
- improve aesthetic values and increase property values
- In addition, ground covers can provide stabilization in areas which are heavily shaded.

7. Protection/Seeding of Excavation Soil Piles

This BMP entails the temporary seeding of soil piles to minimize erosion of exposed soil during the course of construction projects.

8. Silt Fencing

The use of geotextile fabric which removes sediment from stormwater prior to discharge. The effectiveness of this BMP depends on the design, flow, and proper maintenance of the silt fencing.

9. Slope Stabilization

This BMP addresses structures which stabilize shorelines and slopes that cannot be stabilized with vegetation. Structures included in this BMP are: revetments, gabions, seawalls, bulkheads, groins, breakwaters and retaining walls. Typical applications of each of these structures are included in this BMP. Note that some of these structures are also used to stabilize stream banks.

Permits for the construction of slope/shoreline stabilization practices will be required by the Department of Natural Resources, Land and Water Management Division if the structure is below the ordinary high water mark of a lake (or stream), floodplain or wetland. In some situations, both MDNR and U.S. Army Corps of Engineer permit requirements will need to be met.

10. Soil Testing

Property owners are urged to sample their soils to determine the level of phosphorus. Most soils in Ottawa County have enough phosphorus to maintain crops, turf, etc. Soil testing will indicate when applications of other nutrients are necessary.

11. Stabilized Outlets

Outlets are areas which receive discharge water. Stabilized outlets are outlets which reduce the velocity of discharge water to non-erosive velocities.

12. Staging and Scheduling

Staging is dividing a construction area into two or more areas to minimize the area of soil that will be exposed at any given time. It is done to ensure that as much of the site as possible is stabilized. Scheduling is a planning process which provides a basis for implementing other BMPs in a timely and logical fashion. In any one development, not all BMPs should be implemented at the same time.

13. Stream Crossings

A structure which provides a more confined, safer, and environmentally sensitive means for crossing from one side of a stream to the other.

Such crossings may be either above or below the water surface. The type of crossing may vary with respect to length, width, height, and construction design, depending on the purpose of the crossing and the environmental and physical characteristics of the stream.

All crossings require a permit from the MDNR and the local soil erosion enforcing agency, and some may require permits from the U.S. Army Corps of Engineers or the Michigan Department of Transportation.

14. Street Scraping/Sweeping

Street Scraping/Sweeping involves the use of specialized equipment to remove litter, loose gravel, soil, pet waste, vehicle debris and pollutants, dust, de-icing chemicals, and industrial debris from road surfaces. Street sweeping equipment can consist of a truck or truck-like vehicle equipped with multiple brushes, pick-up deflector, holding bin, water sprayer, vacuum nozzle and filter, or a combination of some or all of these features.

15. Use of Access Roads

Access roads are graveled areas or pads which allow construction equipment and workers to enter and leave the work site from a public right-of-way, street, alley, sidewalk or parking area. This practice provides for the delivery and removal of construction equipment and materials in a manner which will protect vegetative cover, prevent erosion, and protect water quality. Access roads should be used on all construction sites and in forestry and mining to allow the mud on tires to fall off onto the access road before vehicles enter the main (primary road). In urban and urbanizing areas, this practice may reduce the frequency in which street sweeping is done.

16. Use of Riprap

Riprap is a permanent cover of rock used to stabilize stream banks, provide in-stream channel stability, and provide a stabilized outlet below concentrated flows. Broken concrete can be used in place of rock if it is clean and otherwise meets design criteria. Asphalt should not be used as riprap.

All work conducted below the ordinary high water mark of a lake or stream, or in a floodplain or wetland will require permits from the MDNR, Land and Water management Division. This includes the placement of riprap.

17. Wetland Construction/Restoration/Development

To maintain and/or enhance existing wetland characteristics such as vegetative composition and cover, flow characteristics of surface and groundwater, hydrology and geochemical characteristics of substrate, and wildlife; to restore wetlands and their range of functions and values where they existed previously by re-establishing the hydrology, vegetation, and other habitat characteristics; to create new farm wetlands which are compatible with agricultural uses.

18. Education/Awards - Construction Equipment Operators

19. Support for Additional Staff to Monitor and Enforce Erosion Prevention Regulations

20. Use of GIS by Local Planning and Zoning Boards and Watershed Staff and Committees to Implement Methods in Locations with Greatest Impact

21. Successful Planning for, and Inclusion of, Maintenance in Implementation of Methods

Road/Drain/Construction Sources of Phosphorus

The following is a list of suspected sources of phosphorus in the road/drain/construction areas in the Macatawa Watershed.

Streambank or slope erosion

Applicable BMPs:

- Critical Area Stabilization
- Buffer/Filter Strips
- Planting Trees, Shrubs and Ground Cover
- Slope Stabilization
- Stabilized Outlets
- Stream Crossings
- Use of Rip-Rap

Runoff of fertilizer, sediment, and organic material into gutters and storm sewers

Applicable BMPs:

- Catch Basins
- Street Sweeping

Runoff of fertilizer, sediment, and organic material into streams and ditches

Applicable BMPs:

- Buffer/Filter Strips
- Check Dams
- Sedimentation Basins
- Planting Trees, Shrubs, Ground Cover
- Wetland Construction

Excessive flow through increased impervious areas

Applicable BMPs:

- Catch Basins/Stormwater System Updates
- Planting Trees, Shrubs, Ground Cover
- Wetland Construction

Erosion from construction sites

Applicable BMPs:

- Critical Area Stabilization
- Buffer Strips
- Planting Trees, Shrubs, Ground Cover
- Protection/Seeding of Soil Piles
- Silt Fencing
- Slope Stabilization
- Soil Testing
- Staging and Scheduling
- Use of Access Roads

Road/Drain/Construction Watershed Areas

The geographic areas over which the preceding methods should be applied include land adjacent to streams, new road construction/road repair, and construction sites, especially in the area delineated in the urban and urbanizing maps in Appendix F.

It was estimated, from a land use change study for Ottawa County, that during one year an amount of land in the watershed equal to approximately two percent of all existing commercial and residential land undergoes construction[15]. Therefore, it is critical that community members who are responsible for the land which is under construction at any one time, whether for new housing, road repair or construction, drain maintenance, or industrial or commercial development, are following these recommended Best Management Practices (BMPs) to mitigate any negative impact to the area's waterways.

Priority BMPs

The BMPs in Table 4 are being recommended as priority actions. These are the management practices which were able to be quantified as the most cost-effective at present. All other methods are encouraged and should be considered as part of the long-term management plans for Road/Drain/Construction groups.

The cost for the priority activities listed above are summarized below. The annual costs are comprised of capital expense amortized over a twenty year period, with interest at 8%, and annual operation and maintenance expenses.

Please note that several "Downstream" methods are proposed. Those methods are not associated with any particular subwatershed. Instead, they are intended to serve at key locations in the watershed where their functions will be most valuable.

BMP Control Option	Level of Effort	Capital Cost ($)	Annual Cost ($)	Removal (lb/yr)	Unit Cost ($/lb)
Urban					
Catch Basin Cleaning	6,850 cleaned/yr	$ 400,000	$ 308,200	3,505	$ 88
Urbanizing					
Construction–Soil Erosion Control	5,390 ac	N/A	$ 40,730	780	$ 52
Grass/Open Ditches	14,490 ft	$ 46,360	$ 11,960	1,405	$ 12
Street Sweeping	3 times/yr	$ 125,000	$ 44,020	1,137	$ 39
Downstream Control Options:					
Sediment Basins	50 ac	$ 4,000,000	$ 460,000	10,970	$ 42
Wetland Construction	100 ac	$ 3,000,000	$ 360,000	12,680	$ 28
Alum Treatment	75% of area	$ 600,000	$ 160,000	49,100	$ 3
TOTAL		**$ 8,171,360**	**$ 1,384,910**	**79,577**	

Table 4. Summary of Costs of Priority Activities for Road/Drain/Construction Implementation Plan

Note: The method "Construction BMPs" includes street cleaning, silt fencing, slope stabilization, staging /scheduling. Gravel access roads, and slope stabilization.

Proposed Demonstration Activities

Road/drain/construction stakeholders and agency leaders proposed several demonstration projects with which to begin the Implementation Phase of the Macatawa Watershed Project. Following is a list of such projects:

1. **Purchase of a street sweeper to use on construction site roadways**

   Lead Agency: Holland Home Builders Association, Rental Agency or Excavator

   Details: Lead agency will purchase and maintain street sweeper. Builders, developers and excavators will rent the sweeper from the Lead Agency.

2. **Establishment of phosphorus/erosion control guidelines between builders and subcontractors**

   Lead Agency: Holland Home Builders Association, Ottawa and Allegan County Soil Erosion Control Agents

   Details: Project plans will include phosphorus/erosion control guidelines. Phosphorus/erosion control guidelines could include:

   - the development of a regular schedule for maintenance of sediment and catch basins during construction
   - use of crushed stone over geotextile fabric between the road and the house
   - spreading of straw over spoil piles
   - creation of / spreading of wood chips if trees are cleared from lot
   - use of a gravel drive (over geotextile fabric) into the site

3. **Create a network of protected green and open lands along the Macatawa River and its Tributaries.**

   Lead Agency: Macatawa Greenway Partnership

   Details: Will require a cooperative effort between the lead agency, private landowners and other private parties, and various units of government. Land will

be acquired through purchase, donation, or granting of conservation easements. This network will provide many benefits to the community, including:

- Recreational and educational opportunities
- Wildlife habitat
- Improved water quality

4. **Develop a stormwater policy for the Macatawa Watershed**

   Lead Agency: Ottawa and Allegan County Drain Commissions, MACC member Planning and Zoning Board Chairs

   Details: Development of model guidelines for use by local units of government. Will address issues of runoff volumes and water quality produced from new site development. Will also address requirements for NPDES stormwater permits.

5. **Convert existing turfgrass highway right-of-way areas into alternative vegetation/wetland mitigation demonstration areas**

   Lead Agency: Holland Area Beautiful, City of Holland Parks Department, Ottawa and Allegan County Road Commissions, Michigan Department of Transportation

   Details: Turfgrass areas in the rights-of way of the existing US 31, 196, and Business Route 196 will be planted with alternative vegetation or converted to wetlands for stormwater mitigation areas. The sites will be highly visible, serving as educational demonstration areas.

6. **Develop a maintenance schedule for all existing sediment basins in the Macatawa Watershed.**

   Lead Agency: Ottawa and Allegan County Drain Commissioners

   Details: Drain Commissioners will develop a regular schedule for maintenance of all existing sediment basins in the Macatawa Watershed. The maintenance schedule will allow existing basins to function properly again, and could allow for monitoring to determine necessary maintenance intervals for new basins as well as to estimate existing sediment loads.

Information and Education

Information and Education activities will enhance and initiate the implementation of other structural, vegetative, and managerial best management practices. Watershed stakeholders voiced a strong opinion during the development of the Implementation Plan that information and education activities will be the most desirable and important components of the Plan.

One important part of the information and education plan will be a monitoring program to determine the effectiveness of the plan. A preliminary survey will be conducted before the plan is implemented, and a follow-up survey will also be conducted. Therefore, it will be important that all information and education activities are carried out as part of a carefully designed plan. Following is a summary of the Information and Education activities which will be implemented by members of the Road/Drain/Construction community.

1. The Holland area Home Builders Association (HBA) will provide continuing education to its members. It will develop and distribute a customized document describing watershed friendly construction techniques based on the Clark County, WA, Home Builders Association's "A Builders Guide to Erosion Prevention & Sedimentation Control".

2. The HBA will also produce continuing education seminars, organize on-site demonstrations of construction-related best management practices, and write articles in the monthly HBA newsletter.

New and Emerging Methods/Technologies

The stakeholders of the Macatawa Watershed Project have set an ambitious goal for phosphorus reduction. In an effort to make the best use of available resources now and into the future, new and emerging methods/technologies should be analyzed and tested for inclusion in the Implementation Plan as they become available. Following are potential methods or technologies which will be implemented on a trial basis in order to assess the efficiency of phosphorus, erosion, and peak flow reduction.

1. **Alum Injection into Stormwater Outfall**

   Details: The application of alum in lakes to settle out sediment and nutrients is not a new technology. However, a new system has been devised to provide a continual injection of liquid alum into a stormwater outfall, precipitating sediment and nutrients as the stormwater mixes and settling out the precipitate as the flow enters a lake. McNamee, Porter, and Seeley, Inc. has proposed including the use of alum injection into stormwater in the Macatawa Watershed in order to realize significant phosphorus reductions for relatively little cost.

   This technology is being evaluated by scientists at Hope College. An independent limnological assessment of the effects of this process on the lake should be performed before implementation in the Watershed. A small-scale trial of this method should also precede full implementation.

Sources of Funding

A summary of examples of potential federal and state funding is contained in Appendix H.

Chapter 6: Schedule and Project Logistics

Project Schedule

The Implementation Phase of the Macatawa Watershed Project is slated to begin October 1, 1999. At that time, The Macatawa Area Coordinating Council will receive funding from the Clean Water Action Plan for administering the project during the years 1999-2001, and for providing initial cost-sharing dollars to projects listed in this plan.

The activities for the first ten years of the Implementation Phase are addressed in this plan. MDEQ will continue its annual monitoring of Lake Macatawa and the six major tributaries throughout the ten year period, with a comprehensive sampling effort, similar in nature to the one conducted in 1996/1997, to occur in 2009.

Administration of the Macatawa Watershed Project, development of information and education programs, and implementation of selected Best Management Practices (BMPs) during the first two years of the Implementation Phase is slated to be covered by the Clean Water Action Plan grant. The first year of the Implementation Phase, October 1, 1999 through September 30, 2000, will focus on the following activities:

- Evaluation of the study and planning phase of the project
- Conducting a major initial survey to determine public awareness and acceptance of Watershed Project goals, and current use of recommended practices
- Conducting a targeted survey of priority subwatersheds to determine feasible sites on which to locate BMPs which will have the most water quality impact
- Completion of key proposed demonstration activities
- Evaluation of alum treatment method on trial basis

The following subwatersheds are intended to receive priority attention during the first two years of the Implementation Phase of the Watershed Project:

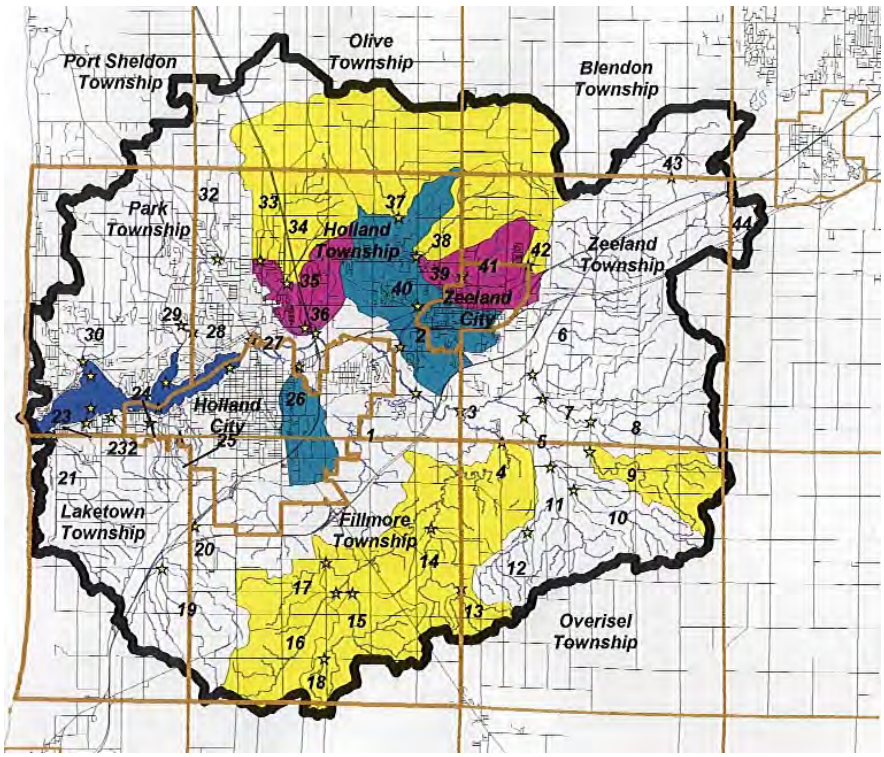


Figure 10. Priority Subwatersheds in the Macatawa Watershed
<u>NOTE:</u> two larger versions of this figure are included directly after this chapter

Macatawa Watershed Priority Areas
10/1/99 - 9/30/01

Color Key for Map	Station Number	Land Use	Subwatershed/ Subarea (mi2)	Miles of Streams	Annual Load (lbs/mi2)
	18	Agriculture	0.6	2.6	3314
	38	Agriculture	3.8	9.7	1861
	37	Agriculture	10.5	15.8	1858
	14	Agriculture	2.6	8.4	1670
	9	Agriculture	2.0	9.9	1642
	4	Agriculture	7.9	21.5	1469
	42	Agriculture	0.4	1.8	1346
	13	Agriculture	1.3	4.9	1256
	15	Agriculture	14.2	9.8	1175
	34	Agriculture	3.7	9.0	822
	17	Agriculture	2.3	5.9	576
	33	Agriculture	3.3	3.4	503
	16	Agriculture	3.7	7.7	355
		Total:	***56.3***	***110.3***	
	2	Urban	3.8	8.8	1082
	26	Urban	2.4	3.3	1079
	40	Urban	22.0	9.7	61
		Total:	***28.2***	***21.8***	
	35	Urbanizing	0.4	0.9	737
	36	Urbanizing	2.4	8.5	562
	41	Urbanizing	1.5	3.2	425
	39	Urbanizing	3.9	2.6	422
		Total:	***8.2***	***15.2***	

Note 1 Land Uses are designated only to the portion of each watershed falling outside of any upstream subwatersheds

Note 2 Subareas apply only to the portion of each watershed falling outside of any upstream subwatersheds

Note 3 Stream lengths found using MIRIS GIS data, modified for single-line stream representation. Miles of streams from subwatershed excluding any upstream subwatersheds.

Note 4 Annual loads from MDEQ sampling data, 11/96-11/97. Annual loads assumed from entire subwatershed, including upstream subwatersheds.

Table 5. Priority Subwatersheds in the Macatawa Watershed

Year two, October 2000 through September 2001, will consist of the following actions:

- Implementation of priority BMPs including the development of site plans, engineering design, physical construction, and proper documentation and evaluation
- Continued development, and implementation of, key information and education projects
- Conducting a follow-up survey to determine the effectiveness of information and education projects

Members of the Watershed Project will continue, in years three through ten, to implement recommended BMPs as defined in this Implementation Plan.

Evaluation

Project participants will use the following means of evaluating progress achieved during the Implementation Phase of the Watershed Project:

1. Water Quality Evaluation

The recommendations made in this ten year Implementation Plan will be carried out in the years 1999 through 2009. The MDEQ has committed to carry out a comprehensive evaluation of water quality at the end of 2009. This comprehensive sampling effort will be similar to the effort conducted in 1996/1997 when 44 sites throughout the watershed were sampled twice monthly for one year.

The MDEQ also conducts routine (once every five years) water quality sampling to determine which state bodies of water are meeting their designated uses. This sampling, and the resulting data, determines which water bodies will be listed on the MDEQ's 305 (b) list. The 305 (b) list is an indicator of state water bodies not meeting designated uses. The MDEQ has also committed to sample a limited number of sites as well as the lake water quality every year during the growing season for the duration of this Implementation Phase of the Watershed Project.

2. Evaluation of Study Phase of the Watershed Project

The first three years of this watershed project consisted of a thorough study of water quality and physical parameters in the Watershed, and the development of solutions to the water quality issues. Due to a large number of watershed projects scheduled to be undertaken in the State of Michigan in upcoming years, it will be important to understand what made this project a success. An evaluation of the first phase of this project will be conducted to assemble recommendations for other groups who face the same task.

The evaluation will include an assessment of the strengths and weaknesses of the processes developed during the first three years of the project. Part of the evaluation process will include soliciting peer review of the Implementation Plan. Critical analysis from outside water quality scientists, watershed project managers, and others will allow a more thorough understanding of the Implementation Plan's strengths and weaknesses.

3. Evaluation of Best Management Practices

As Best Management Practices are installed, several methods will be used to track their implementation, maintenance and effectiveness. Standard forms will be developed to collect data from administering parties upon installation of the Practices. The forms will be formatted to collect all data required to be reported to MDEQ. BMP installation forms and BMP maintenance forms will be created, and could be made available online. The data from the forms will be stored in a database and linked to a Geographic Information System (GIS) layer which will track the locations of all BMPs implemented.

4. **Monthly, Quarterly and Annual Meetings**

Regular Watershed Project monthly (Technical committee, Executive committee) meetings will be continued through the duration of this ten year plan. Quarterly Watershed Project Stakeholder committee meetings should be continued as well. Additionally, all participating Watershed Partners will meet on an annual basis to discuss progress and evaluate future direction. This meeting should include all Watershed Project Stakeholders who have assumed responsibility for administering portions of the Implementation Plan.

National Pollutant Discharge Elimination System (NPDES) Phase II Stormwater Regulations

New regulations under the NPDES Phase II, stormwater regulations for smaller sized municipalities, will become effective during the early portion of this Implementation Phase of the Watershed Project. These new rules will likely call for municipalities to comply with six minimum control measures[16][17]:

1. Public education and outreach
2. Public involvement and participation
3. Illicit discharge detection and limitation
4. Construction site stormwater runoff control
5. Post construction stormwater management
6. Pollution prevention and good housekeeping for municipal operations

Many of the Best Management Practices and Demonstration Activities recommended in this Implementation Plan will directly address these six minimum control measures.

Recommended Next Steps

It is recommended that the water quality modeling process be continued and refined. First, the same process used to produce the results described in this document should be carried out using data from the 44 subwatersheds. This procedure will provide a check of the results obtained for this report. Smaller scale digital geographic data sets will add to the accuracy of future water quality modeling for the Macatawa Watershed. Smaller scale elevation data, currently being developed by the Army Corps of Engineers and Ottawa County, will enhance future watershed modeling efforts.

Appendix A

MACC Water Quality Data Analysis Description

One analysis examined the direct relationship between land uses in the watershed and phosphorus levels observed by the MDEQ. Land uses were summarized for each subwatershed in a table. The table listed the area of each land use in each subwatershed.

The amount of each subwatershed's area falling into the defined land uses was plotted against the annual phosphorus load observed at each of the 38 subwatersheds using a spreadsheet (See Figure 11). Regression lines were drawn to fit the data set created by each land use. Linear, polynomial, and exponential lines were fit to the data sets. To determine whether any of the regression lines were statistically significant representations of their corresponding data sets, the coefficient of determinations, R^2 values, were calculated for each of the regression lines.

The coefficient of determination is a measure of the effect a dependant variable (in this case, the land use type) has on reducing the variability of the independent variable[18] (phosphorus levels). A coefficient of determination close to one implies a significant correlation between the dependent and independent variables. The largest R^2 value observed for plots of the land uses versus the phosphorus levels was 0.4.

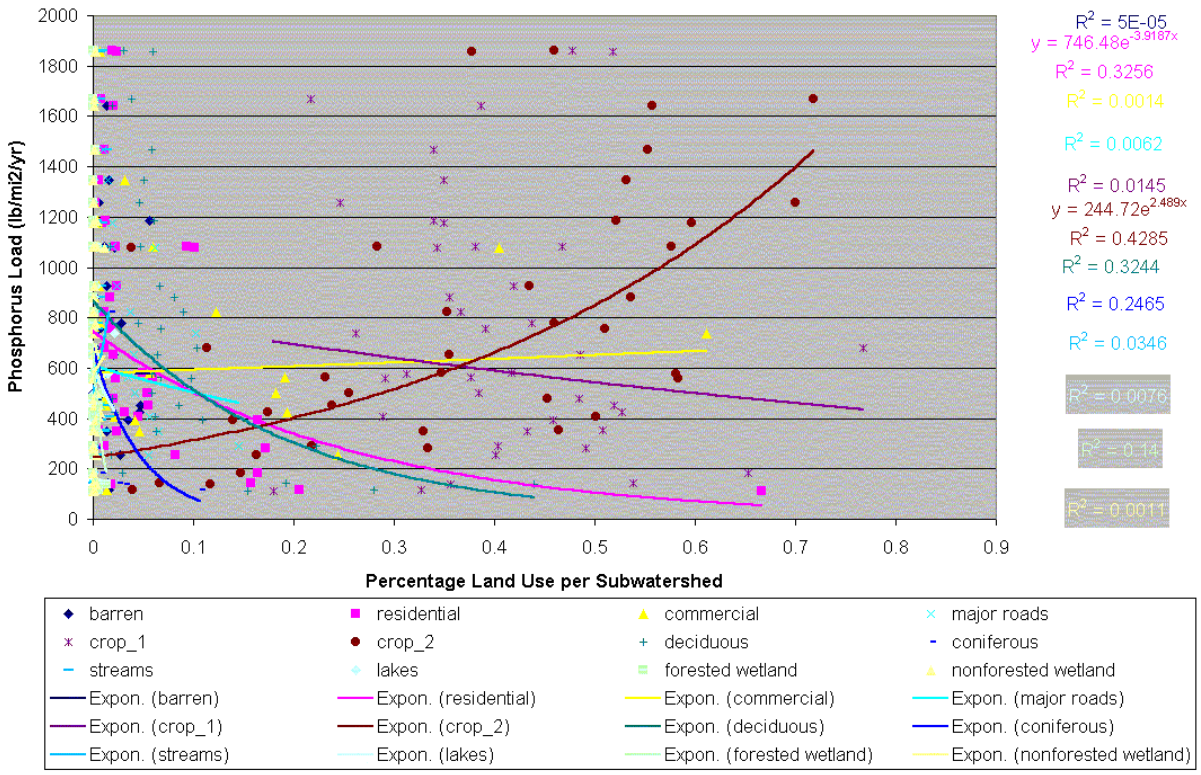


Figure 11. Plot of Land Uses versus Phosphorus Levels for 38 Subwatersheds and Associated Regression Lines and Coefficient of Determination Values

Therefore, the direct relationship between land uses and phosphorus levels was not considered statistically significant. It was concluded that a further analysis should be performed which would include the use of water quality models to take into consideration the effects soil types, slopes, and land uses together may have on phosphorus levels.

Analysis of Water Quality Results versus Land Use, Soils and Slopes

Two water quality models, or sets of equations, were used to analyze the relationship between land uses, soils, slopes, and potential phosphorus loads. Following is a description of the application of the two models.

Universal Soil Loss Equation (USLE)

The Universal Soil Loss Equation (USLE) is a lumped parameter equation developed in 1978 to estimate the amount of soil eroding from agricultural fields on an annual basis[19]. Since that time, it has been applied to various urban and non-urban land uses, and over a large range of parcel sizes, from single fields to large river basins[20, 21]. The USLE is traditionally used to predict annual average soil loss. However, a method has been developed to translate the annual average soil loss into annual average phosphorus loss depending on the amount of organic matter in each soil type.

The USLE was used to determine phosphorus loads from non-urban land uses in the Macatawa Watershed. Following is the USLE equation and a description of each of its parameters:

$$A = RKLSCP$$

where

A = average annual soil loss
R = rainfall and runoff erosivity index
K = soil erodibility factor
L = slope length factor
S = slope steepness factor
C = cover management factor
P = conservation practice factor

R is found using a map which displays rainfall erosivity values over the United States. The Macatawa Watershed falls between the gradient lines showing 2000 and 2500 (units are MJ-mm/ha-h-y). Therefore, the value of 2250 was used.

K is a value which is contained in the STATSGO ancillary data. The values of K for the soils in the Macatawa Watershed range from 0.15-0.43.

The slope length factor, L, is found using the following equations:

$$L = \left(\frac{l}{22}\right)^m$$

where

$$m = \frac{\sin\theta}{\sin\theta + 0.269(\sin\theta)^{0.8} + 0.05}$$

l = slope length (default 30 meters for this analysis due to grid size)
θ = field slope steepness

The factors l and θ were found using the USGS elevation data. The calculations were carried out in ArcView using the Spatial Analyst extension and the Map Calculator function.

The slope steepness factor, S, was also calculated using the Map Calculator in ArcView. The equation for finding S is:

$$S = 10.8\sin\theta + 0.03$$

for slopes longer than 4 meters and field slope less than 9 percent, and

for slopes longer than 4 meters and field slope greater than 9 percent.

$$S = 16.8 \sin\theta - 0.50$$

Both slope steepness equations were calculated for the entire watershed, and the average of the results was used in the final USLE calculation.

C, the cover management factor, is based on the type of vegetative cover present on the area of land. Values were obtained from tables in the original USLE Handbook[22]. The following non-urban land uses and their corresponding C values were used for the USLE calculations:

Land Use	USLE C Value
Cropland	0.009
Deciduous Forest	0.009
Coniferous Forest	0.004
Forested Wetland	0.003
Non Forested Wetland	0.003

Table 6. Land Uses and Associated USLE C Values for the Macatawa Watershed

Due to a lack of data regarding current distribution of management practices in the watershed, the variable P, the conservation practice factor, was given the value of 1 for all non-urban areas, which is the value used when cropping is practiced straight up and down a slope with no terracing and no strip cropping. Thus, the soil erosion and phosphorus load predictions should be overestimated. However, due to the relatively flat slopes in the watersheds, the effect should be minimized.

The resulting annual soil losses predicted for the Macatawa Watershed range from 100 to 12,000 megagrams per hectare (Mg/ha) (1 megagram = 1.10 tons).

The USLE is generally used to predict soil loss from a parcel of land. However, for the purpose of this project, the average annual phosphorus load was needed. In order to determine phosphorus load from soil loss calculations, the gross erosion amount is found using the following equation[23]:

$$O^p = 0.02 \times O^c \times A$$

where

O^p = amount of organic phosphorus transported with the gross erosion
O^c = organic carbon in the upper soil level (information obtained from the STATSGO ancillary data).
A = average annual soil loss, calculated with the USLE equation

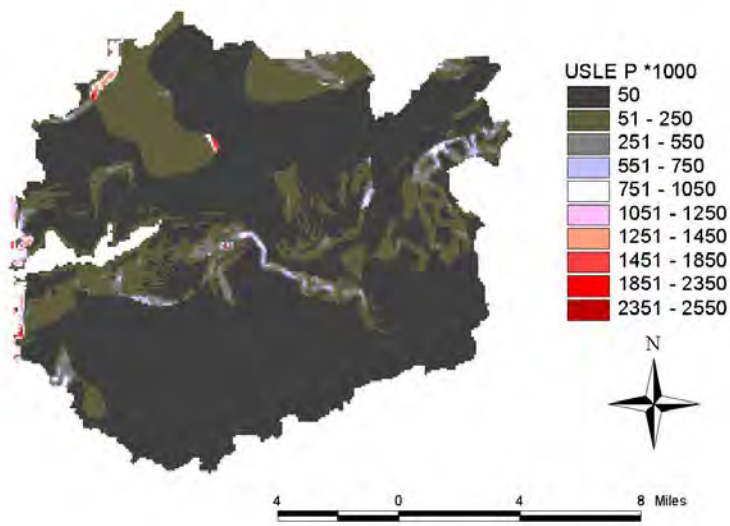


Figure 12. USLE Phosphorus Load Predictions for the Macatawa Watershed

The phosphorus losses calculated using this equation are predicted to range from 0.05 to 2.55 Mg/ha/yr. See Figure 12 for the distribution of predicted phosphorus loss concentrations in the Macatawa Watershed.

Generalized Watershed Loading Functions (GWLF)

The Generalized Watershed Loading Functions (GWLF) is a lumped parameter model which was developed at Cornell University to assess the point and nonpoint loads of nitrogen and phosphorus from relatively large, mixed-use watersheds[24]. The GWLF model includes hydrologic, erosion, and sediment calculation components, as well as total and dissolved nitrogen and phosphorus loads. It bases its calculation of phosphorus loading on a build-up rate and a wash-off function which estimates the amount of phosphorus delivered to waters with each simulated rainfall event.

Selected equations were used to find the predicted phosphorus loads from urban areas in the Macatawa Watershed. GWLF was recommended for use by Limno-Tech, Inc., Ann Arbor, who participated in the facilitation of both Macatawa Watershed Workshops. Following is a description of the equations used and the results.

The fundamental equation in GWLF is used to calculate phosphorus loads from urban areas. It sums the nutrient load in runoff during one month over all urban land uses:

$$SU_m = \sum_k \sum_{t=1}^{d_m} W_{kt} AR_k$$

where

SU_m = urban runoff nutrient load (kg)
k = land use
t = day
d_m = number of days in month m
W_{kt} = runoff nutrient load from land use k on day t (kg/ha)
AR_k = area of source area k (ha)

The land uses, represented by k, are residential, commercial/industrial, and major roads. A representative 30-day month was used to perform these calculations. The methods and equations used to find W_{kt}, the runoff nutrient load, on a daily basis, follow.

$$W_{kt} = w_{kt}\left[N_{kt}e^{-0.12} + (n_k / 0.12)(1 - e^{-0.12})\right]$$

where

w_{kt} = first-order wash-off function,
N_{kt} = nutrient accumulation at the beginning of day t (kg/ha),
n_k = constant phosphorus accumulation rate for land use k (kg/ha-day)

The nutrient accumulation was assumed to be zero at the beginning of the month. The phosphorus accumulation rates were obtained from tables included in the GWLF manual. The tables presented typical nutrient accumulation rates for various localities and urbanization trends. The numbers used for the Macatawa Watershed follow:

Land Use	**Phosphorus Accumulation Rate, n_k (kg/ha-day)**
Residential	0.00735
Commercial/Industrial	0.011675
Major Roads	0.0112

Table 7. n_k Values, Nutrient Accumulation Rates for the Macatawa Watershed

The first-order wash-off function, w_{kt}, is defined as follows:

$$w_{kt} = 1 - e^{-1.81Q_{kt}}$$

where

Q_{kt} = runoff from source area k on day t

For this analysis, Q_{kt} was calculated using the Soil Conservation Service method for calculating runoff volume. The equation for the Soil Conservation Service method is:

$$Q = \frac{(I - 0.2S)^2}{I + 0.8S}$$

where

Q = direct surface runoff depth (mm)
I = storm rainfall (mm)
S = maximum potential difference between rainfall and runoff when storm begins (mm)

The storm rainfall, I, was derived from historical precipitation data collected by Michigan State University. A precipitation summary table was available for a 30-year period from 1951-1980. For each month, the following precipitation data is available: mean precipitation, maximum daily precipitation, and mean number of days with at least 0.10, 0.25, and 0.50 inches of precipitation. The GWLF model calls for calculating wash off of nutrients during a typical month. Since the phosphorus loads to Lake Macatawa are the highest during the spring and summer months, the precipitation data were averaged over the months of April through October to represent an average month.

Month	**Mean Monthly Precipitation (in.)**	**Mean # Days with at least 0.10 in. precip.**	**Mean # Days with at least 0.25 in. precip.**	**Mean # Days with at least 0.50 in. precip.**
April	3.59	8	5	2
May	2.80	6	4	2
June	3.91	6	4	2
July	3.17	6	4	2
August	3.32	6	4	2
September	3.39	6	4	2
October	3.13	7	4	2
Average	*3.33*	*6.43*	*4.14*	*2*

Table 8. Precipitation Summary for Holland for the 30 Year Period 1951-1980[25]

Historical rainfall data were used to calculate information to simulate rainfall for a representative month (See Table 8). If it is assumed that it will rain at least 0.5 inches twice a month, then, using the average number of days data, it can be assumed that it will rain 0.25 inches or less 2.14 times a month, and it will rain 0.10 inches 2.29 times a month. On average, then, there will be six rainfall events per month. Using a hypothetical 30-day month, a rainfall pattern of one rainfall every five days will accommodate the average event frequency.

The rainfall amount during those six events is taken from the table value and weighted according to the average monthly total (3.33 inches). That is,

2 events at 0.50 in. = 1.00 in.

2 events at 0.25 in. = 0.50 in.

2 events at 0.10 in. = 0.20 in.

Total before weighing = 1.70 in.

3.33 in. / 1.70 in. = 1.96 : the weighing factor

1.96* 0.50 = 0.98

1.96* 0.25 = 0.49

1.96 * 0.10 = 0.20

Therefore, a rainfall schedule was developed where once every five days during the calculation period one of these events would occur.

The variable S in the Soil Conservation Service runoff volume equation takes into consideration antecedent rainfall, soil conditions, land use, and conservation practices. The equation used to find S follows:

$$S = \frac{25400}{N} - 254$$

where

N = an arbitrary curve number which varies from 1 to 100

The N value takes into account land use and soil type. The values for N used for the analysis of the Macatawa Watershed are listed here:

Land Use	N value
Residential	75.25
Commercial/Industrial	85
Major Roads	85

Table 9. N Values, Curve Numbers, for the Macatawa Watershed.

The GWLF equations were carried out using a spreadsheet application (see results, end of this section). A separate set of calculations was carried out for each urban land use (residential, commercial/industrial, major roads).

Combining Results from USLE and GWLF to Find Phosphorus Load from Land Uses

The phosphorus contributions predicted by each model needed to be checked against the phosphorus concentrations obtained by sampling. Two adjustments were made to the model results in order to fit the model predictions to the observed values. The first adjustment consisted of modifying the results found from each model according to a measure of relative contribution of phosphorus from key land uses.

The initial inspection of the land use compared to the MDEQ-measured phosphorus levels indicated few or no statistically significant relationships. Two relationships did have coefficients of determination (R^2 values) of 0.3 to 0.4. Those relationships were between phosphorus levels and agriculture (R^2 = 0.43) and residential (R^2 = 0.33). The regression equations for those two relationships were then used to predict the amount of phosphorus contributed by each land use given the total amount of land use in the Macatawa Watershed. Following are the predicted regression equations and the resulting predicted phosphorus load from each land use.

Residential:

$$y = 746.48e^{-3.9187x}$$

Cropland:

$$y = 244.72e^{2.489x}$$

where

Y = phosphorus level (lb/mi^2/yr) predicted by relationship between land uses in subwatersheds and phosphorus measured at each monitoring station
X = amount of residential area in subwatershed

When solved for the amount of each land use (x) present in the entire watershed (residential: 8.96%, cropland: 67.72%,) the phosphorus levels predicted to be contributed from each land use become:

$$y_{residential} = 525 \frac{lb}{mi^2 - yr}$$

$$y_{cropland} = 1320 \frac{lb}{mi^2 - yr}$$

Land Use	Initially Adjusted Model Predicted Loads (lb/year)	Secondary Adjusted Current Load (lb/year)	% of Phosphorus Load
Barren	3,832.91	1,337.75	1.06%
Deciduous	47,331.20	16,519.31	13.10%
Coniferous	4,154.42	1,449.95	1.15%
Cropland	200,838.63	70,095.73	55.58%
Nonforested Wetland	989.63	345.39	0.27%
Forested Wetland	1,376.43	480.40	0.38%
Residential	50,355.50	17,574.83	13.94%
Commercial/Industrial	35,847.50	12,511.32	9.92%
Roads	16,633.40	5,805.31	4.60%
Predicted Total:	361,359.62	**Tot:** 126,120.00	

MDEQ Measured Phosphorus Load in 1997:	138,536.00
NonPoint Source Contribution (MDEQ, 3/98):	126,120.00

Table 10. Initial and Secondary Adjustments made to Model Predicted Phosphorus Contributions

The ratio of these two values was used to balance the initial model results. Cropland was used as the key land use to represent the USLE, non-urban phosphorus predictions. Residential was used as the key for the GWLF, urban predictions. The ratio of the y values above was used to fit the ratio of the total phosphorus predictions from the USLE and the GWLF. The resulting adjusted total phosphorus loads from each model are: USLE – 258,523 pounds, GWLF – 102,836 pounds.

Note that the total combined phosphorus load after the initial adjustment is significantly greater than the MDEQ-observed 1997 phosphorus load (126,120 from nonpoint sources). Therefore, a second adjustment consisted of finding the ratio of the actual phosphorus load to the initially adjusted phosphorus loads, and applying it to each land use's initially adjusted phosphorus contribution.

Table 10 presents the model-predicted and adjusted phosphorus loads contributed by each land use, taking into consideration soils and slopes, in the Macatawa Watershed. The column listed 'Secondary Adjusted Current Load' contains the final values which were used to develop the Implementation Plan and evaluate the effect potential best management practices could have on the water quality in the Macatawa Watershed.

Appendix B

Original Matrix of 44 Methods to Reduce Phosphorus in the Macatawa Watershed

Appendix C

Best Management Practice Glossary

Appendix D

List of Watershed Project Partners

The following is a list of agencies which have been instrumental in the development of this Watershed Implementation Plan.

Cities of Holland and Zeeland

Holland, Zeeland, Park, Laketown, Fillmore, Blendon, Port Sheldon, Overisel and Olive Townships

Hope College

Ottawa and Allegan County Drain Commissions

Michigan State University Extension

Michigan Department of Environmental Quality

Holland Home Builders Association

Macatawa Greenway Partnership

Michigan Farm Bureau

Natural Resources Conservation Service

Ottawa and Allegan County Soil and Water Conservation Districts

Ottawa and Allegan County Health Departments

Ottawa and Allegan County Road Commissions

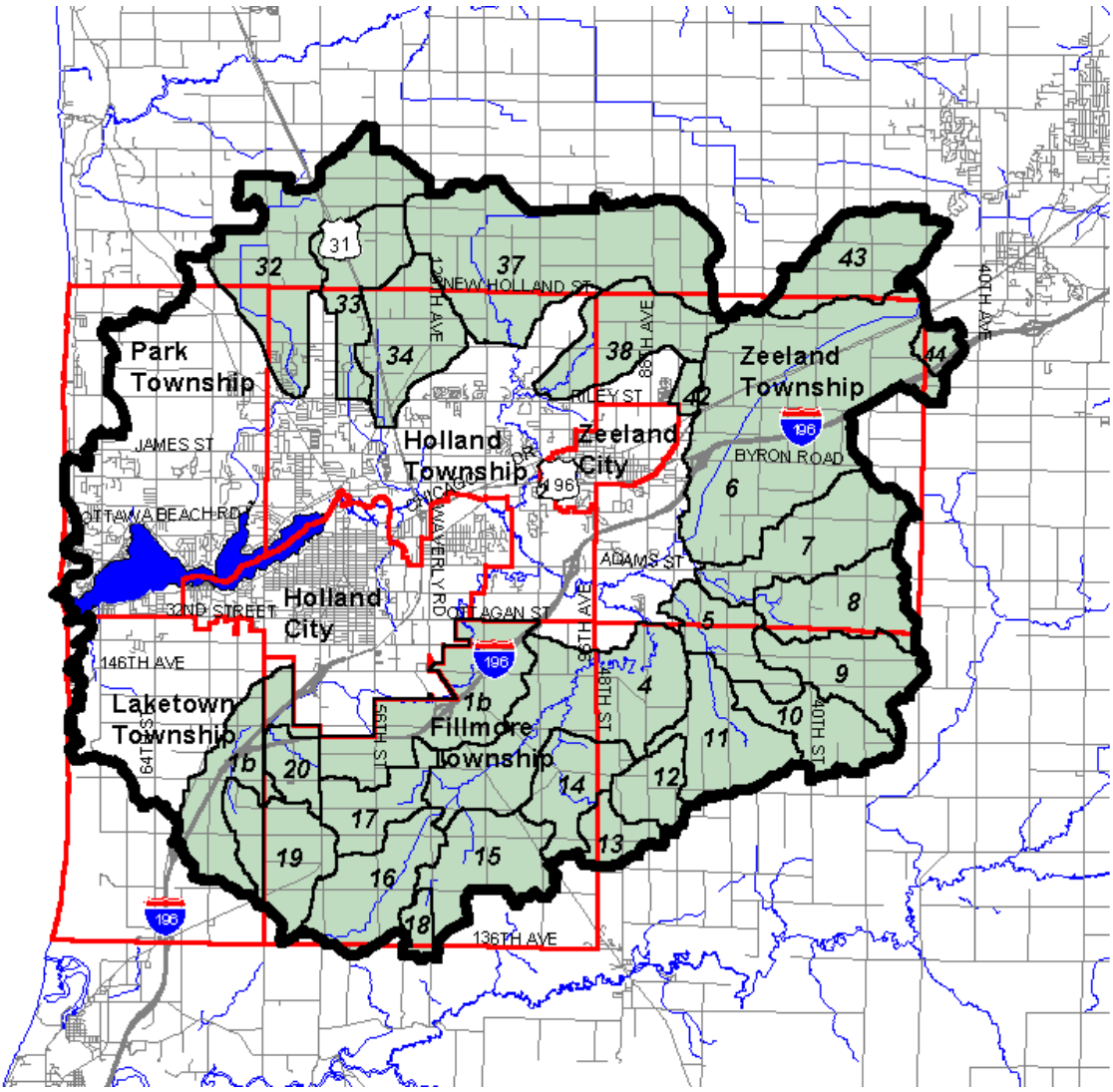
Appendix E

Summary Cost and Effectiveness Table

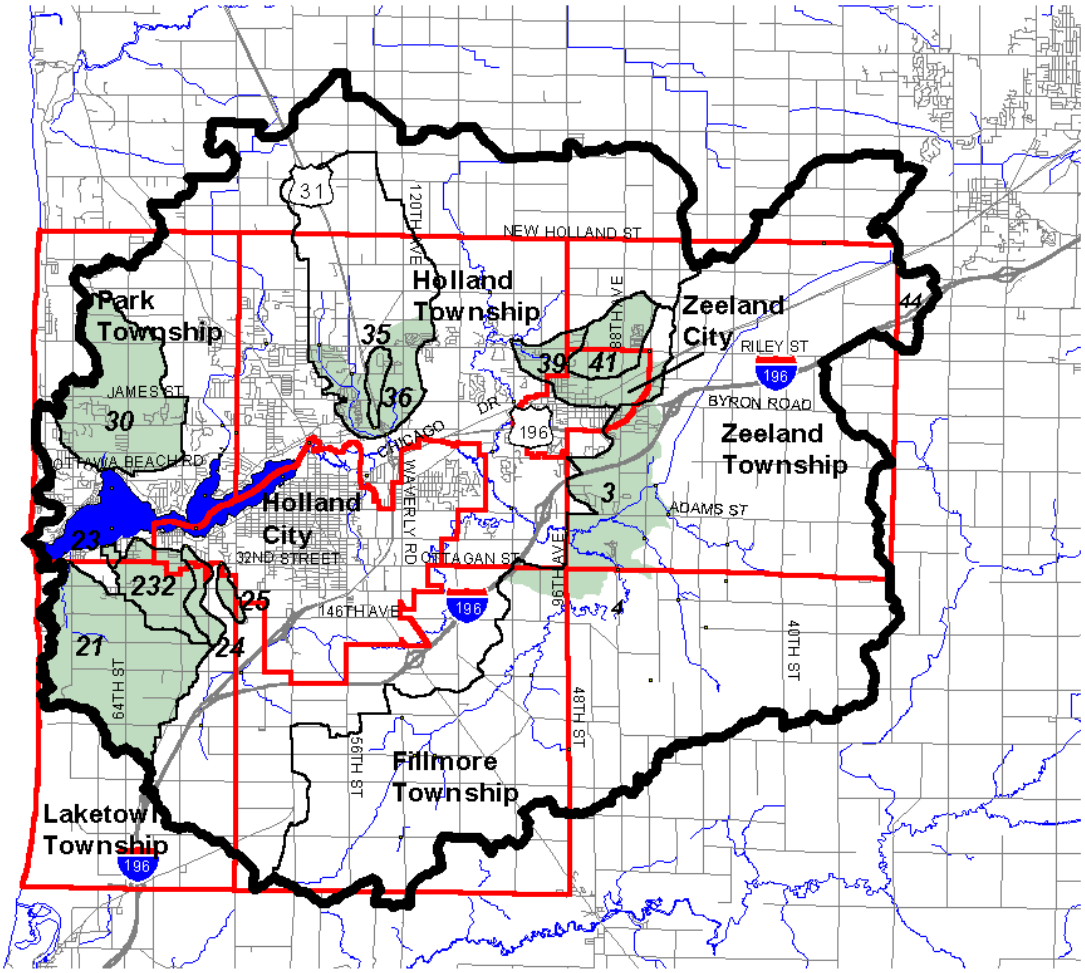
BMP Control Option	Level of Effort	Capital Cost ($)	Annual Cost ($)	Removal (lb/yr)	Unit Cost ($/lb)
Urban					
Landscape Management	4,650 ac	N/A	$ 88,270	1,380	$ 64
Street Sweeping	4 times/yr	$ 400,000	$ 297,450	9,275	$ 32
Catch Basin Cleaning	6,850 cleaned/yr	$ 400,000	$ 308,200	3,505	$ 88
Subtotal		**$ 800,000**	**$ 693,920**	**14,160**	
Agricultural					
Nutrient Management	11,520 ac	N/A	$ 86,410	2,640	$ 33
Livestock Fencing	230 ac	N/A	$ 6,000	140	$ 43
No Till/Mulch Till	19,550 ac	N/A	$ 195,530	5,980	$ 33
Cover/Green Manure Crop	28,040 ac	N/A	$ 168,230	5,150	$ 33
Grass Waterways	90,850 ft	$ 590,410	$ 105,570	16,760	$ 10
Filter Strips	538,600 ft	$ 148,370	$ 31,270	4,820	$ 10
Subtotal		**$ 738,780**	**$ 593,010**	**35,490**	
Urbanizing					
Low Maintenance Lawns	5,390 ac	N/A	$ 4,930	90	$ 55
Construction–Soil Erosion Control	5,390 ac	N/A	$ 40,730	780	$ 52
Grass/Open Ditches	14,490 ft	$ 46,360	$ 11,960	1,405	$ 12
Street Sweeping	3 times/yr	$ 125,000	$ 44,020	1,137	$ 39
Subtotal		**$ 171,360**	**$ 101,640**	**3,412**	
Upstream BMP Totals		**$ 1,710,140**	**$ 1,388,570**	**53,062**	
Downstream Control Options:					
Sediment Basins	50 ac	$ 4,000,000	$ 460,000	10,970	$ 42
Wetland Construction	100 ac	$ 3,000,000	$ 360,000	12,680	$ 28
Alum Treatment	75% of area	$ 600,000	$ 160,000	49,100	$ 3
Downstream BMP Totals		**$ 7,600,000**	**$ 980,000**	**72,750**	
Total Removal				**125,812**	
Target Reduction				***91,000***	
Safety Margin				***34,812***	

Appendix F

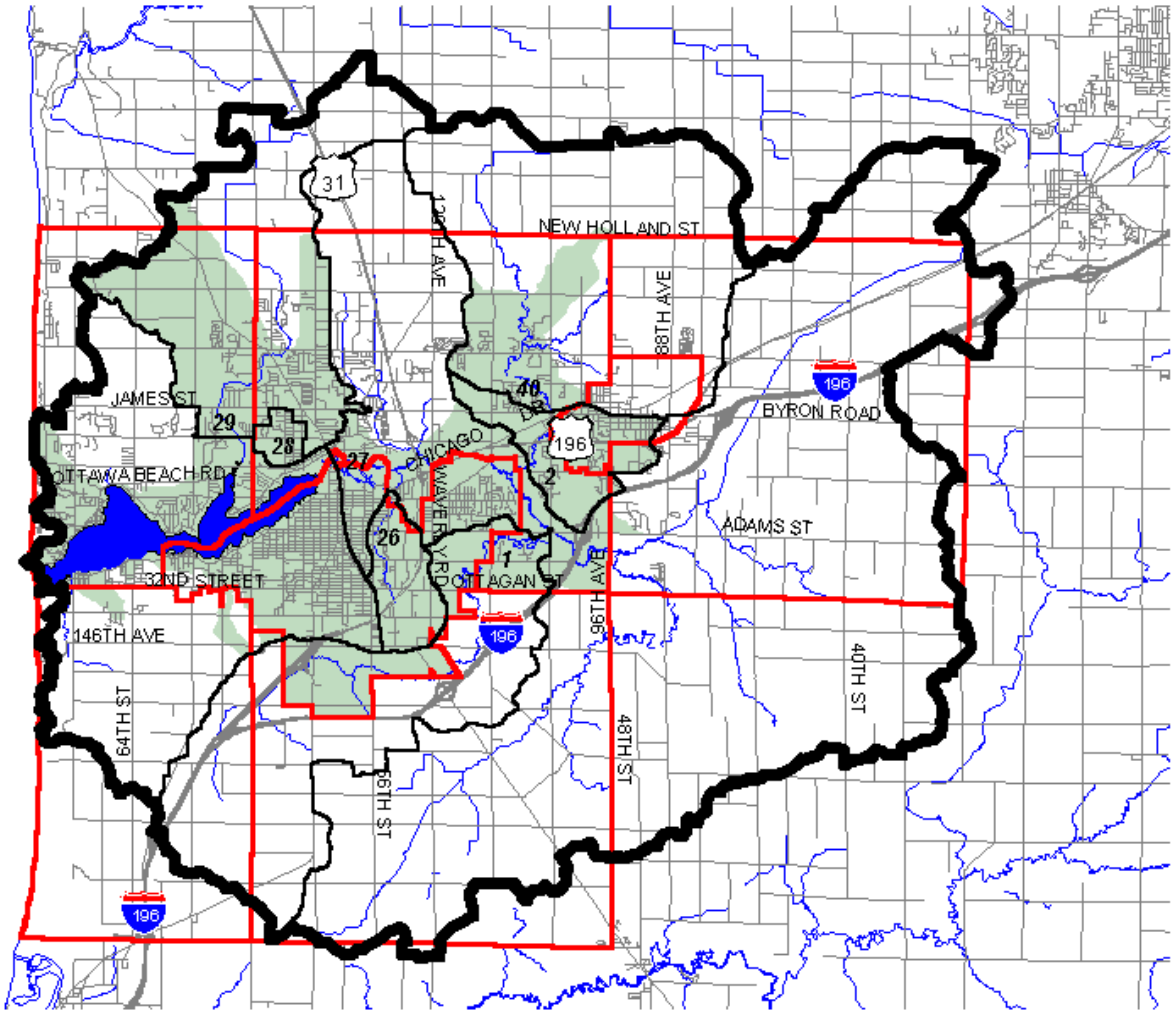
Maps of Subwatershed Classifications



Subwatersheds Designated as Agricultural



Subwatersheds Designated as Urbanizing



Subwatersheds Designated as Urban

Appendix G

Priority Best Management Practices by Subwatershed

	Landscape Management		Street Sweeping			Catch Basin Cleaning		
Sub #	Annual Cost	Removal (lbs/yr)	Frequency	Annual Cost	Removal (lbs/yr)	Number/yr	Annual Cost	Removal (lbs/yr)
1b	$ 14,060	130	4 times/yr	$ 47,370	880	1,090	$ 49,080	330
2	$ 7,690	220	4 times/yr	$ 25,910	1,485	600	$ 26,850	560
26	$ 4,730	120	4 times/yr	$ 15,950	790	370	$ 16,530	300
27	$ 13,810	175	4 times/yr	$ 46,550	1,175	1,070	$ 48,230	445
28	$ 1,280	15	4 times/yr	$ 4,330	110	100	$ 4,480	40
29	$ 18,240	230	4 times/yr	$ 61,460	1,550	1,420	$ 63,680	590
40	$ 8,030	230	4 times/yr	$ 27,060	1,550	620	$ 28,040	585
WSHED	$ 20,430	260	4 times/yr	$ 68,820	1,735	1,580	$ 71,310	655
TOTAL	**$ 88,270**	**1,380**		**$ 297,450**	**9,275**	**6,850**	**$ 308,200**	**3,505**

Table 11. Priority Urban BMPs

Note: WSHED indicates all areas not falling in a numbered subwatershed

Landscape Management: education of the public in urban areas regarding the methods "Planting Trees, Shrubs, and Ground Cover; Including During/After Construction", and " New Types of Low Maintenance Lawn Grass/ Change in Lawn Maintenance"

	Grassed Waterways			Street Sweeping		
Sub #	Length (ft)	Capital Cost	Removal (lbs/yr)	Frequency	Annual Cost	Removal (lbs/yr)
3	2,810	$ 9,000	385	3 times/yr	$ 8,550	310
21	3,590	$ 11,490	255	3 times/yr	$ 10,890	204
23	50	$ 160	5	3 times/yr	$ 150	3
23a	1,040	$ 3,330	70	3 times/yr	$ 3,150	60
24	330	$ 1,040	25	3 times/yr	$ 990	20
25	150	$ 490	10	3 times/yr	$ 470	10
30	2,900	$ 9,290	200	3 times/yr	$ 8,800	160
35	240	$ 760	20	3 times/yr	$ 720	15
36	1,390	$ 4,440	115	3 times/yr	$ 4,200	95
39	1,120	$ 3,570	180	3 times/yr	$ 3,430	145
41	870	$ 2,790	140	3 times/yr	$ 2,670	115
TOTAL	**14,490**	**$ 46,360**	**1,405**		**$ 44,020**	**1,137**

Table 12. Priority Urbanizing BMPs (I)

Note: The method "Construction BMPs" includes street cleaning, silt fencing, slope stabilization, staging /scheduling. Gravel access roads, and slope stabilization.

Sub #	Low Maintenance Lawn Annual Cost	Low Maintenance Lawn Removal (lbs/yr)	Construction BMPs Annual Cost	Construction BMPs Removal (lbs/yr)
3	$ 960	25	$ 7,900	215
21	$ 1,220	15	$ 10,060	145
23	$ 20	1	$ 140	2
23a	$ 350	5	$ 2,910	40
24	$ 110	1	$ 910	10
25	$ 50	1	$ 430	5
30	$ 980	15	$ 8,120	110
35	$ 80	1	$ 670	10
36	$ 470	5	$ 3,880	65
39	$ 390	10	$ 3,200	100
41	$ 300	10	$ 2,510	80
TOTAL	**$ 4,930**	**89**	**$ 40,730**	**781**

Table 13. Priority Urbanizing BMPs (II)

	Cover/Green Manure Crop			Grassed Waterways			Filter Strip		
Sub #	acres	Annual Cost	Removal (lbs/yr)	Length (ft)	Capital Cost	Removal (lbs/yr)	Length (ft)	Capital Cost	Removal (lbs/yr)
1a	1,920	$ 11,520	150	6,220	$ 40,430	490	36,880	$ 10,160	140
4	2,165	$ 12,990	444	7,010	$ 45,570	1445	41,560	$ 11,450	415
5	860	$ 5,160	176	2,790	$ 18,110	575	16,520	$ 4,550	165
6	3,877	$ 23,260	795	12,560	$ 81,640	2585	74,490	$ 20,520	745
7	1,160	$ 6,960	237	3,760	$ 24,440	775	22,290	$ 6,140	220
8	973	$ 5,840	200	3,150	$ 20,490	650	18,690	$ 5,150	185
9	540	$ 3,240	111	1,750	$ 11,360	360	10,350	$ 2,850	105
10	877	$ 5,260	179	2,840	$ 18,460	585	16,840	$ 4,640	170
11	1,012	$ 6,070	207	3,280	$ 21,300	675	19,420	$ 5,350	195
12	453	$ 2,720	93	1,470	$ 9,560	305	8,710	$ 2,400	85
13	342	$ 2,050	70	1,110	$ 7,200	230	6,570	$ 1,810	65
14	712	$ 4,270	146	2,310	$ 15,000	475	13,690	$ 3,771	138
15	978	$ 5,870	202	3,170	$ 20,610	650	18,800	$ 5,180	190
16	1,010	$ 6,060	207	3,270	$ 21,280	675	19,420	$ 5,350	195
17	630	$ 3,780	130	2,040	$ 13,270	420	12,120	$ 3,340	120
18	172	$ 1,030	35	560	$ 3,610	115	3,300	$ 910	35
19	953	$ 5,720	74	3,090	$ 20,070	245	18,300	$ 5,040	70
20	335	$ 2,010	26	1,090	$ 7,060	85	6,430	$ 1,770	25
32	1,948	$ 11,690	207	6,310	$ 41,030	675	37,430	$ 10,310	195
33	902	$ 5,410	115	2,920	$ 18,980	370	17,320	$ 4,770	105
34	1,012	$ 6,070	128	3,280	$ 21,290	415	19,420	$ 5,350	120
37	2,875	$ 17,250	696	9,310	$ 60,520	2260	55,210	$ 15,210	650
38	1,027	$ 6,160	248	3,330	$ 21,630	810	19,750	$ 5,440	230
42	113	$ 680	28	370	$ 2,390	90	2,180	$ 600	25
43	1,017	$ 6,100	209	3,290	$ 21,400	680	19,530	$ 5,380	195
44	177	$ 1,060	37	570	$ 3,710	120	3,380	$ 930	35
TOTAL	**28,038**	**$ 168,230**	**5,150**	**90,850**	**$ 590,410**	**16,760**	**538,600**	**$ 148,371**	**4,818**

Table 14. Priority Agricultural BMPs (I)

	Nutrient Management			Livestock Fencing			No Till/Mulch Till		
Sub #	acres	Annual Cost	Removal (lbs/yr)	acres	Annual Cost	Removal (lbs/yr)	acres	Annual Cost	Removal (lbs/yr)
1a	789	$ 5,920	77	16	$ 310	4	1,339	$ 13,390	174
4	889	$ 6,670	228	18	$ 350	12	1,509	$ 15,090	516
5	353	$ 2,650	91	7	$ 140	5	600	$ 6,000	205
6	1,593	$ 11,950	408	32	$ 630	21	2,704	$ 27,040	924
7	477	$ 3,580	122	10	$ 190	6	809	$ 8,090	275
8	400	$ 3,000	103	8	$ 160	5	679	$ 6,790	232
9	221	$ 1,660	57	5	$ 90	3	376	$ 3,760	129
10	360	$ 2,700	92	7	$ 140	5	611	$ 6,110	209
11	416	$ 3,120	106	8	$ 160	6	705	$ 7,050	241
12	187	$ 1,400	48	4	$ 70	3	316	$ 3,160	108
13	140	$ 1,050	36	3	$ 60	2	239	$ 2,390	82
14	292	$ 2,190	75	6	$ 120	4	497	$ 4,970	170
15	403	$ 3,020	104	8	$ 160	5	682	$ 6,820	234
16	415	$ 3,110	106	8	$ 160	6	705	$ 7,050	241
17	259	$ 1,940	67	5	$ 100	4	439	$ 4,390	151
18	71	$ 530	18	2	$ 30	1	120	$ 1,200	41
19	392	$ 2,940	38	8	$ 150	2	665	$ 6,650	86
20	137	$ 1,030	13	3	$ 50	1	234	$ 2,340	30
32	800	$ 6,000	106	16	$ 320	6	1,359	$ 13,590	241
33	371	$ 2,780	59	8	$ 150	3	629	$ 6,290	133
34	416	$ 3,120	66	8	$ 160	3	705	$ 7,050	148
37	1,181	$ 8,860	357	24	$ 470	19	2,004	$ 20,040	808
38	423	$ 3,170	127	9	$ 170	7	716	$ 7,160	288
42	47	$ 350	14	1	$ 20	1	79	$ 790	32
43	417	$ 3,130	107	8	$ 160	6	709	$ 7,090	243
44	72	$ 540	19	2	$ 30	1	123	$ 1,230	43
TOTAL	**11,521**	**$ 86,410**	**2,644**	**228**	**$ 4,550**	**141**	**19,553**	**$ 195,530**	**5,984**

Table 15. Priority Agricultural BMPs (II)

Appendix H

Potential Funding Sources

Source of Funding	Amount Available	Description
Clean Water Action Plan	$568 million in new resources for FY 1999; total of $2.3 billion over five years	States must define Unified Watershed Assessments and Watershed Restoration Priorities: Michigan Department of Environmental Quality lists Macatawa Watershed #2 in Michigan's top 8 Watershed Restoration Priority list
Clean Michigan Initiative	$675 million to environmental activities; $50 million over six or seven years specifically for nonpoint sources, beginning late 1999	To receive funding, project must lie in area with an Approved Watershed Management Plan (this Implementation Plan will serve as the Approved Watershed Management Plan for the Macatawa Watershed.) Few areas will have approved watershed management plan by late 1999. Applicants must be a Local Unit of Government or a Nonprofit Entity.
Environmental Quality Incentives Program (EQIP)	$200 million per year nationally through the year 2002	Administered by county Soil Conservation Districts (SCD) and Natural Resources Conservation Service (NRCS) offices. Eligible land includes cropland, rangeland, and forest land with approved conservation plans.
Small Business Low Interest Revolving Loan Fund		Holland Chamber of Commerce operates an existing Revolving Loan Fund; could assist in creating a similar fund to assist with Watershed activities
Great Lakes Protection Fund	Grants from a $76.8 million permanent endowment	Fund supports pollution prevention, natural resources and health effects projects.
US Army Corps of Engineers Continuing Authorities Program	Single-project funding limits of $500,000 to $5 million, depending on project	Projects under nine separate categories, relating to previous Army Corps' work mitigation, or environmental restoration
Transportation Enhancement Act for the 21st Century (TEA-21) and Clean Mi		Grants to enhance existing or future transportation networks with environmental projects including those which will positively affect water quality.

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Appendix D

Environmental Review Forms and Policies

The purpose of this section is to provide copies of environmental review forms and policies to assist in the protection of Holland's Source Water. These forms are provided for reference and usage in the site plan review process. To this effect, this section includes the following documents:

(a) MDEQ (now MDNRE) General Permit FAQ

(b) MDEQ (now MDNRE) Permit Checklist

(c) SWIPP Environmental Permits Checklist

(d) Non-Domestic Wastewater Customer Requirements for New Construction or Additions (Checklist)

(e) Holland Area WWTP Non-Domestic Users Survey

(f) Industrial User Requirements (from Wastewater Industrial Pretreatment Program)

(g) Wastewater Discharge Permit Application

I am starting a new manufacturing business. What permits may I need from the Michigan Department of Environmental Quality (DEQ)?

There are several resources to assist companies in determining the permits that may be needed from DEQ.

PERMIT INFORMATION CHECKLIST:
An initial evaluation can be done through use of the **Permit Information Checklist.** The checklist contains "yes" and "no" questions to help identify the types of activities at the proposed facility that may require permits from the DEQ.

If you need more information about a specific permit program, then refer to the relevant chapter of the **DEQ Permit and Licensing Requirements Guidebook**.

Contact the Environmental Assistance Center at 800-662-9278 if a hard copy is necessary. In addition, if you have any questions as you go through the permit information checklist, you can call the Environmental Assistance Center and ask for a program specialist. You can also contact the program directly (phone numbers are included on the page to assist in this regard).

MICHIGAN MANUFACTURER'S GUIDEBOOK:
Another excellent reference is the **Michigan Manufacturers' Guide to Environmental, Health, and Safety Regulations**. This guidebook was written by the DEQ, in cooperation with the Michigan Occupational Safety and Health Administration (MIOSHA) to assist manufacturers with regulations.

We have received some very positive feedback from Michigan manufacturers as to the usefulness of this desk reference. If you would like hard copy, you can purchase a guidebook for $25 plus tax and shipping. A CD version is also available for $3 plus tax and shipping. An order form can be found at the site above, or you can contact the Environmental Assistance Center 800-662-9278 for help with the order.

BROWNFIELD REDEVELOPMENT:
Various cities work with the Michigan Department of Environmental Quality's Brownfield Redevelopment Grant Program. If the site under consideration is a brownfield (old industrial site or site of environmental contamination), then you may want to consider calling the city to investigate incentives in this regard. When calling a city, ask whether they have a Brownfield Authority or similar office.

MICHIGAN ECONOMIC DEVELOPMENT CORPORATION:
You may want to also consider contacting the Michigan Economic Development Corporation to see whether they offer any incentives and counseling services for the new venture. They may also be able to assist with other permits that may be necessary through other executive departments within the State of Michigan. Customer Service can be reached at 517-373-9808. They also have a chat function through the Web at www.michigan.org/medc. In addition, small business resources can be obtained from the Small Business Resource Center, 800-946-6829 or Email at MEDCServices@michigan.org.

ONCE YOU GET SETTLED:
Once a facility gets settled in Michigan, they may want to learn about DEQ's other valuable business assistance programs, including: Small Business Pollution Prevention Loan Program, Environmental Management System Guidance, Clean Corporate Citizen, Retired Engineer Technical Assistance Program (free, non-regulatory and confidential pollution prevention audits), and the Michigan Business Pollution Prevention Partnership.

PERMIT INFORMATION

The Department of Environmental Quality (DEQ) has prepared a list of key questions to help identify what departmental permits, licenses, or approvals of a permit-like nature may be needed for a project. By contacting the appropriate offices listed below, you will help reduce the possibility that your project or activity will be delayed due to the untimely discovery of additional permitting requirements later in the process. While this list covers the existence of permits and approvals required from the DEQ, it is not a comprehensive list of all legal responsibilities (i.e. planning requirements and chemical storage regulations may apply). A useful way to learn whether any other requirements will apply is to go through the Self Environmental Assessment in the Michigan Manufacturers Guide, online at:

KEY QUESTIONS: (DEQ Permit and Licensing Guidebook Chapter)	Yes ☐	No ☐	If "Yes," refer to the DEQ Permit and Licensing Guidebook Section(s), the Web Page, or Call the Program:
CONSTRUCTION PERMITS			
Permit to Install: Does the project involve installation, construction, reconstruction, relocation, or alteration of any process equipment (including **air pollution control equipment**) which has the potential to emit air contaminants?	Y☐	N☐	AQD, Permit Section, 517-373-7023
Asbestos Notification: Does the project involve renovating or demolishing all or portions of a building? (Notification is required for all renovations and demolitions, even if the structure never contained asbestos.)	Y☐	N☐	AQD Asbestos NESHAP Program 517-373-7064
Soil Erosion and Sedimentation Control (SESC): Does the project involve an earth change activity within 500 feet of a lake or stream, or will the project disturb an area greater than one acre in size?	Y☐	N☐	Contact Your Local SESC Agency WB, SESC Program, 517-335-3178
Does the project involve **construction** which will disturb one or more acre that comes into contact with **storm water** that enters a storm sewer, drain, lake, stream, or other surface water?	Y☐	N☐	WB, Permits Section, 517-241-8993 or appropriate DEQ District Office
Does the project involve **construction** or alteration of any **sewage collection or treatment** facility?	Y☐	N☐	Appropriate District Office, WB, Part 41 Construction Permit Program
Does the project involve **construction** of a **community water supply** well or the extension of a water supply from an existing water system?	Y☐	N☐	Appropriate DEQ District Office, WB, Community Water Supply Program
Does the project involve **construction** of a **water supply well** (a private, irrigation, process, or public water well)?	Y☐	N☐	Contact a Registered Well Driller, Web, Local Health Department Contacts, Non Community Water Supply,
Does the project involve construction of a facility that landfills, transfers, or processes of any type of **solid non-hazardous waste** on-site, or places **industrial residuals/sludge** into or onto the ground?	Y☐	N☐	Appropriate DEQ District Office, WHMD 517-335-4035
Does the project involve the construction of an on-site treatment, storage, or disposal facility for **hazardous waste**?	Y☐	N☐	WHMD, Hazardous Waste Section, 517-373-9875
CONSTRUCTION PERMITS (LAND/WATER FEATURE)			
Does the project involve filling, dredging, placement of structures, draining, or use of a **wetland**?	Y☐	N☐	(Permit Application)Land & Water Management Division (LWMD), Permit Consolidation Unit, 517-373-9244
Storm Water Discharge to Wetlands: Will storm water be collected, stored, or treated in a wetland area from a public road, industrial, commercial, or multi-unit residential development?	Y☐	N☐	(Permit Application)LWMD, Permit Consolidation Unit, 517-373-9244

Great Lakes: Does the project involve construction, filling, or dredging below the Ordinary High Water Mark of one of the Great Lakes?	Y☐ N☐	(Permit Application)LWMD, Permit Consolidation Unit, 517-373-9244
Inland Lakes and Streams: Does the project involve any dredging, filling, placement of structures, or the operation of a marina within an inland waterbody (e.g. lake, river, stream, drain, creek, ditch, or canal), enlargement of a waterbody, or excavation of a pond within 500 feet of a waterbody?	Y☐ N☐	(Permit Application)LWMD, Permit Consolidation Unit, 517-373-9244
Storm Water Ponds and Discharges to Inland Lakes/Streams, or Great Lakes: Will storm water from any road or any other part of the development be discharged either directly or ultimately to an inland waterbody, or one of the Great Lakes; or will a storm water pond be constructed within 500 feet of an inland waterbody?	Y☐ N☐	(Permit Application) LWMD, Permit Consolidation Unit, 517-373-9244
Does the project involve placement of fill, earth moving, or placement of structures within the 100-year **floodplain** of a watercourse?	Y☐ N☐	(Pemit Application) LWMD, Permit Consolidation Unit, 517-373-9244
Does the project involve construction of a building or septic system in a designated Great Lakes **high risk erosion area**?	Y☐ N☐	(Permit Application)LWMD, Permit Consolidation Unit, 517-373-9244
Does the project involve dredging, filling, grading, or other alteration of the soil, vegetation, or natural drainage, or placement of permanent structures in a designated **environmental area**?	Y☐ N☐	(Permit Application)LWMD, Permit Consolidation Unit, 517-373-9244
Does the project propose any development, construction, silvicultural activities or contour alterations within a designated **critical dune area**?	Y☐ N☐	(Permit Application),LWMD, Permit Consolidation Unit, 517-373-9244
Does the project involve construction of a **dam**, weir or other structure to impound flow?	Y☐ N☐	(Permit Application) LWMD, Dam Safety Program, 517-241-9862
CONSTRUCTION PERMITS (SECTOR SPECIFIC)		
Does the project involve a **subdivision or site condominium** project utilizing individual on-site subsurface disposal systems or individual wells?	Y☐ N☐	WB, DWEHS, 517-241-1345
Does the project involve the construction or modification of a **campground**?	Y☐ N☐	WB, DWEHS, 517-241-1340
Does the project involve the construction or modification of a **public swimming pool**?	Y☐ N☐	DEQ, WB, Drinking Water & Environmental Health Section (DWEHS), 517-241-1340
OPERATIONAL PERMITS		
Renewable Operating Permit: Does your facility have the potential to **emit** any of the following: 100 tons per year or more of any criteria pollutant; 10 tons per year or more of any hazardous **air pollutant**; or 25 tons per year or more of any combination of hazardous **air pollutants**?	Y☐ N☐	AQD, Permit Section, 517-373-7023
NPDES: Does the project involve the **discharge of any type of wastewater** to a storm sewer, drain, lake, stream, or other **surface water**?	Y☐ N☐	WB, Appropriate District Office, or National Pollutant Discharge Elimination (NPDES) Permit Program 517-241-1346
Does the facility have **industrial** activity that comes into contact with **storm water** that enters a storm sewer, drain, lake, stream, or other surface water?	Y☐ N☐	WB, Permits Section, 517-241-8993 or appropriate DEQ District Office

Does the project involve the **discharge of wastewaters** into or onto the **ground** (e.g. subsurface disposal or irrigation)?	Y☐ N☐	WB, Groundwater Permits Program, 517-373-8148
Does the project involve the drilling or deepening of **wells for waste disposal**?	Y☐ N☐	OGS, Minerals and Mapping Unit, 517-241-1532
Does the project involve landfilling, transferring, or processing of any type of **solid non-hazardous waste** on-site, or placing **industrial residuals/sludge** into or onto the ground?	Y☐ N☐	Appropriate DEQ District Office, WHMD 517-335-4035
Does the project involve the on-site treatment, storage, or disposal of **hazardous waste**?	Y☐ N☐	WHMD, Hazardous Waste Section, 517-373-9875
Does the project require a **site identification number** (EPA number) for regulated waste activities (used oil, liquid waste, hazardous waste, universal waste, PCBs)?	Y☐ N☐	WHMD, Appropriate DEQ District Office
Does the project involve the receipt, possession, manufacture, use, storage, transport, transfer, release, or disposal of **radioactive material** in any form?	Y☐ N☐	WHMD, Radioactive Material and Standards Unit, 517-241-1275
Do you desire to develop a **withdrawal** of over 2,000,000 gallons of **water** per day from any source other than the Great Lakes and their connecting waterways? Or, do you desire to develop a withdrawal of over 5,000,000 gallons of water per day from the Great Lakes or their connecting waterways?	Y☐ N☐	WB, DWEHS, Source Water Protection Unit, 517-241-1318
CHEMICAL ADDITION PROJECTS		
Are you using **chemicals** or materials in, or in contact with, **drinking water** at any point in the **water works system**?	Y☐ N☐	WB, Appropriate District Office, Public Water Supply Program 517-241-1318
Are you applying a chemical treatment for the purpose of **aquatic nuisance control** (pesticide/herbicide etc) in a water body (i.e. lake, pond or river)? (Permit Guidebook Chapter	Y☐ N☐	WB, Aquatic Nuisance Control and Remedial Action Unit 517-241-7734
Are you applying materials to a water body for a **water resource management project** (i.e. mosquito control treatments, dye testing, or fish reclamation projects)?	Y☐ N☐	WB, Surface Water Assessment Section 517-373-2190
OPERATIONAL PERMITS (SECTOR SPECIFIC)		
Does the project involve the **transport** of some other facility's non-hazardous **liquid waste**? (Permit Guidebook Chapter	Y☐ N☐	WHMD, Transporter Program, 586-753-3850
Does the project involve the **transport hazardous waste**?	Y☐ N☐	WHMD, Transporter Program, 586-753-3850
Does your facility have an **electric generating unit** that sells electricity to the grid and burns a fossil fuel?	Y☐ N☐	AQD, Acid Rain Permit Program, 517-373-7023
Is the project a **dry cleaning establishment** utilizing perchloroethylene or a flammable solvent in the cleaning process?	Y☐ N☐	DEQ, Air Quality Division (AQD), 517-241-1324
Does your **laboratory test potable water** as required for compliance and monitoring purposes of the Safe Drinking Water Act?	Y☐ N☐	ESSD, Laboratory Services Section 517-335-9800

Does the project involve the generation of **medical waste** or a facility that treats medical waste prior to its disposal?	Y☐ N☐	Waste and Hazardous Materials Division (WHMD), Medical Waste Regulatory Program 517-241-1320
Does the project involve transport of septic tank, cesspool, or dry well contents or the discharge of **septage** or sewage sludge into or onto the ground?	Y☐ N☐	WB, DWEHS, Septage Program 517-241-1318
Do you store, haul, shred or process **scrap tires**?	Y☐ N☐	WHMD, Storage Tank and Solid Waste Section 517-241-2924
Does the project involve the operation of a **public swimming pool**?	Y☐ N☐	DEQ, WB, Drinking Water & Environmental Health Section (DWEHS), 517-241-1340
Does the project involve the operation of a **campground**?	Y☐ N☐	WB, DWEHS, 517-241-1340
Do you engage in the business of **hauling bulk water** for drinking or household purposes (except for your own household use)?	Y☐ N☐	WB, DWEHS, Noncommunity Unit, 517-241-1370
Does the project involve composting over 200 cubic yards of yard clippings?	Y☐ N☐	WHMD, Storage Tank and Solid Waste Section 517-241-2924
STORAGE TANKS (CONSTRUCTION AND OPERATION)		
Does the project involve the installation of an **aboveground storage tank** for a flammable or combustible liquid (under 200 degrees Fahrenheit)?	Y☐ N☐	WHMD, Storage Tank and Solid Waste Section (STSWS), 517-335-7211
Does the project involve the installation of a **compressed natural gas dispensing station** with storage?	Y☐ N☐	WHMD, STSWS, 517-335-7211
Does the project involve the installation of a **liquefied petroleum gas** container filling location or storage location that has a tank with a capacity of more than 2,000 gallons or has two (2) or more tanks with an aggregate capacity of more than 4,000 gallons?	Y☐ N☐	WHMD, STSWS, 517-335-7211
Does the project involve the installation, removal, or upgrade of an **underground storage tank** containing a petroleum product or a hazardous substance?	Y☐ N☐	WHMD, STSWS, 517-335-7211
Does the project involve the **installation** of a **hydrogen system**?	Y☐ N☐	WHMD STSWS, 517-335-7211
PERSONAL LICENSES/CERTIFICATIONS		
Are you designated by your facility to be the **Certified Operator** to fulfill the requirements of a wastewater discharge permit (**NPDES including Storm Water or Groundwater**)?	Y☐ N☐	Environmental Science and Services Division (ESSD), Operator Training 517-373-4755 and Water Bureau (WB), Storm Water Program 517-241-8993
Are you a **drinking water operator** in charge of a water treatment or water distribution system, back-up operator, or shift operator?	Y☐ N☐	ESSD, Operator Training 517-241-7199
Are you a **water well** drilling contractor, pump installer, **dewatering well** contractor or dewatering well pump installer?	Y☐ N☐	WB, Well Construction Unit 517-241-1377

OIL, GAS AND MINING		
Do you want to operate a **central production facility** (applies to oil and gas production facilities where products of diverse ownership are commingled)?	Y☐ N☐	Office of Geological Survey (OGS), Petroleum Geology and Production Unit 517-241-1515
Does the project involve the removal of sand from a **sand dune area** within two (2) miles of a Great Lakes shoreline?	Y☐ N☐	Office of Geological Survey (OGS), Minerals and Mapping Unit, 517-241-1542
Does the project involve the diversion and control of water for the mining and processing of **low-grade iron ore**?	Y☐ N☐	OGS, Minerals and Mapping Unit, 517-241-1542
Does the project involve the surface or open-pit mining of **metallic mineral deposits**?	Y☐ N☐	OGS, Minerals and Mapping Unit, 517-241-1542
Does the project involve the mining of **nonferrous mineral deposits** at the surface or in underground mines?	Y☐ N☐	OGS, Minerals and Mapping Unit, 517-241-1542
Does the project involve mining **coal**?	Y☐ N☐	OGS, Minerals and Mapping Unit, 517-241-1542
Do you want to change the status of an **oil or gas** well (i.e. plug the well)?	Y☐ N☐	OGS, Permits and Bonding Unit, 517-241-1528
Does the project involve drilling of **oil, gas, brine disposal, secondary recovery, or hydrocarbon** storage wells?	Y☐ N☐	OGS, Permits and Bonding Unit, 517-241-1528
Does the project involve plugging or deepening of an **oil or gas** well, or conveying rights in the well as an owner to another person?	Y☐ N☐	OGS, Permits and Bonding Unit, 517-241-1528
Does the project involve changing the status or plugging of a **mineral well**?	Y☐ N☐	OGS, Minerals and Mapping Unit, 517-241-1532
Does the project involve the drilling or deepening of **wells for brine production, solution mining, storage, or as test wells**?	Y☐ N☐	OGS, Minerals and Mapping Unit, 517-241-1532
Does the project involve decommissioning or decontamination of tanks, piping, and/or appurtenances that may have **radioactive levels** above background?	Y☐ N☐	WHMD Radioactive Material and Standards Unit, 517-241-1275

ENVIRONMENTAL ASSISTANCE CENTER: 1-800-662-9278

ENVIRONMENTAL PERMITS CHECKLIST

FOR THE

HOLLAND SOURCE WATER PROTECTION AREA

OTTAWA AND ALLEGAN COUNTIES, MICHIGAN

Name of Business:	
Mailing Address:	
Telephone:	**Fax:**
Type of Business:	
Facility Owner or Manager:	
Date:	**Signature:**

Note: For assistance with permits and approvals from the Michigan Department of Natural Resources & Environment, including permit coordination between MDNRE divisions, contact the Permit Coordinator, 517/335-4235.

Circle (Y/N) the items that <u>may</u> pertain to your project or facility; then contact the office(s) listed to determine specific requirements. Return a copy of this checklist to the municipality as part of your site plan submittal – even if state and county approvals have not yet been obtained. An updated copy should be submitted prior to occupancy.

This list includes the most common permits and approvals related to waste, water quality, and air quality. Other permits and approvals, including local approvals, may also be needed.

1. Y N Will the project involve the discharge of any type of wastewater to a storm sewer, drain, lake, stream, wetland or other surface water? **Contact:** *MI Department of Natural Resources & Environment, Surface Water Quality Division, Permits Section: 517/373-8088*

2. Y N Will the project involve the direct or indirect discharge of waste, waste effluent, wastewater, pollutants, and/or cooling water into the groundwater or on the ground? **Contact:** *MI Department of Natural Resources & Environment, Waste Management Division, Groundwater Program Section: 517/373-8148*

3. Y N Will the project involve the construction or alteration of any sewage collection or treatment facility? For **facilities discharging to surface waters,** contact the *MI Department of Natural Resources & Environment, Surface Water Division, District Office: 517/780-7690.* For **facilities discharging to groundwater,** contact the *MI Department of Natural Resources & Environment, Waste Management Division, District Office: 517/780-7690.*

DRAFT

4. Y N Will the project or facility store or use chemicals, petroleum products, or salt? Depending on the type of substance, secondary containment and a Pollution Incident Prevention Plan (PIPP) may be required. **Contact:** *MI Department of Natural Resources & Environment, Waste Management Division: 517/780-7690.*

5. Y N Will the project involve the installation, operation, or removal of an underground or aboveground storage tank containing a petroleum product or a hazardous substance? **Contact:** *MI Department of Natural Resources & Environment, Storage Tank Division: 517/373-8168*

6. Y N Will the project involve liquefied petroleum gas storage tanks or container filling stations? **Contact:** *MI Department of Natural Resources & Environment, Storage Tank Division: 517/373-8168*

7. Y N Does the project involve the installation of a compressed natural gas dispensing station with storage? *MI Department of Natural Resources & Environment, Storage Tank Division: 517/373-8168*

8. Y N Will the project involve the generation of hazardous waste? **Contact:** *MI Department of Natural Resources & Environment, Waste Management Division, District Office: 517/780-7690.*

9. Y N Will the project involve the on-site treatment, storage or disposal of hazardous waste? **Contact:** *MI Department of Natural Resources & Environment, Waste Management Division Hazardous Waste Permit Unit: 517/373-9875.*

10. Y N Will the project involve the transport of hazardous waste or non-hazardous liquid industrial waste? **Contact:** *MI Department of Natural Resources & Environment, Waste Management Division, And Hazardous Waste Permit Unit: 517/373-9875.*

11. Y N Will the project involve land filling, transferring or processing solid non-hazardous wastes on-site? **Contact:** *MI Department of Natural Resources & Environment, Waste Management Division, Dist. Office: 517/780-7690.*

12. Y N Will the project involve the installation, construction, reconstruction, relocation, or alteration of any process or process equipment (including air pollution control equipment) which has the potential to emit air contaminants? **Contact:** *MI Department of Natural Resources & Environment, Air Quality Division, Permit Section: 517/373-7023*

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Non-Domestic Customer Requirements for New Construction or Additions

Pollution Control Division

- ☐ Monitoring manhole is required for all non-domestic customers. It is to be installed on the owner's property. All wastewater must pass through the manhole before connecting to the main sewer. Only one connection to the main sewer will be permitted for each building.

- ☐ In the case of additions to an existing building, all new sewer lines must tie into existing sewer lines on the owner's property. The connection should be at least 10 feet before the monitoring manhole for sufficient mixture to ensure proper wastewater sampling.

- ☐ Any food service area will be required to discharge through a 1,000-gallon three chamber fats, oil, and grease (FOG) interceptor.

- ☐ Any floor drains within a facility must discharge through a 1,000-gallon oil interceptor before entering the sanitary sewer system.

- ☐ No customer will discharge uncontaminated process water, storm water, uncontaminated cooling water, surface water, groundwater, roof runoff, or subsurface drainage to the sanitary sewer system.

- ☐ Contact the Pollution Control Division at (616) 355-1275 for wastewater discharge requirements.

To be considered for any waiver to the requirements listed above, a written request from the owner must be sent to the address listed below or faxed to 616.355.1273 or e-mailed to gbunschoten@hollandbpw.com

Holland Board of Public Works
Pollution Control Division
625 Hastings Avenue
Holland, MI 49423

Holland Area Wastewater Treatment Plant
Non-Domestic Users Survey

gpd_____
SIC

Parent Company

Parent Address

Parent City, State, Zip

Facility Name

Facility Address

Facility City, State, Zip

Authorized Contact Person Title Phone

1. Does this building contain multiple company occupants? [ ] yes [ ] no
   If yes, please list all of the company names at this address.

2. Please describe the products and/or types of activities that take place at your facility. Please be specific.

3. Please list your North American Industry Classification System (NAICS) Code if known.

4. List the name of chemical compounds suspected or known to be present in the wastewater from this facility that are associated with manufacturing and/or byproducts.

Over

5. What types of waste, other than lavatories and hand washing, are discharged into the sanitary sewer system from this facility? (ie: process, noncontact cooling water, boiler blowdown, stormwater)

6. List any pretreatment devices. (ie: kitchen grease trap, oil interceptor, sand trap, pH adjustment, silver recovery system)

7. List any waste disposal methods other than into the sewer system.

8. What liquids are stored at this facility in quantities larger than five gallons?

   Is there containment that will prevent discharge of these materials into the sewer system if a spill occurs? [ ] yes [ ] no

9. Does this company have any expansions or process changes planned in the next three years? [ ] yes [ ] no
   If yes, please explain.

Certification Statement: I have personally examined and am familiar with the information submitted in this document. Based upon my inquiry of those individuals immediately responsible for obtaining the information reported herein, I believe that the submitted information is true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and/or imprisonment.

Authorized Signature _____ Date_____

Print Name _____

Please mail, fax, or e-mail this survey to the address listed below

Pollution Control Division
625 Hastings Avenue
Holland, MI 49423
616.355.1275 fax-616.355.1273
gbunschoten@hollandbpw.com

Industrial User Requirements

1. One person from each industry should be delegated the authority to be responsible for nondomestic wastewater discharged to the municipal sewers. He would be involved with maintaining the pretreatment facility operations and assuring a continual high level of performance. In case no pretreatment is provided, he would be involved with prevention of accidental discharges of process wastes to the sanitary sewer system. He must become aware of all potential and routine toxic wastes generated by his industry. He must be informed of all process alterations which could in any manner: increase or decrease normal daily flow or waste strength discharged to the sanitary sewer.

2. This industrial representative must catalog all chemicals stored, used, or manufactured by his industry. Such a listing should include specific chemical names - not manufacturers codes. Those wastes discharged to the sanitary sewer are a prime concern; however, all discharge should be cataloged. An estimate of daily average flows and strengths must be made including process cooling, sanitary, etc. Such a determination should separate the flows according to appropriate categories. The aforementioned flow and chemical listing is to be sent to the Control Authority and must be treated as confidential information.

3. The industrial representative should attempt to determine whether or not large process alterations will occur during the next few years; one year, two years, five years. He should consult with management to determine if such alterations are scheduled and forthcoming and notify the Control Authority of any change.

4. A sketch of the plant building(s) must be made, including a diagram of process and chemical storage areas. Location of any pretreatment equipment should be indicated and floor drains located near process and storage areas should be noted. Manhole and sewer locations at the industry's point of discharge into the municipal collection system should be included on the plant layout sketch.

5. There must be separation of spent concentrates from the sanitary sewer to prevent toxic wastes from upsetting the municipal biological treatment plant. Supervision and operation of the pretreatment equipment for spent concentrates as well as all toxic wastes and high strength organic wastes to an acceptable level as detailed in the POTW's Wastewater Control Ordinances is the responsibility of the industrial representative. All sludges generated by such treatment must be handled in an acceptable manner, such as in designated areas of a sanitary landfill or by a licensed waste hauler. Adequate segregation of those waters and wastes to be pretreated to meet discharge limits is a vital portion of the industrial effort to prevent operational problems at the wastewater treatment plant.

6. Throughout the industry adequate secondary containment or curbing must be provided to protect all floor drains from accidental spills and discharges to the receiving sewers. Such curbing should be sufficient to hold 150% of the total process area tank volume unless a lesser volume can be shown to provide adequate containment. All floor drains found within the containment area must be plugged and sealed. Spill troughs or sumps within process areas must discharge to appropriate pretreatment tanks. Secondary containment should be provided for storage tanks which may be serviced by commercial haulers and for chemical storage areas.

7. An adequate sampling vault or manhole must be provided in an accessible place for municipal treatment plant personnel to obtain samples and flow measurement data. The complexity of the vault will vary with the sampling requirements the Control Authority determines necessary to protect the treatment plant and the receiving stream. Should the Control Authority desire continual flow recording and long duration, 24 hour composite sampling, then a more complex manhole would be mandatory, complete with 110 volt AC. Samples collected could be divided between the industry and Control Authority for analysis if so desired by the industry. The sampling vault should be located so as to give access by Control

Authority personnel without entering the industrial property. The industry shall bear all costs of sampling vault and equipment needed.

8. Industries in need of outside consulting services for sampling/ analysis can contact the Control Authority for information on possible sources of assistance.

WASTEWATER DISCHARGE PERMIT APPLICATION FORM
Note: Please read all attached instructions prior to completing this application.

SECTION A - GENERAL INFORMATION

1. Facility Name: _____

   a. Operator Name:_____

   b. Is the operator identified in 1.a., the owner of the facility?
      - Yes
      - No

      If no, provide the name and address of the operator and submit a copy of the contract and/or other documents indicating the operator's scope of responsibility for the facility.
      _____
      _____

2. Facility Address:
   Street: _____
   City: _____ State: _____ Zip: _____

3. Business Mailing Address:
   Street or P.O. Box: _____
   City:_____ State: _____ Zip: _____

4. Designated signatory authority of the facility:
   [Attach similar information for each authorized representative]
   Name: _____
   Title: _____
   Street: _____
   City: _____ State:_____ Zip: _____
   Phone # _____

5. Designated facility contact:
   Name: _____
   Title: _____
   Phone #: _____

SECTION B - BUSINESS ACTIVITY

1. If your facility employs or will be employing processes in any of the industrial categories or business activities listed below (regardless of whether they generate wastewater, waste sludge, or hazardous wastes), place a check beside the category of business activity (check all that apply).

Industrial Categories

- ❑ Aluminum forming
- ❑ Asbestos Manufacturing
- ❑ Battery Manufacturing
- ❑ Can Making
- ❑ Carbon Black
- ❑ Coal Mining
- ❑ Coil Coating
- ❑ Copper Forming
- ❑ Electric and Electronic Components Manufacturing
- ❑ Electroplating
- ❑ Feedlots
- ❑ Fertilizer Manufacturing
- ❑ Foundries (Metal Molding and Casting)
- ❑ Glass Manufacturing
- ❑ Grain Mills
- ❑ Inorganic Chemicals
- ❑ Iron and Steel
- ❑ Leather Tanning and Finishing
- ❑ Metal Finishing
- ❑ Nonferrous Metals Forming
- ❑ Nonferrous Metals Manufacturing
- ❑ Organic Chemicals Manufacturing
- ❑ Paint and Ink Formulating
- ❑ Paving and Roofing Manufacturing
- ❑ Pesticides Manufacturing
- ❑ Petroleum Refining
- ❑ Pharmaceutical
- ❑ Plastic and Synthetic Materials Manufacturing
- ❑ Plastics Processing Manufacturing
- ❑ Porcelain Enamel
- ❑ Pulp, Paper, and Fiberboard Manufacturing
- ❑ Rubber
- ❑ Soap and Detergent Manufacturing
- ❑ Steam Electric
- ❑ Sugar Processing
- ❑ Textile Mills
- ❑ Timber Products

A facility with processes inclusive in these business areas may be covered by Environmental Protection Agency's (EPA) categorical pretreatment standards. These facilities are termed "categorical users".

2. Give a brief descriptions of all operations at this facility including primary products or services (attach additional sheets if necessary):

_____
_____
_____
_____
_____
_____
_____
_____

3. Indicate applicable Standard Industrial Classification (SIC) for all processes (If more than one applies, list in descending order of importance.):

a. _____
b. _____
c. _____
d. _____
e. _____

4. PRODUCT VOLUME:

PRODUCT (Brandname)	PAST CALANDER YEAR Amounts Per Day (Daily Units)		ESTIMATE THIS CALENDAR Amounts Per Day (Daily Units)	
	Average	Maximum	Average	Maximum
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____
_____	_____	_____	_____	_____

SECTION C - WATER SUPPLY

1. Water Sources: (check as many as are applicable)

- ❑ Private Well
- ❑ Surface Water
- ❑ Municipal Water Utility (Specify): _____
- ❑ Other (Specify): _____

2. Name on the water bill:

Name: _____

Street: _____

City: _____ State: _____ Zip: _____

3. Water service account number: _____

4. List average water usage on premises:
[New facilities may estimate]

Type	Average Water Usage (GPD)	Indicate Estimated (E) or Measured (M)
a. Contact cooling water	_____	Measured
b. Non-contact cooling water	_____	Measured
c. Boiler feed	_____	Measured
d. Process	_____	Measured
e. Sanitary	_____	Measured
f. Air pollution control	_____	Measured
g. Contained in product	_____	Measured
h. Plant and Equipment washdown	_____	Measured
i. Irrigation and lawn watering	_____	Measured
j. Other	_____	Measured
k. TOTAL OF A – J	_____	Measured

SECTION D - SEWER INFORMATION

1. a. For an existing business:

Is the building presently connected to the public sanitary sewer system?

- ○ Yes: Sanitary sewer account number _____
- ○ No: Have you applied for a sanitary sewer hookup?
  - ○ Yes
  - ○ No

b. For a new business:

(i) Will you be occupying an existing vacant building (such as in an industrial park)?
- ○ Yes
- ○ No

(ii) Have you applied for a building permit if a new facility will be constructed?
- ○ Yes
- ○ No

(iii) Will you be connected to the public sanitary sewer system?
- ○ Yes
- ○ No

2. List size, descriptive location, and flow of each facility sewer which connects to the POTW's sewer system. (If more than three, attach additional information on another sheet.)

Sewer Size	Descriptive Location of Sewer Connection or Discharge Point	Average Flow (GPD)
_____	_____	_____
	_____	
_____	_____	_____
	_____	
_____	_____	_____

SECTION E - WASTEWATER DISCHARGE INFORMATION

1. Does (or will) this facility discharge any wastewater other than from restrooms to the City sewer?

   ○ Yes — If the answer to this question is "yes", complete the remainder of the application.
   ○ No — If the answer to this question is "no", skip to Section I.

2. Provide the following information on wastewater flow rate.
   [New facilities may estimate]

   a. Hours/Day Discharged (eg., 8 hours/day):

Mon _____ Tue _____ Wed _____ Thu _____ Fri _____ Sat _____ Sun _____

   b. Hours of Discharge (eg., 9 am to 5 pm)

Mon _____ Tue _____ Wed _____ Thu _____ Fri _____ Sat _____ Sun _____

   c. Peak hourly flow rate (GPH) _____

   d. Maximum daily flow rate (GPD) _____

   e. Annual daily average (GPD) _____

3. If batch discharge occurs or will occur, indicate:
   [New facilities may estimate]

   a. Number of batch discharges _____ per day

   b. Average discharge per batch _____ (GPD)

   c. Time of batch discharges _____at _____
   (days of week) (hours of day)

   d. Flow rate _____ gallons/minute

   e. Percent of total discharge _____

4. Schematic Flow Diagram- For each major activity in which wastewater is or will be generated, draw a diagram of the flow of materials, products, water, and wastewater from the start of the activity to its completion, showing all unit processes. Indicate which processes use water and which generate wastestreams. Include the average daily volume and maximum daily volume of each wastestream (new facilities may estimate). If estimates are used for low data this must be indicated. Number each unit process having wastewater discharges to the community sewer. Use these numbers when showing this unit process in the building layout in Section H. It is strongly recommended this drawing be certified by a State Registered Professional Engineer.

Facilities that checked activities in question 1 of Section B are considered Categorical Industrial Users and should skip to question 6.

5. For Non-Categorical Users Only: List average wastewater discharge, maximum discharge, and type of discharge (batch, continuous, or both), for each plant process. Include the reference number from the process schematic that corresponds to each process. [New facilities should provide estimates for each discharge].

No.	Process Description	Average Flow (GPD)	Maximum Flow (GPD)	Type of Discharge (batch, continuous none)
___	_____	_____	_____	_____
___	_____	_____	_____	_____
___	_____	_____	_____	_____
___	_____	_____	_____	_____
___	_____	_____	_____	_____

ANSWER QUESTIONS 6 & 7 ONLY IF YOU ARE SUBJECT TO CATEGORICAL PRETREATMENT STANDARDS

6. For Categorical Users: Provide the wastewater discharge flows for each of your processes or proposed processes. Include the reference number from the process schematic that corresponds to each process. [new facilities should provide estimates for each discharge].

No.	Regulated Description	Average Flow (GPD)	Maximum Flow (GPD)	Type of Discharge (batch, continuous none)
___	_____	_____	_____	_____
___	_____	_____	_____	_____
___	_____	_____	_____	_____
___	_____	_____	_____	_____
___	_____	_____	_____	_____

No.	Regulated Description	Average Flow (GPD)	Maximum Flow (GPD)	Type of Discharge (batch, continuous none)
___	_____	_____	_____	_____
___	_____	_____	_____	_____
___	_____	_____	_____	_____
___	_____	_____	_____	_____
___	_____	_____	_____	_____

No.	Dilution	Average Flow (GPD)	Maximum Flow (GPD)	Type of Discharge (batch, continuous none)
___	_____	_____	_____	_____
___	_____	_____	_____	_____
___	_____	_____	_____	_____
___	_____	_____	_____	_____
___	_____	_____	_____	_____

7. For Categorical Users Subject To Total Toxic Organic (TTO) Requirements:

Provide the following (TTO) information.

a. Does (or will) this facility use any of the toxic organics that are listed under the TTO standard of the applicable categorical pretreatment standard published by the EPA?
   - ☐ Yes
   - ☐ No

b. Has a baseline monitoring report (BMR) been submitted which contains TTO information?
   - ☐ Yes
   - ☐ No

c. Has a toxic organics management plan (TOMP) been developed?
   - ☐ Yes
   - ☐ No

8. Do you have, or plan to have, automatic sampling equipment or continuous wastewater flow metering equipment at this facility?

Current:	Flow Metering	☐ Yes	☐ No	☐ N/A
	Sampling Equipment	☐ Yes	☐ No	☐ N/A
Planned:	Flow Metering	☐ Yes	☐ No	☐ N/A
	Sampling Equipment	☐ Yes	☐ No	☐ N/A

If so, please indicate the present or future location of this equipment on the sewer schematic and describe the equipment below:

_____

_____

_____

_____

_____

9. Are any process changes or expansions planned during the next three years that could alter wastewater volumes or characteristics? Consider production processes as well as air or water pollution treatment processes that may affect the discharge.
   - ☐ Yes
   - ☐ No, (skip question 10)

10. Briefly describe these changes and their effects on the wastewater volume and characteristics: (Attach additional sheets if needed.)

_____

_____

_____

_____

11. Are any materials or water reclamation systems in use or planned?

- ○ Yes
- ○ No, (skip question 12)

12. Briefly describe recovery process, substance recovered, percent recovered, and the concentration in the spent solution. Submit a flow diagram for each process: (Attach additional sheets if needed.)

_____

_____

_____

_____

_____

_____

SECTION F - CHARACTERISTICS OF DISCHARGE

All **current industrial users** are required to submit monitoring data on all pollutants that are regulated specific to each process. Use the tables provided in this section to report the analytical results. **DO NOT LEAVE BLANKS.** For all other (non-regulated) pollutants, indicate whether the pollutant is known to be present (P), suspected to be present (S), or known not to be present (O), by placing the appropriate letter in the column for average reported values. Indicate on either the top of each table, or on a separate sheet, if necessary, the sample location and type of analysis used. Be sure methods conform to 40 CFR Part 136; if they do not, indicate what method was used.

New dischargers should use the table to indicate what pollutants will be present or are suspected to be present in proposed wastestreams by placing a P (expected to be present), S (may be present), or O (will not be present) instead of the average reported values.

Pollutant	Detection Level Used	Maximum Daily Value		Average of Analyses		Number of Analyses	Units	
		Conc.	Mass	Conc.	Mass		Conc.	Mass
Acenaphthene								
Acrolein								
Acrylonitrile								
Benzene								
Benzidine								
Carbon Tetrachloride								
Chlorobenzene								
Hexachlorobenzene								
1,24-Trichlorobenzene								
1,1,1-Trichloroethane								
Hexachloroethane								
1,1-Dichloroethane								
1,1,2-Trichloroethane								
1,1,2,2-Tetrachloroethane								
Chloroethane								
Bis(2-chloroethyl) ether								
17 Bis (chloro methyl) ether								
2-Chloroethyl vinyl ether								
2-Chloronaphthalene								
2,4,6-Trichlorophenol								
Parachlorometa cresol								
Chloroform								
2-Chlorophenol								
1,2-Dichlorobenzene								
1,3-Dichlorobenzene								
1,4-Dichlorobenzene								
3,3-Dichlorobenzidine								
1,1-Dichloroethylene								
1,2-Trans-dichloroethylene								

Pollutant	Detection Level Used	Maximum Daily Value		Average of Analyses		Number of Analyses	Units	
		Conc.	Mass	Conc.	Mass		Conc.	Mass
2,4-Dichloropheno	_____	_____	_____	_____	_____	_____	_____	_____
1,2-Dichloropropane	_____	_____	_____	_____	_____	_____	_____	_____
1,2-Dichloropropylene	_____	_____	_____	_____	_____	_____	_____	_____
1,3-Dichloropropylene	_____	_____	_____	_____	_____	_____	_____	_____
2,4-Dimethylphenol	_____	_____	_____	_____	_____	_____	_____	_____
2,4-Dinitrotoluene	_____	_____	_____	_____	_____	_____	_____	_____
2,6-Dinitrotoluene	_____	_____	_____	_____	_____	_____	_____	_____
1,2-Diphenylhydrazine	_____	_____	_____	_____	_____	_____	_____	_____
Ethylbenzene	_____	_____	_____	_____	_____	_____	_____	_____
Fluoranthene	_____	_____	_____	_____	_____	_____	_____	_____
4-Chlorophenyl phenyl ether	_____	_____	_____	_____	_____	_____	_____	_____
4-Bromophenyl phenyl ether	_____	_____	_____	_____	_____	_____	_____	_____
Bis(2-chlorisopropyl) ether	_____	_____	_____	_____	_____	_____	_____	_____
Bis(2-chloroethoxy) methane	_____	_____	_____	_____	_____	_____	_____	_____
Methylene chloride	_____	_____	_____	_____	_____	_____	_____	_____
Methyl chloride	_____	_____	_____	_____	_____	_____	_____	_____
Methyl bromide	_____	_____	_____	_____	_____	_____	_____	_____
Bromoform	_____	_____	_____	_____	_____	_____	_____	_____
Dichlorobromomethane	_____	_____	_____	_____	_____	_____	_____	_____
Chlorodibromomethane	_____	_____	_____	_____	_____	_____	_____	_____
Hexachlorobutadiene	_____	_____	_____	_____	_____	_____	_____	_____
Hexachlorocyclopentadiene	_____	_____	_____	_____	_____	_____	_____	_____
Isophorone	_____	_____	_____	_____	_____	_____	_____	_____
Naphthalene	_____	_____	_____	_____	_____	_____	_____	_____
Nitrobenzene	_____	_____	_____	_____	_____	_____	_____	_____
Nitrophenol	_____	_____	_____	_____	_____	_____	_____	_____
2-Nitrophenol	_____	_____	_____	_____	_____	_____	_____	_____
4-Nitrophenol	_____	_____	_____	_____	_____	_____	_____	_____
2,4-Dinitrophenol	_____	_____	_____	_____	_____	_____	_____	_____
4,6-Dinitro-o-cresol	_____	_____	_____	_____	_____	_____	_____	_____

Pollutant	Detection Level Used	Maximum Daily Value		Average of Analyses		Number of Analyses	Units	
		Conc.	Mass	Conc.	Mass		Conc.	Mass
N-nitrosodimethylamine	_____	_____	_____	_____	_____	_____	_____	_____
N-nitrosodiphenylamine	_____	_____	_____	_____	_____	_____	_____	_____
N-nitrosodi-n-propylamine	_____	_____	_____	_____	_____	_____	_____	_____
Pentachlorophenol	_____	_____	_____	_____	_____	_____	_____	_____
Phenol	_____	_____	_____	_____	_____	_____	_____	_____
Bis(2-ethylhexyl) phthalate	_____	_____	_____	_____	_____	_____	_____	_____
Butyl benzyl phthalate	_____	_____	_____	_____	_____	_____	_____	_____
Di-n-butyl phthalate	_____	_____	_____	_____	_____	_____	_____	_____
di-n-octyl phthalate	_____	_____	_____	_____	_____	_____	_____	_____
Diethyl phthalate	_____	_____	_____	_____	_____	_____	_____	_____
Dimethyl phthalate	_____	_____	_____	_____	_____	_____	_____	_____
Benzo(a)anthracene	_____	_____	_____	_____	_____	_____	_____	_____
Benzo(a)pyrene	_____	_____	_____	_____	_____	_____	_____	_____
3,4-benzofluoranthane	_____	_____	_____	_____	_____	_____	_____	_____
Benzo(k) fluoranthane	_____	_____	_____	_____	_____	_____	_____	_____
Chrysene	_____	_____	_____	_____	_____	_____	_____	_____
Acenaphthylene	_____	_____	_____	_____	_____	_____	_____	_____
Anthracene	_____	_____	_____	_____	_____	_____	_____	_____
Benzo(ghi)perylene	_____	_____	_____	_____	_____	_____	_____	_____
Fluorene	_____	_____	_____	_____	_____	_____	_____	_____
Phenanthrene	_____	_____	_____	_____	_____	_____	_____	_____
Dibenzo(a,h)anthracene	_____	_____	_____	_____	_____	_____	_____	_____
Indeno(1,2,3-cd)pyrene	_____	_____	_____	_____	_____	_____	_____	_____
Pyrene	_____	_____	_____	_____	_____	_____	_____	_____
Tetrachloroethylene	_____	_____	_____	_____	_____	_____	_____	_____
Toluene	_____	_____	_____	_____	_____	_____	_____	_____
Trichloroethylene	_____	_____	_____	_____	_____	_____	_____	_____
Vinyl chloride	_____	_____	_____	_____	_____	_____	_____	_____
Aldrin	_____	_____	_____	_____	_____	_____	_____	_____
Dieldrin	_____	_____	_____	_____	_____	_____	_____	_____

Pollutant	Detection Level Used	Maximum Daily Value		Average of Analyses		Number of Analyses	Units	
		Conc.	Mass	Conc.	Mass		Conc.	Mass
Chlordane	_____	_____	_____	_____	_____	_____	_____	_____
4,4'-DDT	_____	_____	_____	_____	_____	_____	_____	_____
4,4'-DDE	_____	_____	_____	_____	_____	_____	_____	_____
4,4'-DDD	_____	_____	_____	_____	_____	_____	_____	_____
Alpha-endosulfan	_____	_____	_____	_____	_____	_____	_____	_____
Beta-endosulfan	_____	_____	_____	_____	_____	_____	_____	_____
Endosulfan sulfate	_____	_____	_____	_____	_____	_____	_____	_____
Endrin	_____	_____	_____	_____	_____	_____	_____	_____
Endrin aldehyde	_____	_____	_____	_____	_____	_____	_____	_____
Heptachlor	_____	_____	_____	_____	_____	_____	_____	_____
Heptachlor epoxide	_____	_____	_____	_____	_____	_____	_____	_____
Alpha-BHC	_____	_____	_____	_____	_____	_____	_____	_____
Beta-BHC	_____	_____	_____	_____	_____	_____	_____	_____
Gamma-BHC	_____	_____	_____	_____	_____	_____	_____	_____
Delta-BHC	_____	_____	_____	_____	_____	_____	_____	_____
PCB-1242	_____	_____	_____	_____	_____	_____	_____	_____
PCB-1254	_____	_____	_____	_____	_____	_____	_____	_____
PCB-1221	_____	_____	_____	_____	_____	_____	_____	_____
PCB-1232	_____	_____	_____	_____	_____	_____	_____	_____
PCB-1248	_____	_____	_____	_____	_____	_____	_____	_____
PCB-1260	_____	_____	_____	_____	_____	_____	_____	_____
PCB-1016	_____	_____	_____	_____	_____	_____	_____	_____
Toxaphene	_____	_____	_____	_____	_____	_____	_____	_____
(TCDD)	_____	_____	_____	_____	_____	_____	_____	_____
Asbestos	_____	_____	_____	_____	_____	_____	_____	_____
Acidity	_____	_____	_____	_____	_____	_____	_____	_____
Alkalinity	_____	_____	_____	_____	_____	_____	_____	_____
Bacteria	_____	_____	_____	_____	_____	_____	_____	_____
BOD5	_____	_____	_____	_____	_____	_____	_____	_____

Pollutant	Detection Level Used	Maximum Daily Value		Average of Analyses		Number of Analyses	Units	
		Conc.	Mass	Conc.	Mass		Conc.	Mass
COD	_____	_____	_____	_____	_____	_____	_____	_____
Chloride	_____	_____	_____	_____	_____	_____	_____	_____
Chlorine	_____	_____	_____	_____	_____	_____	_____	_____
Fluoride	_____	_____	_____	_____	_____	_____	_____	_____
Hardness	_____	_____	_____	_____	_____	_____	_____	_____
Magnesium	_____	_____	_____	_____	_____	_____	_____	_____
NH3-N	_____	_____	_____	_____	_____	_____	_____	_____
Oil and Grease	_____	_____	_____	_____	_____	_____	_____	_____
TSS	_____	_____	_____	_____	_____	_____	_____	_____
TOC	_____	_____	_____	_____	_____	_____	_____	_____
Kjeldahl N	_____	_____	_____	_____	_____	_____	_____	_____
Nitrate N	_____	_____	_____	_____	_____	_____	_____	_____
Nitrite N	_____	_____	_____	_____	_____	_____	_____	_____
Organic N	_____	_____	_____	_____	_____	_____	_____	_____
Orthophosphate P	_____	_____	_____	_____	_____	_____	_____	_____
Phosphorous	_____	_____	_____	_____	_____	_____	_____	_____
Sodium	_____	_____	_____	_____	_____	_____	_____	_____
Specific Conductivity	_____	_____	_____	_____	_____	_____	_____	_____
Sulfate (SO4)	_____	_____	_____	_____	_____	_____	_____	_____
Sulfide	_____	_____	_____	_____	_____	_____	_____	_____
Sulfite (SO3)	_____	_____	_____	_____	_____	_____	_____	_____
Antimony	_____	_____	_____	_____	_____	_____	_____	_____
Arsenic	_____	_____	_____	_____	_____	_____	_____	_____
Barium	_____	_____	_____	_____	_____	_____	_____	_____
Beryllium	_____	_____	_____	_____	_____	_____	_____	_____
Cadmium	_____	_____	_____	_____	_____	_____	_____	_____
Chromium	_____	_____	_____	_____	_____	_____	_____	_____
Copper	_____	_____	_____	_____	_____	_____	_____	_____
Cyanide	_____	_____	_____	_____	_____	_____	_____	_____

Pollutant	Detection Level Used	Maximum Daily Value		Average of Analyses		Number of Analyses	Units	
		Conc.	Mass	Conc.	Mass		Conc.	Mass
Lead	_____	_____	_____	_____	_____	_____	_____	_____
Mercury	_____	_____	_____	_____	_____	_____	_____	_____
Molybdenum	_____	_____	_____	_____	_____	_____	_____	_____
Nickel	_____	_____	_____	_____	_____	_____	_____	_____
Selenium	_____	_____	_____	_____	_____	_____	_____	_____
Silver	_____	_____	_____	_____	_____	_____	_____	_____
Thallium	_____	_____	_____	_____	_____	_____	_____	_____
Zinc	_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____	_____
_____	_____	_____	_____	_____	_____	_____	_____	_____

SECTION G - TREATMENT

1. Is any form of wastewater treatment (see list below) practiced at this facility?

   ○ Yes
   ○ No

2. Is any form of wastewater treatment (or changes to an existing wastewater treatment) planned for this facility within the next three years?

   ○ Yes, Describe
   _____

   ○ No

3. Treatment devices or processes used or proposed for treating wastewater or sludge (check as many as appropriate).

   ☐ Air flotation
   ☐ Centrifuge
   ☐ Chemical precipitation
   ☐ Chlorination
   ☐ Cyclone
   ☐ Filtration
   ☐ Flow equalization
   ☐ Grease or oil separation, type: _____
   ☐ Grease trap
   ☐ Grinding filter
   ☐ Grit removal
   ☐ Ion exchange
   ☐ Neutralization, pH correction
   ☐ Ozonation
   ☐ Reverse osmosis
   ☐ Screen
   ☐ Sedimentation
   ☐ Septic tank
   ☐ Solvent separation
   ☐ Spill protection
   ☐ Sump
   ☐ Biological treatment, type: _____
   ☐ Rainwater diversion or storage
   ☐ Other chemical treatment, type:_____
   ☐ Other physical treatment, type:_____
   ☐ Other, type:_____

4. Description

Describe the pollutant loadings, flow rates, design capacity, physical size, and operating procedures of each treatment facility checked above.

_____

_____

_____

5. Attach a process flow diagram for each existing treatment system. Include process equipment, by-products, by-product disposal method, waste and by-product volumes, and design and operating conditions.

6. Describe any changes in treatment or disposal methods planned or under construction for the wastewater discharge to the sanitary sewer. Please include estimated completion dates.

_____

_____

_____

_____

7. Do you have a treatment operator?

- ○ Yes
- ○ No

If yes, Name: _____

Title: _____

Phone: _____

Full time: _____ (specify hours)

Part time: _____ (specify hours)

8. Do you have a manual on the correct operation of your treatment equipment?
   - ○ Yes
   - ○ No
9. Do you have a written maintenance schedule for your treatment equipment?
   - ○ Yes
   - ○ No

SECTION H - FACILITY OPERATIONAL CHARACTERISTICS

1. Shift Information

Work Days		☐ Mon	☐ Tues.	☐ Wed	☐ Thurs	☐ Fri	☐ Sat	☐ Sun
Shifts per work day:								
Empl's per shift:	1st	_____	_____	_____	_____	_____	_____	_____
	2nd	_____	_____	_____	_____	_____	_____	_____
	3rd	_____	_____	_____	_____	_____	_____	_____
Shift start and end times:	1st	_____	_____	_____	_____	_____	_____	_____
	2nd	_____	_____	_____	_____	_____	_____	_____
	3rd	_____	_____	_____	_____	_____	_____	_____

2. Indicate whether the business activity is:

- ○ Continuous through the year, or
- ○ Seasonal - Circle the months of the year during which the business activity occurs:

☐ J ☒ F ☐ M ☐ A ☐ M ☐ J ☐ J ☐ A ☐ S ☐ O ☐ N ☐ D

COMMENTS: _____

_____

3. Indicate whether the facility discharge is:

- ○ Continuous through the year, or
- ○ Seasonal - Circle the months of the year during which the business activity occurs:

☐ J ☐ F ☐ M ☐ A ☐ M ☐ J ☐ J ☐ A ☐ S ☐ O ☐ N ☐ D

COMMENTS: _____

_____

4. Does operation shut down for vacation, maintenance, or other reasons?

   ○ Yes, indicate reasons and period when shutdown occurs:
   _____

   ○ No

5. List types and amounts (mass or volume per day) of raw materials used or planned for use (attach list if needed):

_____

_____

_____

_____

6. List types and quantity of chemicals used or planned for use (attach list if needed). Include copies of Manufacturer's Safety Data Sheets (if available) for all chemicals identified:

Chemical	Quantity

7. Building Layout - Draw to scale the location of each building on the premises. Show map orientation and location of all water meters, storm drains, numbered unit processes (from schematic flow diagram), public sewers, and each facility sewer line connected to the public sewers. Number each sewer and show existing and proposed sampling locations. It is strongly recommended this drawing be certified by a State Registered Professional Engineer.

   A blueprint or drawing of the facilities showing the above items may be attached in lieu of submitting a drawing on this sheet.

SECTION I - SPILL PREVENTION

1. Do you have chemical storage containers, bins, or ponds at your facility?
   - ○ Yes
   - ○ No

   If yes, please give a description of their location, contents, size, type, and frequency and method of cleaning. Also indicate in a diagram or comment on the proximity of these containers to a sewer or storm drain. Indicate if buried metal containers have cathodic protection.

2. Do you have floor drains in your manufacturing or chemical storage area(s)?
   - ○ Yes, Where do they discharge?
   - ○ No

3. If you have chemical storage containers, bins, or ponds in manufacturing areas, could an accidental spill lead to a discharge to: (check all that apply).

   - ☐ an onsite disposal system
   - ☐ public sanitary sewer system (e.g. through a floor drain)
   - ☐ storm drain
   - ☐ to ground
   - ☐ other, specify: _____
   - ☐ not applicable, no possible discharge to any of the above routes

4. Do you have an accidental spill prevention plan (ASPP) to prevent spills of chemicals or slug discharges from entering the Control Authority's collection systems?
   - ☐ Yes - **[Please enclose a copy with the application]**
   - ☐ No
   - ☐ Not applicable since there are no floor drains and/or the facility discharges on domestic wastes.

5. Please describe below any previous spill events and remedial measures taken to prevent their reoccurrence.

_____

_____

_____

_____

SECTION J - NON-DISCHARGED WASTES

1. Are any waste liquids or sludges generated and not disposed of in the sanitary sewer system?

   ○ Yes, please describe below
   ○ No, skip the remainder of Section J.

Waste Generated	Quantity (per year)	Disposal Method

2. Indicate which wastes identified above are disposed of at an off-site treatment facility and which are disposed of on-site.

3. If any of your wastes are sent to an off-site centralized waste treatment facility, identify the waste and the facility.

4. If an outside firm removes any of the above checked wastes, state the name(s) and address(es) of all waste haulers:

a.

_____

_____

_____

_____

Permit No.
(if applicable:
_____

b.

_____

_____

_____

_____

Permit No.
(if applicable):
_____

5. Have you been issued any Federal, State, or local environmental permits?
   ○ Yes
   ○ No

If yes, please list the permit(s):_____

_____

_____

SECTION K - AUTHORIZED SIGNATURES

Compliance certification:

1. Are all applicable Federal, State, or local pretreatment standards and requirements being met on a consistent basis?
   - ○ Yes
   - ○ No
   - ○ Not yet discharging

2. <u>If No:</u>

   a. What additional operations and maintenance procedures are being considered to bring the facility into compliance? Also, list additional treatment technology or practice being considered in order to bring the facility into compliance.

   b. Provide a schedule for bringing the facility into compliance. Specify major events planned along with reasonable completion dates. Note that if the Control Authority issues a permit to the applicant, if may establish a schedule for compliance different from the one submitted by the facility.

Milestone Activity	Completion Date

Authorized Representative Statement

I certify under penalty of law that this document and all attachments were prepared under my direction or supervision in accordance with a system designed to assure that qualified personnel properly gather and evaluate the information submitted. Based on my inquiry of the person or persons who manage the system, or those persons directly responsible for gathering the information, the information submitted is, to the best of my knowledge and belief, true, accurate, and complete. I am aware that there are significant penalties for submitting false information, including the possibility of fine and imprisonment for knowing violations.

Name	Title
Signature	Date Phone
Name	Title
Signature	Date Phone