SANILAC COUNTY LAKESHORE WATERSHED

WATERSHED MANAGEMENT PLAN

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TABLE OF CONTENTS

EXECUTIVE SUMMARY 1

CHAPTER 1 - DESCRIPTION OF WATERSHED 5
1.0 Overview 5
1.1 Location and Size 5
1.2 Topography 6
1.3 Soils 6
1.3.1 Hydrologic Soil Groups 7
1.3.2 Prime Farmland Soils 8
1.3.3 Suitability for Septic Systems 8
1.4 Hydrology 9
1.4.1 Surface Water 9
1.4.2 Groundwater 10
1.4.3 Wetlands 11
1.5 County Drains and Road Ditches 11
1.6 Climate 12
1.7 Natural Resources 12
1.7.1 Vegetation 12
1.7.2 Michigan Natural Features Inventory 13
1.7.3 Water Resources 14
1.7.4 Beaches 14
1.8 Land Use 15
1.8.1 Agriculture 15
1.8.2 Residential 15
1.8.3 Commercial 16
1.8.4 Wildlife Habitat 16
1.8.5 Land Use Trends 16

CHAPTER 2 - POLITICAL LANDSCAPE 18
2.0 Demographics 18
2.1 Community Profiles 20
2.1.1 Phase II Communities 20
2.1.2 Employment 22
2.2 Schools 23
2.3 Officials 24

CHAPTER 3 - WATER QUALITY 26
3.0 Water Quality Studies 26
3.1 Point Source Pollution 32
3.2 Nonpoint Source Pollution Inventory 32
3.3 Designated Uses 37
3.4 Desired Uses 44
3.5 Impairments to Designated and Desired Uses 45
3.6 Goals and Objectives 48
3.7 Water Quality Summary 51

CHAPTER 4 - IMPLEMENTATION STRATEGY 60
4.1 Critical Areas 60
4.2 Description of Critical Areas 60
4.2.1 Agricultural *E. coli* Critical Areas 60
4.2.2 Residential *E. coli* Critical Areas 61
4.2.3 Critical Agricultural Headwaters 61
4.2.4 Coastal Zone/Development Critical Areas 62
4.2.5 Preservation Critical Areas 62
4.3 Best Management Practice Recommendations 62

TABLE OF CONTENTS

4.3.1 Best Management Practices for Agricultural *E. coli* Areas 69
4.3.2 Best Management Practices for Residential *E. coli* Areas 72
4.3.3 Best Management Practices for Critical Agricultural Headwaters 74
4.3.4 Best Management Practices for Coastal Zone / Development Critical Areas 79
4.3.5 Best Management Practices for Preservation Areas 80
4.4 Implementing Best Management Practices 81

CHAPTER 5 - information and education strategy 92
5.0 Introduction 92
5.1 Public Participation Process 92
5.2 Goal of the Information and Education Strategy 93
5.3 Watershed Logo 94
5.4 Information and Education Action Plan 94
5.4.1 Information and Education Delivery Methods 95
5.4.2 Develop Partnerships 95
5.4.3 Identify Target Audiences 96
5.4.4 Develop Messages 97
5.5 Schedule and costs 98

CHAPTER 6 - EVALUATION METHODS 113
6.1 Project Evaluation Criteria 113
6.2 Paired Watershed Study 116

CHAPTER 7 - SUSTAINABILITY 118
7.1 Long Term Planning 118
7.2 Existing Management Strategies 119
7.3 Watershed organization 120
7.3.1 Agriculture Committee 120
7.3.2 Urban Committee 121
7.3.3 Information and Education Committee 122
7.3.4 Sustainability and Funding Committee 122
7.4 Watershed technician 123
7.5 Ongoing Programs and Opportunities 124
7.6 Resource Library 128

LIST OF TABLES

Chapter 1

Table 1.0 Michigan Natural Features Inventory 13

Chapter 2

Table 2.0 Population Trends 19
Table 2.1 Housing Trends 21
Table 2.2 Employment by Industry 22
Table 2.3 Principal Employers in Sanilac County 23
Table 2.4 School Districts in the Eastern Sanilac Coastal Tributary Watersheds 24
Table 2.5 Representatives and Officials for the Eastern Sanilac Coastal Tributary Watersheds 24

TABLE OF CONTENTS

Chapter 3

Table 3.0 Summary of Michigan Department of Environmental Quality Biological Surveys....27
Table 3.1 Lake Huron Use Impairments....30
Table 3.2 Designated Uses and Impairments....41
Table 3.3 Desired Uses....44
Table 3.4 Water Quality Goals and Objectives....49

Chapter 4

Table 4.0 Recommended Systems of Best Management Practices....64
Table 4.1 Best Management Practice Implementation Guidelines....66
Table 4.2 Best Management Practice Schedules and Costs....83
Table 4.3 Best Management Practice Milestones and Costs....88

Chapter 5

Table 5.0 Potential Partners for Information and Education....96
Table 5.1 Target Audience Prioritization....97
Table 5.2 Cost Estimates....98
Table 5.3a and 5.3b Pollutant *E. coli*....100
Table 5.4a and 5.4b Pollutant Sediment....103
Table 5.5a and 5.5b Pollutant Nutrients....106
Table 5.6a and 5.6b Pollutant Pesticides/Herbicides....110

Chapter 6

Table 6.0 Summary of Evaluation Techniques....115

Chapter 7

Table 7.0 Watershed Technician Tasks....122

LIST OF FIGURES

Figure 1 Location Map
Figure 2 Base Map
Figure 3 Topography
Figure 4 Erodibility Class
Figure 5 Hydrologic Soils
Figure 6 Prime Farmland
Figure 7 Wetlands
Figure 8 Presettlement Vegetation
Figure 9 Land Use/Land Cover
Figure 10 Nonpoint Source Sites
Figure 11 Critical Areas
Figure 12 Watershed Logo

TABLE OF CONTENTS

LIST OF APPENDICES

Appendix 1	Soil Properties
Appendix 2	High Risk Erosion Areas
Appendix 3	Worth Township Sanitary Survey
Appendix 4	National Pollutant Discharge Elimination System Permitted Discharges
Appendix 5	Nonpoint Source Pollution Sites
Appendix 6	Policy Review Document Summary
Appendix 7	USGS Domestic Geographic Name Report
Appendix 8	Sanilac County Planning Commission Goals and Objectives

EXECUTIVE SUMMARY

The Sanilac County Lakeshore Watershed Management Plan (WMP) is the result of a nonpoint source (NPS) pollution grant under the U.S. Environmental Protection Agency's (EPA) Clean Water Act Section 319 initiative, in coordination with the Michigan Department of Environmental Quality (MDEQ). The Sanilac County Lakeshore Watershed (Watershed) exhibits water quality, human health, and soil erosion issues that are unique to the Michigan "thumb" area. The primary goal of this WMP is to restore designated uses of the Watershed's resources by improving cooperation between watershed residents and local and state agencies, and to implement practices that will reduce NPS pollution.

The Watershed contains a series of small streams located along 42 miles of Lake Huron shoreline on the eastern boundary of Sanilac County. There are over 101 tributaries in the Watershed that feed directly into Lake Huron. These smaller tributary watersheds are part of the larger Birch Willow Watershed (HUC 04080104) and total approximately 148,186 acres. Land use in Sanilac County is approximately 79% agricultural, 6% urban and built-up, 10% forest and wetlands, and 5% open and fallow land. However, the proportion of urban and built-up areas is concentrated in the coastal area. Urban areas of the Watershed include the Village of Forestville, Village of Port Sanilac, Village of Lexington, and the lakeshore of Worth and Lexington Townships.

Recent MDEQ sanitary surveys and beach water quality monitoring has left watershed residents concerned about the health of the Watershed and recreational safety of Lake Huron and its tributaries. A comprehensive inventory of the Watershed concluded that *E. coli*, sediment, and nutrients were the highest priority pollutants that were impairing the designated uses of partial and total body contact recreation and public water supplies. The primary sources of *E. coli* were failing septic systems in dense residential coastal areas, inadequate manure storage, inappropriate fertilizer application in riparian areas, and unrestricted livestock access. Sediment and nutrients result from streambank erosion due to flashy hydrology and farming practices that allow tillage directly through the shallow headwater streams. High velocity, flashy flows have created severe incision erosion at the mouth of the tributaries. While most drains and streams are ephemeral, the streams with established base flow, such as Mill Creek, Indian Creek, and Elk Creek have suitable habitat for a warmwater fishery, but are often nutrient and pathogens enriched and clogged with sediment.

Sanilac County experienced a growth rate of 7.63% from 1990 to 1998, with an even greater increase in the number of new homes built. Summer cottages are now becoming full-time residences, overtaxing the original small septic systems in poor soil conditions. Pathogen contamination including toxic and infectious agents found in sewage has been documented on many properties in the coastal region. Many residents cannot afford to properly maintain their septic tanks. Swimming beaches and shoreline

campgrounds have had health advisories in the past. Beach closings are a concern for permanent and part time residents, as well as businesses that rely on tourism. The marinas in Port Sanilac and Lexington depend on clean, clear, and accessible water resources to maintain economic viability.

The Sanilac County area is steeped in agrarian tradition and this WMP supports the preservation of the existing rural character, promotes agricultural sustainability, and recommends methods to enhance water quality. The land areas that are suspected to be the most significant sources of pollution were identified as critical areas. Critical areas will receive the most attention for implementing the recommended Best Management Practices (BMPs). Recommended BMPs include structural, vegetative, policy, and management changes that can have beneficial impacts on water quality. The results of the investigation completed for the plan led to the following general recommendations about agricultural practices, land use policies, and public outreach and education:

Recommendations for Agricultural Practices

- Apply for Section 319 grant funding to implement a cost share and incentive program for cattle exclusion, Comprehensive Nutrient Management Plan design and implementation, establishing permanent vegetative cover, cover crops, and conservation tillage. This cost share program would reduce *E. coli,* sediment, and nutrient contamination from agricultural sources. This program would be managed by a partnership with the Sanilac Conservation District and the Natural Resource Conservation Service.

- Enhance existing Conservation Reserve Program (CRP) incentives with competitive rental rates, sign-up bonuses, and allowing controlled manure spreading on CRP lands. Enhanced rental payments would be available to landowners located in the critical agricultural headwaters area.

- Create a Conservation Farmers' Alliance to promote WMP recommendations. The Farmers' Alliance would be a subgroup of a larger organization that would continue implementation of the WMP recommendations. The larger organization would be housed at the Sanilac Conservation District office and would serve as an umbrella to four subgroups: Farmers' Alliance, urban communities, information and education, and watershed sustainability and funding.

Recommendations for Land Use Policies

- Create a series of workshops hosted by the Sanilac Conservation District and the Sanilac County Planning Commission to continue the momentum of this project and to facilitate communication between local planning officials about regional planning for coastal areas.

- Adopt ordinances for low impact development, riparian buffers, set backs for structures and septic drain fields from wells and surface water, cluster development, open space preservation, and impervious surface reduction. Model ordinance language will be supplied in a Policy Review Document. Model ordinances can be revised and adopted by the lakeshore communities during the land use policy workshops.

- Investigate possible framework for a county wide septic system inspection and maintenance service program. Additional funding for the Sanilac County Health Department is needed to enforce existing septic system construction and design policies.

- Communities served by public water utilities should consider sewer utilities to prevent failure of septic systems. The most critical areas are along the lakeshore where housing density is the greatest and septic systems are not adequate for year round family residences.

- Develop a close relationship between a land conservancy and the Sanilac County Planning Commission to begin to prioritize areas for forest and open space preservation.

- Strengthen enforcement of existing policies and permit programs in local ordinances and state regulations, for example, the Wetland Protection Act and National Pollutant Discharge Elimination System Soil Erosion and Sedimentation Control.

Recommendations for Public Outreach and Education

- Increase awareness of water quality issues through workshops and public presentations conducted by the Sanilac Conservation District. Section 319 funding is needed to hold the current Watershed technician position during the implementation of this WMP.

- Provide opportunities for stewardship by implementing a name-a-stream, adopt-a-stream, volunteer monitoring, and stream clean-up programs. The implementation of these programs would result from a partnership between the Michigan State University Extension and the Sanilac Conservation District.

- Integrate WMP recommendations into Farm*A*Syst, Lake*A*Syst, and Home*A*Syst programs.

- Increase awareness of watershed issues by increasing the Sanilac Conservation District's presence at public meetings, at fairs, in printed media, on local radio and television, and outreach programs. Use of a watershed logo would give brand identification to the watershed project and build trust that this program does not constitute regulatory action.

The above recommendations will work toward meeting the goals of the WMP, which are to restore the designated uses of the partial and total body contact recreation and public water supply. The project will institutionalize change, while preserving the local character and providing long-term sustainability, by creating an atmosphere of cooperation between landowners, agencies, and organizations within the Watershed. Sustainability of the goals of the Watershed project depends on the coordination of the numerous programs and efforts of other groups and organizations associated with the Watershed. Creating a watershed organization to collaborate with concurrent projects will greatly increase the chance of success of the WMP implementation.

CHAPTER 1 - DESCRIPTION OF WATERSHED

1.0 OVERVIEW

Sanilac County was settled in the 1830s by Irish pioneers who were interested in farming rather than the area's abundant timber resources. Forests along Lake Huron's shores were so dense that settlers found passage extremely difficult. An early pioneer account states that travelers leaving Fort Gratiot for Port Sanilac would remake their packs and carry only the absolute essentials for the balance of the trip, a distance of 24 miles (USGenNet). Speculators soon discovered the area's potential for lumber and farming; logging and agricultural operations soon followed. Sanilac County's population expanded rapidly with the promise of jobs in the mills and shipyards developing along the lakeshore.

A series of tragedies changed the course of development in Sanilac County. Storms and ice destroyed the docks at Port Sanilac. Forest fires, fueled by brush left from clear cutting, consumed what trees remained in the 1880s. Settlers that survived the fires and remained in the area turned to farming for subsistence. Soil drainage and fertilizer application are some of the modern farming practices that make soils in Sanilac County so productive. Today agriculture is the dominant land use in the Sanilac County Lakeshore Watershed (Watershed).

Sediment, nutrients, and bacteria are degrading many of the tributaries that flow into Lake Huron. As a result, beach closings and a loss of aesthetic qualities has impacted tourism and land values along the lakeshore. Agricultural operations, steep streambank escarpments, failing septic systems, and impacts of increased development are contributing pollutants to surface waters. The goal of this project is to develop a Watershed Management Plan (WMP) that will improve water quality while preserving rural character of the area, maintaining sustainable agricultural and economic growth, and increasing the potential for tourism and recreational industries.

1.1 LOCATION AND SIZE

The Watershed encompass 114,560 acres of the larger Birch-Willow Watershed (Figure 1 and Figure 2). The Watershed contains a series of small ephemeral and intermittent streams located along 42 miles of Lake Huron shoreline on the eastern side of the Lower Peninsula's "thumb region." Included in the system are the entire eastern shoreline of Sanilac County, small portions of southern Huron and northern St. Clair Counties, and all or part of 13 townships and 5 municipalities.

1.2 TOPOGRAPHY

Glacial processes shaped the Watershed during the Wisconsinan Era. The western watershed boundary, known as the Port Huron Moraine, is a mound of unconsolidated sand and gravel formed about 13,000 years ago as the glacier receded (Farrand, 1998). The moraine rises 80 feet above the old lake plain to the west and reaches a maximum elevation about 850 feet above sea level, about 270 feet above the present level of Lake Huron. The moraine area is hilly to undulating with slopes typically ranging from 2% to 8%. Topography east of the Port Huron Moraine is generally flat to rolling with slopes averaging 1% to 2% (United States Department of Agriculture (USDA), 1961). Sheet flow coming from the melting glacier formed an outwash plain of sandy loam. Typical of young glacial landforms, the Watershed is characterized by unstable drainage networks. Today the drainage patterns in the Watershed generally flow from the Port Huron Moraine in the west, toward Lake Huron in the east (Figure 3).

1.3 SOILS

Soils in Sanilac County are very productive if properly managed to maintain fertility and to prevent water and wind erosion. These soils are the result of glacial processes. Variations in glacial till soils are due to differences in parent material, drainage conditions, and topography. Typically, soils east of the Port Huron Moraine are composed of mineral matter that originated from glacial outwash. Glacial outwash soils are characterized by moderate sand content in the surface horizons and clay loam subsurface layers. (USDA, 1961).

Soils in the western upper areas of the Watershed generally fall into the Guelph/London Series. Topography bordering the Port Huron Moraine is undulating and cut by many escarpments and ephemeral streams. Soils in the Guelph/London Series are well to imperfectly drained, light brown to very dark grayish brown, slightly acidic to neutral sandy loams. These soils developed from coarse clay loams and are very productive when carefully managed to prevent water erosion and to maintain organic material. These soils have high runoff potential and erodible characteristics of these soils, drainage ways should be kept in sod and under a no-till conservation practice (USDA, 1961). Moderately well drained soils in this series have a seasonally high water table at a depth of 2.5 feet.

The glacial outwash plain just inland of the Lake Huron coastal zone consists of silty clays and loamy sands. The first of these groups is the Saverine and Iosco Series. Soils in this group are characterized by flat topography, natural fertility, and moderate moisture-holding capacity. The Saverine and Iosco soil series require careful maintenance of soil fertility and drainage tiles. Tiles are necessary to generate moderate yields, since these soils tend to be imperfectly drained. Permeability tends to be rapid in the upper depths but becomes slow in the lower layers. The seasonally high water table is at a depth of 0.5 to

1.5 feet from late fall to spring. Along the shoreline of Lake Huron, soils become sandier and are well drained (USDA, 1961).

The shoreline soil types commonly fall into the Eastport, Arenac, and Kalkaska Series. Soils in these series are well drained to imperfectly drained and are developed from deep sand deposits. Eastport, Arenac, and Kalkaska soils are limited in their use for crops due to their susceptibility to wind erosion, poor nutrient content, and low moisture holding capacity. Although these soils are not suited to agriculture, they serve very well for small residential building sites. However, since these soils are highly permeable with shallow water tables, they present an environmental hazard for septic systems (USDA, 1961).

As previously mentioned, a number of the soil types in the Watershed are potentially highly erodible. Figure 4 illustrates the erodibility classification of soils in the Watershed. Natural Recourse Conservation Service (NRCS) classifies soil as highly erodible if the soil is eroding at a rate 8 or more times the rate the soil can maintain sustainable productivity. Using this definition, most of the Watershed was classified as not highly erodible. However, field surveys indicate that great deals of the Watershed's headwaters are being eroded at a rapid rate. The Technical Committee decided to identify soils with slope ranges greater than "C" as high risk of erosion, soils with a "B" slope as moderate risk of erosion, and slopes under "A" as slight to no risk of erosion. Slope ranges are based on the soils percent slope, soil texture, and characteristics that affect the soil's erodibility with "A" being the slightest risk and "E" being the most severe erosion risk. Ten percent of the Watershed's land area has slope ranges above "C".

1.3.1 HYDROLOGIC SOIL GROUPS

Figure 5 shows the hydrologic soil groups, which indicate the soil's runoff potential and drainage characteristics. The grouping is based on the inherent capacity of the soil, without vegetation, to permit infiltration. Group A soils have rapid infiltration and low runoff potential and Group D soils have very slow drainage and high runoff potential. When soils are classified with two groups (i.e., A/D), the first letter represents the artificially drained condition and the second letter represents the soil's natural drainage condition. If a Group D soil is artificially drained with a resulting hydrologic characteristic of a Group A soil, the soil would be classified as a Group A/D soil.

Group A Soils: High Infiltration rate, low runoff potential. Well drained to excessively drained sands or gravelly sands. High rate of water transmission

Group B Soils: Moderate infiltration rates. Moderately well to well drained. Moderately fine to medium coarse texture. Moderate rate of water transmission.

Group C Soils: Slow infiltration rate. Has layer that impedes downward movement of water moderately fine to fine texture. Slow rate of water transmission.

Group D Soils: Very slow infiltration rate, high runoff potential. Clays with high shrink/swell potential. Permanent high water table. Clay pan or clay layer at or near surface. Shallow over nearly impervious material. Very slow rate of water transmission.

1.3.2 PRIME FARMLAND SOILS

The USDA NRCS defines prime farmland as land with the best combination of physical and chemical characteristics for producing crops. This land must be available for agricultural use in order to receive a prime farmland designation. Prime farmland has the combination of soil properties, growing season, and moisture supply needed to produce sustained high yields of crops in an economic manner if it is treated and managed according to acceptable farming practices. Prime farmland soils may include those that are productive if artificially drained or managed to prevent flooding.

Many acres in the Watershed are classified as prime farmland or farmland of local importance. These soils types grouped into the Guelph/London association are limited to the western boundary of the Watershed. Toward the lakeshore, soils become less suitable for farming due to the increased erosion potential, higher water table, and sand content. Prime farmland soils are shown in Figure 6. All prime farmland soils and their associated capability classes are included in Appendix 1.

1.3.3 SUITABILITY FOR SEPTIC SYSTEMS

Favorable soil properties and site conditions are needed for proper functioning of septic systems. When selecting sites for these facilities, soil properties and site features should be considered to ensure safe operation and relative ease of installation. The USDA categorizes soil suitability in three categories: Slight - generally favorable soil and site conditions, limitations are minor and easily overcome; moderate - soil properties are unfavorable, but limitations can be overcome by special planning and design; severe - soil properties and site conditions are so unfavorable or difficult to overcome that major engineering and maintenance is required (USDA, 1976).

Septic tank adsorption fields are subsurface systems of perforated pipes that distribute effluent from the septic tank into the soil. Properties that affect effluent absorption are permeability, depth to water table, depth to bedrock, and susceptibility to flooding. Excessive slopes can cause seepage and surfacing of the effluent causing health risks, soil erosion, and slope failure. In some soils, loose sands and gravel will not adequately filter the effluent and groundwater may become contaminated. The overwhelming majority of soils in the watershed are classified as severe or moderate, suggesting that nearly the entire watershed is limited for onsite septic systems.

1.4 HYDROLOGY

1.4.1 SURFACE WATER

The origin of the name Sanilac is unknown; most claim the county was named after the respected Wyandotte tribe leader, Chief Sanilac. However, some assert the name comes from the Iroquois interpretation of the French phrase, “Sans Lac” meaning “without lake.” Regardless of the name’s origin the fact remains that Sanilac County does not have one natural inland lake (Du Mond, 1962).

One of the most unique characteristics of the Watershed is the number of stream channels. In the 179 square miles in the Watershed, there are over 101 streams totaling 930 miles of stream channel. Streams in the northern half of the watershed have a larger drainage area and have perennial flow. Most streams in the southern portion of the Watershed have steeper gradients, smaller contribution areas, and are usually intermittent or ephemeral.

Ephemeral streams are common in deep glacial till. Ephemeral streams are not recharged by groundwater inflows; instead they lose water because their channels are continuously above the water table. Intermittent streams experience some groundwater recharge and do not flow continuously, whereas perennial streams have groundwater base flows and flow during dry conditions. The soils in the Watershed headwaters have high runoff potential, potential high erodibility, and steep slopes, resulting in immediate transportation of surface water runoff. This type of hydrology is commonly described as flashy flow.

Flashy high volume flows are capable of producing unstable stream conditions. During a large rain event, runoff is rapidly transported to channels where it increases in velocity. As tributaries join to form larger creeks and rivers, the water's destructive force can quickly erode streambanks and cut deep channels. Channel erosion occurs mainly by scouring. The process involves heavy particles that skid or bump along the channel bottom, freeing or loosening material (Marsh 1998). If the channel material is unconsolidated gravel and sand, the channel will greatly increase in depth. Ephemeral streams, located in deep channels are examples of this process, and are abundant throughout the watershed.

The Watershed, especially in the headwaters, is primarily agricultural with conventional tillage. Stream channels in the headwaters are dry most of the growing season and are shallow enough to allow cultivation through the streambed. This practice is common throughout most of the headwaters where the streams are shallow and the channels are not well defined. Cultivation through the streambed loosens soil and can lead to direct inputs of fertilizer and pesticides into the stream.

1.4.2 GROUNDWATER

Groundwater is the single largest reservoir of fresh water on the planet. However, being so close to the Great Lakes (one fifth of the world's fresh water), groundwater is commonly pictured as a remote and separate entity of surface water. Groundwater begins when surface water seeps into the ground to a zone where all open spaces are filled with water. This zone is called the zone of saturation or the groundwater zone. The geologic material that holds this water is called an aquifer. There are two types of aquifers in the Watershed, the Marshall Sandstone Aquifer and a surficial aquifer.

The Coldwater Shale and Bayport-Michigan layers confine groundwater in the Watershed. The layer between these confining units is the Marshall Sandstone Aquifer, part of the larger Mississippian Aquifer. The Marshall Sandstone Aquifer is one of two major aquifers in the state, and it supplies more than 188,000,000 gallons of water a day to Michigan's residents. Overdraws of this aquifer have resulted in saline encroachment, supply shortages, and the abandonment of municipal wells (Mandle, 1986). This aquifer, typically 250 to 300 feet deep, is usually too deep for residential wells; therefore, most groundwater comes from the glacial till above the Coldwater Shale confining unit.

Glacial till in the eastern portion of Sanilac County is calcareous and rich in clay. This dense till layer, varying from 50 to 250 feet, is a low yielding surficial aquifer that is adequate for residential and commercial uses, but does not support a public water supply needing several hundred gallons per minute (Olcott, 1992). Typically municipal water is supplied by Lake Huron. Wells in the County are typically 40 to 150 feet in depth. Aquifers in shallow glacial till are referred to as an "unprotected aquifer" since they can easily be contaminated by surface water pollution.

1.4.3 WETLANDS

The Watershed are mottled with small patches of forested and scrub-shrub wetlands. Many wetlands have been drained to aid development or to reveal the rich organic soil for farmland. Over 20% of the Lake Huron coastal wetlands have been lost since the beneficial aesthetic and functional uses of wetlands are often overlooked, outweighed by economic, health and safety, or welfare needs.

Wetlands are lands where water saturation is generally the dominant factor determining soil development and the types of plant and animal communities. Wetlands vary widely due to differences in soils, climate, water chemistry, and hydrology. In fact, wetlands can be found on every continent except Antarctica. Wetlands are typically referred to as swamps, bogs, or marshes.

Wetlands are valuable resources that provide wildlife habitat, water quality improvement, and flood storage. Similar to tropical rainforests and coral reefs in other areas, wetlands are the most biologically productive ecosystems in Michigan. Wetlands provide habitat for hundreds of plant and animal species that cannot be found anywhere else. This biological productivity improves water quality and provides flood control by filtering and slowing down water in the dense vegetation. Water passing through wetlands is slowed down enough that bacteria can process wastes, plants can uptake water and nutrients, and groundwater is recharged. Existing wetlands are shown in Figure 7.

Many acres of wetlands have been lost in the Watershed. The majority of wetland loss has been in Forester, Delaware, and Sanilac Townships, where forested swamps were cleared for farming. These soils, when drained, are very productive; however, they are prone to ponding. Wetland loss may contribute to some of the unstable hydrologic and flooding problems associated with most of the coastal tributaries (Michigan Natural Features Inventory).

1.5 COUNTY DRAINS AND ROAD DITCHES

There are many drainage networks in agricultural land use areas. However, no waterways are under the Sanilac County Drain Commissioner's jurisdiction within the Watershed. In some instances, streams are maintained by landowners and are channelized and dredged.

Road ditches are not recognized as streams by the United States Geologic Survey (USGS) and are not regulated by Michigan Department of Environmental Quality (MDEQ). However, road ditches do convey water to streams and lakes and add many miles of surface water drainage to the Watershed. Most of these ditches are alongside unpaved county roads. Assuming all roads have ditches on either side, there are 1,250 miles of road ditches in the Watershed.

1.6 CLIMATE

The climate in the Watershed is typical of Great Lakes coastal areas and can be described as having a wide seasonal variation, many storms, relatively high humidity, and fairly constant year around precipitation. A micro-climate develops when Lake Huron warms the air in the winter and cools the air in the summer. The Port Huron Moraine shelters the Watershed from cold west winds and results in a growing season that is slightly longer than areas west of the moraine (USDA, 1961). In a normal year, growers can expect a growing season that is around 167 days compared to areas west of the moraine that only have 157 growing days. The average annual temperature is 47° F, with a frost-free date from late April to mid-October. Annually, it rains or snows 132 days per year with average rainfall of 31 inches and snowfall of 37 inches (MRCC 2002).

1.7 NATURAL RESOURCES

1.7.1 VEGETATION

The Watershed area consists of a broad expanse of level lake plain that gently slopes toward Lake Huron. The area was once a dense forest of white, red, and jack pines with sugar maple, beech, and some oak until the late 1800s when lumbering and forest fires nearly eliminated all the native coniferous and deciduous vegetation. Agricultural development in the Watershed has been intense as a result of a lake-modified climate and the naturally productive lake-plain loam soils (Albert, 1995).

During the peak development of Sanilac, Huron, and St. Clair Counties, all of Sanilac County was surveyed to establish township and section boundaries. Surveyor notes describing habitat and ecosystems were used to reconstruct maps of what the land would have looked like prior to development in the early 1800s. Figure 8 illustrates the Watershed's pre-settlement vegetation. Beech-sugar maple forests dominated the majority of this Watershed's southern two-thirds. The northern third was largely hemlock-white pine forests. These forests were heavily logged in the mid-1800s. The timber that remained was burned in the fires of 1871 and 1881.

The second growth forests and rangelands that remain today differ greatly from pre-settlement vegetation. Native American settlements were once abundant along the Lake Huron shoreline where dwellings along the beach ridges took advantage of productive marshes and wet prairie. Anthropological fire suppression was probably responsible for maintaining oak savannas of the beach ridges near the northern boundary of the Watershed.

Today, most of the lake plain has been ditched and tiled, which produced some of the most valued agricultural soils in the state. The wettest soils remain as swamp forest, wet prairie, or marsh. The well-drained to imperfectly-drained soils along the Port Huron Moraine are not as fertile as the organic soils to the west, however, they do not require the extensive drainage tiles and ditches. Most forests that remain are sheltered in low depressions, forested wetlands, and coastal stream escarpments. At present, areas that were once conifer-dominated forest have been eliminated on both upland and wetland sites, and conifer swamps have been converted to lowland hardwoods or brush (Albert, 1995).

1.7.2 MICHIGAN NATURAL FEATURES INVENTORY

Rare lake plain prairie areas and wet marshes in Sanilac, Huron, and St. Clair Counties are home to many state threatened as well as federally listed endangered species listed in Table 1.0. The Michigan Natural Features Inventory keeps a running list of species that are of special concern to the state's ecosystem stability. Table 1.0 lists the state threatened and endangered species in the Watershed.

Most of these species require Great Lakes shoreline habitat. Intensive development of coastal communities is largely responsible for population declines. Soil management practices that generate large amounts of sediment have impaired undeveloped coastal shoreline and wetland habitats through sedimentation processes. Conservation management of these unique coastal areas that remain is very important to preserve the species of concern and the communities associated with them.

Table 1.0 - Michigan Natural Features Inventory

Scientific Name	Common Name	Type	Federal Status	State Status
Adlumia fungosa	Climbing fumitory	Vascular Plant		SC
Moraine	Moraine	Land Feature	Unique	Unique
Epioblasma torulosa rangiana	Northern riffleshell	Mussel	LE	E
Obovaria subrotunda	Round hickorynut	Mussel		E
Rallus elegans	King rail	Bird		E

Federal Status: LE = listed endangered
State Status: SC = special concern, E = state endangered

1.7.3 WATER RESOURCES

The Watershed does not have any inland lakes; however, it does have over 42 miles of Lake Huron shoreline. Shoreline communities account for a majority of the population and are largely responsible for the $8,246,000 spent on tourism in Sanilac County each year (Spencer, 1998). The Department of Natural Resources operates marinas in Lexington and Port Sanilac Harbor. Other private boat slips provide access to Lake Huron and its abundant fisheries. In addition to these harbors, many local governments manage public parks and beaches on Lake Huron.

Currently no records of average stream flow exist in the Watershed since inland surface water is practically non-existent during dry summer months. Since most streams are intermittent or ephemeral, fisheries are limited mostly to Elk Creek, Indian Creek, Big Creek, Cherry Creek, Mill Creek, and Birch Creek. Smelt and white sucker runs occasionally occur in the Watershed's tributaries proving that these small streams are important near shore habitat for many Lake Huron fish (Morse, 2002). These streams may even support coldwater sport fish, but the streams are often nutrient and bacteria enriched.

Lake Huron's severe and sudden storms have claimed a number of ships over the Great Lake's shipping history. These shipwrecks are preserved on 163 square miles in the Sanilac Shores Underwater Preserve. Depending on the lake conditions, visibility at depths of up to 120 feet, are between 5 and 25 feet. The preserve presently contains eight wrecks, including the *Mary Alice B*, the preserve's most popular site. In 1992, Michigan's first underwater historical marker was placed in the Sanilac Shores Underwater Preserve on the wreck of the *Sport*. The preserve is one of the most popular attractions in Sanilac County (Michigan's Underwater, 2002).

1.7.4 BEACHES

Sand dunes and shoreline bluffs are by far the youngest of Michigan's geologic features. The shoreline features along the Lake Huron coastline are rock bluffs or cohesive clay. These types of beaches have lower erosion rates than do sandy shorelines. Recession rate studies completed by the MDEQ show rates of approximately 1 foot per year along the cohesion shorelines and less than 1 inch per year for rock bluffs (Bennett, 2002). During periods of high water levels, it is typical for these types of shorelines to have a very shallow beach due to the prevailing westerly winds that blow sand away from the beach. Erosion of clay or rock bluffs in the forms of bluff retreat or lake down-cutting is irreversible. In an attempt to slow the natural erosion process, many homeowners have installed groins perpendicular to the lakeshore. Groins are structures used to intercept longshore transport of sand. The structures are effective at building a beach between the groins; however, they actually increase erosion on adjacent properties. A map of high risk erosion areas can be found in Appendix 2.

Many public access beaches are along the shoreline in the Watershed. Nine of these beaches are being monitored weekly by the Sanilac County Health Department for *E. coli* contamination. If *E. coli* levels exceed water quality standards, the beach will be closed until samples indicate that the water is safe. Beach closings are a concern for permanent and part-time residents, as well as businesses that rely on tourism. The marinas and harbors in Sanilac County depend on clean water and accessibility to maintain economic viability. Water contamination could severely impact the growing tourism industry and the local economy.

1.8 LAND USE

1.8.1 AGRICULTURE

Early settlers' existence in the Watershed relied primarily on forest products until the fires swept the region in the 1880s. When the timber industry era ended, nearly all the land was blackened and treeless. Agriculture soon took precedence as the predominant land use. Today approximately 80% of the land area is devoted to row crop, permanent pasture, and rangeland (Figure 9). The largest single agricultural land use in Sanilac County, according to the 1997 Agricultural Census, is dairy product related. Of the county's 430,000 acres of agricultural land, 82,000 acres are devoted to livestock pasture or silage production. Sanilac County ranks first in the state for revenue generated by dairy product sales and 78th in the nation.

1.8.2 RESIDENTIAL

Like most of the Great Lakes shoreline in the southeast Lower Peninsula, residential development is the fastest expanding land use in the Watershed. Residential and commercial land is concentrated along the shoreline of Lake Huron and makes up 6% of the Watershed's land area. Lakeshore lots are traditionally small and densely packed. Recently, these smaller lots have been purchased in pairs and incorporated into larger residential units. Water utility expansion in Worth Township has stimulated growth and the construction of larger homes.

1.8.3 COMMERCIAL

Commercial development has been primarily directed toward the lakeshore along the M-25 corridor. The principal developments are the Port Sanilac Harbor, Lexington Harbor, Huron Shores Golf Course, and Lakeview Hills Country Club. Commercial development north of Lexington is largely limited by lack of sewer and water utilities.

1.8.4 WILDLIFE HABITAT

The remaining percentage of the Watershed's area is forested and/or wetland, and only comprises 10% of the Watershed's land area. The forests and wetlands that remain are mostly limited to low lying depressions in ravines and creek buffers. Nearly all streams in the Watershed run from west to east therefore, very few forested wildlife corridors run in a north to south direction. Fragmentation of habitat prohibits species from migrating in response to land use changes, such as farmland conversion or forest fires.

Regardless of the habitat type, numerous factors affect habitat quality. Larger areas of contiguous habitat will support diverse populations of flora and fauna, and typically create healthier ecosystems. When habitats are fragmented and become smaller, the size of what is commonly referred to as "edge" or "fringe" habitat increases. Species that depend upon large tracts of prairie or forest for shelter from predators or human influence cannot thrive in edge habitats. However, other species, such as deer, rabbits, raccoons, coyotes, and opossum are highly adapted to live in edge habitats. As habitat becomes more fragmented, the ecological balance is tipped to favor edge species.

1.8.5 LAND USE TRENDS

Building trends in the Watershed are characteristic of most rural Midwest regions; increasing land use is outpacing population growth. The land use growth is mostly new home construction for persons seeking rural lifestyles (Sanilac County Planning Commission, 2000). Most communities are unable to meet increasing demands for water and sewer utilities and they compensate by increasing the minimum lot size for low density residential to ensure adequate water supply and septic drain field area. This results in increased land use for residential buildings.

In the early 20th century, plot sizes in Sanilac County ranged in size from 160 to 240 acres. From the mid 1960s on, the number of individual parcels increased and the average plot size fell. The conversion of agricultural land to large lot rural residential is commonly called “urban sprawl.” This trend is facilitated by the Land Division Act and by local zoning (Sanilac County Planning Commission).

The County’s agricultural land values have steadily increased. According to the 1997 Census of Agriculture, the average farmstead in the County was valued at $275,080 in 1992 and at $400,889 in 1997, a nearly 70% increase. The average age of farmers is increasing statewide; from this, one can conclude that most farmland is being sold for retirement income. Since 1982, more than 14,600 acres of farmland have been lost.

CHAPTER 2 - POLITICAL LANDSCAPE

2.0 DEMOGRAPHICS

Approximately 13,328 people live in the Sanilac County Lakeshore Watershed (Watershed) as projected by the proportion of residents of the townships or cities in the Watershed (US Census, 2000). The majority of the population resides along the Lake Huron coastline around the Villages of Lexington, Port Sanilac, and Forester. The largest portion of the Watershed's population, 2,558 people, dwells in Worth Township, just south of the Village of Lexington. Table 2.0 depicts the population variations by governmental unit within the Watershed. An interesting characteristic of Lexington Township is its extremely fast population growth rate from 1990 to 2000. The population expansion of 47% is much greater than the 1990 census estimate of 17% (US Census, 1990).

The greater part of the Watershed is in Delaware Township, containing about 20% of the land area. Sanilac and Marion Townships contain 15% and 13% of the land area respectively. Both Forester and Worth Townships occupy 10% of the total land area, and Lexington and Bridgehampton Townships both have about 8%. Grant, Burtchville, Paris, Sherman, and Washington Townships share the remaining 14% of the land area. The Villages of Lexington, Port Sanilac, Deckerville, Forestville, and Minden City occupy a combined 2% of the Watershed.

Table 2.0 - Population Trends

Governmental Unit	Total Acres	Acres in Watershed	Square Miles in Watershed	Percentage of the Watershed	Percentage of Unit in Watershed	Total Population[a]	Estimated Population in Watershed 2000	Estimated Population in Watershed 1991	% Population Change 1990 to 2000
Grant Township	19,101.11	5,547.80	8.67	3.7%	29.0%	1,667	484	351	37.8%
Burtchville Township	9,975.53	3,837.34	6.00	2.6%	38.5%	3,956	1,522	1,369	11.2%
Paris Township	23,054.64	15.81	0.02	0.0%	0.1%	557	0	0	na
Sherman Township	28,180.36	5,513.34	8.61	3.7%	19.6%	1,165	228	226	0.9%
Worth Township	24,845.96	15,806.40	24.70	10.7%	63.6%	4,021	2,558	2,001	27.8%
Lexington Township	22,802.81	12,868.69	20.11	8.7%	56.4%	2,584	1,458	1,269	14.9%
Washington Township	23,139.67	553.00	0.86	0.4%	2.4%	1,636	39	37	5.1%
Sanilac Township	25,664.56	22,609.89	35.33	15.3%	88.1%	1,951	1,719	1,503	14.4%
Bridgehampton Township	23,158.86	13,088.50	20.45	8.8%	56.5%	911	515	478	7.8%
Marion Township	22,245.57	19,207.59	30.01	13.0%	86.3%	859	742	705	5.3%
Forester Township	16,149.90	16,149.90	25.23	10.9%	100.0%	1,108	1,108	919	20.6%
Minden Township	22,471.54	1,923.16	3.00	1.3%	8.6%	391	33	37	-10.5%
Delaware Township	29,160.59	28,910.81	45.17	19.5%	99.1%	803	796	801	-0.6%
Lexington Village	473.61	473.61	0.74	0.3%	100.0%	1,104	1,104	779	41.7%
Port Sanilac Village	467.91	467.91	0.73	0.3%	100.0%	658	658	656	0.3%
Deckerville Village	850.609	0.31	0.00	0.0%	0.0%	944	0	0	N/A
Forestville Village	573.70	573.70	0.90	0.4%	100.0%	127	127	153	-17.0%
Minden City Village	644.855	629.84	0.98	0.4%	97.7%	242	236	228	3.9%
Total	**292,961.77**	**148,177.59**	**228.18**	**100.0%**		**24,684**	**13,328**	**11,513**	**15.8%**

[a] 2000 Census

[b] Populations are projected based on 2000 Census and percentage area of township and village in Watershed

[c] Data from 1990 US Census, Selected Population and Housing Characteristics

2.1 COMMUNITY PROFILES

Coastal villages, which were once predominated by seasonal cottages, are rapidly changing to year around residences. Most of these lakeside residences in Port Sanilac, Lexington, and Worth Townships were constructed in the 1950s. These homes were plated on long narrow lots to maximize the number of homes with lakefront access. Lakefront property is a precious resource and development has been rapid especially near urban centers. Table 2.1 reveals this trend in home occupancy, especially in townships and villages with coastal access. Although many homes are being adapted for year-round use, 19% of the Watershed's homes are still seasonally occupied. In Lexington and Worth Townships, 39% of the homes are seasonally occupied. Moving away from the coastline, the Watershed's communities are largely rural with low population density. Residential development has been the fastest in areas adjacent to state highways.

2.1.1 PHASE II COMMUNITIES

The Clean Water Act of 1972 authorized the National Pollutant Discharge Elimination System (NPDES) to require permits for any discharge of water from point sources to a body of water. Phase II of the NPDES storm water regulations requires urbanized communities to obtain storm water permits for discharges from municipal storm water systems. Urbanized communities are defined as one or more adjacent communities that together have an urban core population greater than 50,000 with a population density greater than 1,000 people per square mile. Three communities in the Watershed are linked to the Port Huron urban area via the M-25 corridor; Lexington Township, Worth Township, and the Village of Lexington. The urbanized area is shown in Figure 1.

Table 2.1 - Housing Trends

Governmental Unit	Average Household Size 2000[a]	Total Housing Units 1990[b]	Seasonal Housing 1990[b]	% Seasonal Housing 1990	Total Housing Units 2000[a]	Seasonal Housing 2000[a]	% Seasonal Housing 2000	% Seasonal Housing Change 1990 to 2000
Grant Township	3.0	419	0	0%	606	11	2%	100%
Burtchville Township	2.0	1,600	175	11%	1,880	167	9%	-5%
Paris Township	3.0	234	6	3%	230	9	4%	33%
Sherman Township	3.0	600	165	28%	620	142	23%	-16%
Worth Township	2.0	2,585	1,209	47%	2,778	1,031	37%	-17%
Lexington Township	2.0	1,254	310	25%	1,260	208	17%	-49%
Washington Township	3.0	652	41	6%	670	22	3%	-86%
Sanilac Township	2.0	1,193	434	36%	1,332	427	32%	-2%
Bridgehampton Township	3.0	368	15	4%	376	12	3%	-25%
Marion Township	3.0	321	20	6%	339	6	2%	-233%
Forester Township	2.0	992	566	57%	1,012	492	49%	-15%
Minden Township	3.0	183	11	6%	163	8	5%	-38%
Delaware Township	3.0	471	147	31%	496	163	33%	10%
Lexington Village	2.0	750	298	40%	1,060	462	44%	35%
Port Sanilac Village	2.0	406	98	24%	437	83	19%	-18%
Deckerville Village	2.0	410	15	4%	411	9	2%	-67%
Forestville Village	2.0	156	77	49%	147	84	57%	8%
Minden City Village	3.0	93	3	3%	111	3	3%	0%
Total	**2.5**	**12,687**	**3,590**		**13,928**	**3,339**	**19%**	**-21%**

[a] 2000 Census

[b] Data from 1990 US Census, Selected Population and Housing Characteristics

2.1.2 EMPLOYMENT

Manufacturing and the service industries are the largest employers in the Watershed and supply jobs to nearly 20% of Sanilac County (Midwest PROfiles, 2002). Farm employment was once the largest employer in the county until it began a sharp decline in the 1970s when the automobile industry began to draw jobs away from agriculture. In 2000, agriculture supplied 11% of jobs in the county. Table 2.2 and Table 2.3 show the employment trends in Sanilac County. The largest employers within the Watershed, all making automotive products, are Clements Manufacturing, Dott Manufacturing, Mid-west Rubber, and Huron Manufacturing (Multimag, 2002).

Table 2.2 - Employment by Industry

	1970	1980	1990	1995	1999	2000
Farm employment	3,870	3,350	2,614	2,441	2,253	2,197
Non-farm employment	10,737	10,912	14,361	16,804	16,798	17,044
Private employment	8,989	9,150	12,048	14,307	14,347	14,545
Agriculture, fishing, logging, and other	63	117	198	318	452	452
Mining	14	23	175	145	131	134
Construction	523	521	849	1,004	1,145	1,207
Manufacturing	3,864	2,841	4,012	4,962	3,848	3,871
Transportation and public utilities	317	259	313	489	448	458
Wholesale trade	163	377	377	446	480	479
Retail trade	1,796	1,964	2,286	2,550	2,655	2,813
Finance, insurance, and real estate	663	841	709	801	1,058	1,112
Services	1,586	2,207	3,129	3,592	4,130	4,019
Government and government enterprises	1,748	1,762	2,313	2,497	2,451	2,499
Federal, civilian	108	106	133	120	125	146
Military	110	96	129	100	85	86
State and local	1,530	1,560	2,051	2,277	2,241	2,267
State	(N)	110	221	230	223	225
Local	(N)	1,450	1,830	2,047	2,018	2,042
Totals	38,051	39,626	49,738	57,125	56,887	57,596

Table 2.3 - Principle Employers in Sanilac County

Firm	Location	Employees	Product/Service
Huron Inc.	Lexington	400	Auto supplier
Trelleborg Automotive	Sandusky	350	Auto supplier
Midwest Rubber Company	Deckerville	290	Rubber Products
Trim Trends	Deckerville	257	Plastic molding
Dott Manufacturing	Deckerville	254	Auto molding
Lexington Plastics	Lexington	250	Auto supplier
Numatics	Sandusky	250	Valves
LDM Technologies	Croswell	130	Auto supplier
Laydon	Brown City	120	Plastic molding
Oetiker, Inc.	Marlette	101	Clamps and couplings
Patriot Sensors & Controls	Peck	95	Automotive control products
Deckerville Plastics	Deckerville	88	Plastic molding
Cotterman, Co.	Croswell	75	Scaffolding
Michigan Sugar	Saginaw	70	Beet sugar
Jay & Kay Mfg.	Croswell	60	Metal fabrication
Paramount Industries	Croswell	52	Lighting products
Jensen Bridge & Supply	Sandusky	47	Building products
Michigan Peat	Sandusky	40	Peat and horticulture products
Xplorer Motor Homes	Brown City	35	Motor homes
A.G. Davis	Brown City	35	Manufacturing technology
Eugene Welding	Marlette	35	Metal fabrication
Fraser Manufacturing	Lexington	35	Metal fabrication
Grupo Antolin	Marlette	30	Auto supplier
Beaden Screen, Inc	Croswell	30	Metal fabrication
Conveyor Components	Croswell	30	Conveyers
Gielow Pickles	Lexington	30	Pickle products

2.2 SCHOOLS

Six school districts serve the Watershed's year-round residents. The geographical base and contact information for each are listed in Table 2.4. Schools can be a valuable resource for developing watershed educational programs, volunteer water quality monitoring, and stream restoration projects.

Table 2.4 - School Districts in the Sanilac County Lakeshore Watershed

School District	Township(s) in Watershed	Address	Phone Number
Carsonville-Port Sanilac Community Schools	Sanilac, Washington, and Bridgehampton	100 North Goetze Road Carsonville, MI 48419	810-657-9393
Croswell-Lexington	Lexington, Worth, and Bridgehampton	5407 East Peck Road Croswell, MI 48422	810-679-1000
Deckerville Community Schools	Forester, Bridgehampton, Marion, Delaware, and Minden	2633 Black River Street Deckerville, MI 48427	810-376-3615
Harbor Beach Community	Sherman	402 South Union Street Harbor Beach, MI 48441	989-479-3267
Ubly Community Schools	Paris and Minden	2020 Union Street Ubly, MI 48475	989-658-8202
Sanilac Intermediate School District		175 East Aitken Road Sandusky, MI 48471	810-648-4700

2.3 OFFICIALS

Watershed management involves local stakeholders and decision-makers. Communication with these individuals is essential to achieve the goals and objectives of the plan. The Watershed is in the jurisdictions of Sanilac, St. Clair, and Huron Counties. A list of the key state, senate, congressional, and local government officials is provided in Table 2.5.

Table 2.5 - Representatives and Officials for the Sanilac County Lakeshore Watershed

Officials	Title	Phone
United States Senators		
Mr. Carl Levin	U.S. Senator	202-224-6221
Ms. Debbie Stabenow	U.S. Senator	202-224-4822
United States Representatives		
Ms. Candice Miller	U.S. Representative (10th)	
State of Michigan		
Mr. James Barcia	State Senator (31st)	
Mr. Judson Gilbert II	State Senator (25th)	
Ms. Lauren Hager	State Representative (81st)	517-373-1790
Mr. John Stahl	State Representative (82nd)	517-373-1800
Mr. Stephen Ehardt	State Representative (83rd)	517-373-0835
Mr. Thomas Myer	State Representative (84th)	517-373-0476
Sanilac County Officials		
Mr. John Males	County Administrator	810-648-2933
Mr. James Bowerman	Drain Commissioner	810-648-4900
Mr. Virgil Strickler	County Sheriff	810-648-2000
Ms. Sandra Pritchett	Conservation District	810-648-2116 x4
Mr. William Strickler	Soil Erosion Control Agent	810-648-4664
MR. Dale Benish	Economic Development	810-648-7000
Ms. Judith Ferguson / Grant Carmen	Health Department	810-648-4098
Mr. Martin Nagelkirk	MSU Cooperative Extension	810-648-2515
Mr. John Stefan	County Parks Department	810-622-8715
Ms. Donna Allen	Recycling Center	810-648-3590

Table 2.5 - Representatives and Officials for the Sanilac County Lakeshore Watershed

Officials	Title	Phone
Mr. Michele VanNorman	Register of Deeds	810-648-2313
Mr. Jerome Essenmacher / Robb Falls	County Road Commission	810-648-2185
Ms. Rosemarie Gallagher	USDA Farm Service Agency	810-648-2998
Mr. David Newkirk	USDA Natural Resources Conservation Service	810-648-2116 x3
St. Clair County Officials		
Mr. Troy Feltman	Administrator	810-989-6900
Mr. Fred Fuller	Drain Commissioner	810-364-5369
Mr. Ronald Miller	Health Department	810-987-5306
Ms. Stacey Kautz	Conservation District	810-984-3001
Mr. Kenneth Foerster	County Road Commission	810-367-3806
Ms. Kathy Hale	MSU Cooperative Extension	
Huron County Officials		
	Administrator	
Mr. J. Dean Smith	Deputy Drain Commissioner	989-269-6405
	Health Department	
Ms. Jeanette Renn	Conservation District	989-269-9540
	County Road Commission	989-269-6404
	MSU Cooperative Extension	989-269-9949
Local Government Officials		
Village Presidents		
Mr. Donald Murdock	Deckerville	810-376-4895
Mr. Richard Lautner	Forestville	989-864-3176
Mr. Robert Gabler	Lexington	810-359-8631
Mr. Robert Kaufman	Minden City	989-864-3452
Ms. Mary Sertich	Port Sanilac	810-622-9637
Township Supervisors		
Mr. Robert Tanton	Bridgehampton	810-376-4717
Mr. Kenneth Klaus	Delaware	989-864-3114
Mr. David Messing	Forester	810-622-8421
Mr. Wayne Clarkson	Lexington	810-679-3780
Mr. Arnold McVittee	Marion	810-376-4273
Mr. Dale Halifax	Minden	989-864-3418
Mr. Bill Noelke	Sanilac	Not listed
Ms. Shirley Feirer	Washington	810-633-9517
Ms. Janice Lee Putz	Worth	810-679-3776
Mr. Donald Sheldon	Burtchville	810-385-5577
Mr. James Reid	Grant	810-327-6830
Mr. Ronald Smalley	Paris	989-658-2380
Mr. Leonard Emming	Sherman	989-864-5461
State Environmental Programs		
Mr. Mark Breederland	Michigan Sea Grant	810-989-6323
Mr. Michael Juhasz	Michigan Department of Agriculture	989-758-1778
Mr. Charles Bauer	MDEQ Water Division	989-686-8025 x8261
Ms. Sara Bonnette	MDEQ Geologic and Land Management Division	989-686-8025 x8365

CHAPTER 3 - WATER QUALITY

Water quality is a measure of chemical and physical properties. The perception of water quality varies between groups of people depending upon their use of the water. The Clean Water Act was designed to improve water quality by giving the U.S. Environmental Protection Agency (EPA) the authority to regulate pollution discharges through a permit compliance system. Early in the Clean Water Act's implementation, efforts focused primarily on direct discharges from one source, or "point sources." The majority of point source pollution has been successfully eliminated from impairing Michigan's water resources; however, water quality impairments still exist. Unlike discharges from wastewater treatment plants and industrial wastewater discharge, these lingering impairments come from many diffuse sources called nonpoint source (NPS) pollution. NPS pollution results from rain or snowmelt moving over or through the ground and picking up pollutants and depositing them in lakes, rivers, streams, and groundwater.

3.0 WATER QUALITY STUDIES

Limited information is available about the water quality in the Sanilac County Lakeshore Watershed (Watershed). The Michigan Department of Environmental Quality (MDEQ), Sanilac County Health Department (SCHD), the Village of Lexington, and the Sanilac County Math and Science Center have collected water chemistry data.

Michigan Department of Environmental Quality Biological and Water Quality Surveys

Biological indicators of streams were conducted by the MDEQ in 1984, 1994, 1997, and 1999, on Mill Creek, Miller Creek, Cherry Creek, and White Rock Creek. The objective of the biological surveys is to qualitatively evaluate the impact that land use practices have on macroinvertebrates (aquatic insects, crustacean, snails, etc.), fish communities, habitat, and water chemistry. Water chemistry analysis was performed on some of the creeks; however, water quality is not always the best indicator of stream health. Biological surveys examine fish and insect population to determine watershed health.

Habitat, macroinvertebrate communities, and fish communities are assessed by the MDEQ, using Procedure #51 developed by the MDEQ and Michigan Department of Natural Resources biologists. Procedure #51 scores components of habitat, insect and fish populations, and insect and fish community diversity. Fish and insect species that are representative of higher water quality are assigned a higher score. The scores are totaled and the section of stream that was surveyed is assigned a value of poor, fair, acceptable, good, or excellent. Summaries of the report ratings are listed in Table 3.0

Table 3.0 - Summary of Michigan Department of Environmental Quality Biological Surveys

Creek and Station	Habitat Rating	Macroinvertebrate Community Rating	Fish Community Rating
Cherry Creek (Goetz Road)	Fair (1998)	Acceptable (1998)	NA
Cherry Creek (M-25)	Good (1998)	Acceptable (1998)	Acceptable (1994)
Mill Creek (all stations)	Poor (1988)	Poor (1988)	NA
Miller Creek (Huron View Road)	Fair (1998)	Acceptable (1998)	NA
White Rock Creek (M-25)	Fair (1998)	Acceptable (1998)	Acceptable (1994)
White Rock Creek (Schock Road)	Fair (1998)	Acceptable (1998)	NA

Habitat

Habitat in White Rock Creek and Miller creek was rated “fair,” indicating moderate impairments. Impairments listed in the report are straightening and dredging the stream channel, intensive agricultural practices in the headwaters, and lack of riparian buffers. Cherry Creek was rated “good,” indicating only slight impairments. Impairments listed for Cherry Creek were channel dredging and straightening. The report noted the apparent stream flow extremes. When the stream sites were surveyed in June, many of the channels were already dry and remained dry throughout the summer months. However, evidence of high flow damage was observed at all locations. The evidence cited in the report was “lack of woody instream cover resulting from high flow scour.” Mill Creek was rated in 1988 and was given a habitat rating of “poor” due to extreme flow fluctuations, lack of riparian buffer, limited stream cover, and sedimentation.

Macroinvertebrate Community

The macroinvertebrate surveys completed in Cherry Creek and White Rock Creek in 1993 rated insect communities as “acceptable” tending toward “good.” The two creeks, along with Miller Creek, were surveyed again in 1998 and the conditions had degraded to “acceptable” tending toward “poor.” The reason for the degraded macroinvertebrate communities was given as channel dredging, sedimentation, and agricultural impacts. Extreme flow fluctuations also contribute to the low diversity and low density of aquatic macroinvertebrate populations. Healthy insect populations are essential to maintain a viable Lake Huron fishery since many fish feed upon these insects and crustaceans. Macroinvertebrates in Mill Creek were abundant; however, the communities present indicated poor stream quality since they were of the types that thrive in stagnant, nutrient enriched water.

Fish Communities

Fish surveys were completed in Cherry Creek and White Rock creek in 1993. Fish communities in the warmwater streams were both rated “good.” In 1998, a new scoring method was applied and the ratings were changed to “acceptable.” Eleven fish species were found, including a 13-inch Brown trout in Cherry Creek. A diverse population of seven species of minnow and shiner were found in White Rock Creek. Although the diversity index was high, the fish population counts were small. It was also noted that these two streams were heavily used for white sucker spawning. Fish communities were void of young-of-the-year, indicating that these streams do not support successful rearing of most fish species. Impaired macroinvertebrate communities and physical habitat conditions in the headwaters must be restored before these streams can support viable fish populations.

Water Quality

Water quality parameters in White Rock Creek, Miller Creek, and Cherry Creek complied with Michigan’s Water Quality Standards, with the exception of total dissolved solids. The high quality stream habitat in the lower reaches of the Lake Huron tributaries indicates that they could be useful spawning and rearing streams for many fish species native to the Watershed. However, excessive silt from erosion produced in the headwater’s agricultural areas could be impairing successful spawning. Phosphorus and ammonia concentrations met Michigan’s Water Quality Standards, but they were higher than other reference streams in the Lake Huron ecoregion.

Wanke Creek, in Forester Township, was assessed in 1997 to determine the potential impact of sanitary waste discharges from storage lagoons in the Village of Forestville. The objective of the survey was to determine if this discharge would cause a violation of the Michigan Water Quality Standards, primarily whether the discharge will contribute to algae blooms. Due to the dramatic fluctuation between high and low flows and the amount of phosphorus loading coming from the headwaters, the MDEQ determined that the sanitary waste discharge would not contribute to nuisance algal conditions in Lake Huron.

Lake Huron Initiative Action Plan 2002

Unlike the other Great Lakes, Lake Huron does not have a lake management plan (LaMP). The Lake Huron Initiative is a cooperative program between Environment Canada, the EPA, and the Michigan Office of the Great Lakes. The Lake Huron Initiative 2002 is a dynamic document that changes as natural resource issues are addressed or changed. This effort was created to begin discussion of:

- Issues of importance to Lake Huron,
- Actions that need to be taken to protect and restore the Lake Huron ecosystem, and
- Partnerships that can undertake efforts that cannot be accomplished by individual agencies.

The Lake Huron Initiative is an action-oriented process to address the priority issues of Lake Huron to ensure a sustainable watershed. The two immediate future efforts will focus on critical impairments and fish and wildlife populations. The plan outlines trends in pollutant loadings and their relationship to fish consumption advisories. Actions that are required to protect and restore fish and wildlife habitat are:

- Develop a habitat classification system to determine an ecosystem's health.

- Identify indicator species to be used as an index of habitat quality.

- Inventory habitats deemed critical for ecosystem health.

- Improve understanding of the relationship between habitat and the abundance of dependant species.

- Determine the importance of physical habitat, nutrients, and biotic factors that control the capacity of the Lake Huron Watershed.

- Formulate a plan to restore and protect wetlands.

A joint agreement between the United States and Canada has developed a list of fourteen beneficial uses that could be impaired. Three of these uses are impaired in the Lake Huron Watershed and are listed in Table 3.1. The Lake Huron Action Plan Steering Committee identified pollutants that are causing the beneficial use impairments. The categories of pollutants are Priority, Concern, and Emerging. "Priority pollutants," are toxic materials that bioaccumulate, human carcinogens, and/or causing an immediate threat to fish or wildlife in the entire basin. Pollutants that have local impacts or increasing concentrations in Lake Huron are called "Pollutants of Concern." "Emerging Pollutants" are substances that have characteristics that could be a potential threat to the Lake Huron ecosystem.

Table 3.1 - Lake Huron Use Impairments

Use Impairment	Reason
Restrictions on fish or wildlife consumption	Fish consumption advisories are in effect for Lake Huron waters (polychlorinated biphenyls's (PCBs), chlordane, mercury, toxaphene, and dioxins)
Degradation of fish or wildlife populations	Fish populations impacted by interactions with non-native species, sedimentation, and loss of spawning areas (dams, river degradation, etc.). Some wildlife populations may be impacted by DDT
Loss of fish or wildlife habitat	Loss of wetlands, sedimentation, and loss of high gradient streams has affected some species (sedimentation, dams, etc.)

Table from the Lake Huron Initiative Action Plan - Michigan Office of the Great Lakes 2002.

MDEQ Sanitary Wastewater Survey of Worth Township

The SCHD identified a need for a municipal wastewater collection and treatment system in the coastal subdivisions in Worth Township. Small lots sizes, poor soils conditions, and high water tables make septic systems difficult to maintain. Chronic septic tank failure is common in many of homes along the shoreline. With the rising number of year-round residents in subdivisions designed as vacation communities, a municipal wastewater treatment system is necessary (Seifferlein, 2003).

The MDEQ verified the need for the wastewater treatment system after conducting a Sanitary Wastewater Survey, May 1, 2003. The results of the survey indicated, "raw or inadequately treated sewage is being illegally discharged to surface waters at several locations (Bauer, 2003)." The purpose of the survey was to determine if raw or improperly treated sewage was being discharged in Worth Township. Thirty-one samples were collected from storm sewer outfalls and drains between Mortimer Line Road and Galbraith Line Road.

Sampling was conducted during very wet conditions after a rain event. Under these circumstances, sampling would be able to test for failing septic systems and illegal connections of sewage to storm drains. Water samples were tested for Coliform bacteria. Elevated counts of Fecal Coliform and *E. coli* are indicators of untreated domestic waste and the presence of disease causing microorganisms. Michigan Water Quality Standards require *E. coli* counts in grab samples to be below 300 organisms per 100 milliliters (ml) of water. Of the 31 samples 25 (81%) were above water quality standards. Eighty percent of storm sewer outfalls and 86% of the tributaries had *E. coli* levels exceeding Water Quality Standards. This indicated illegal discharges to storm sewers and Lake Huron tributaries. The full report can be found in Appendix 3.

United States Geological Survey Groundwater Studies

In 2000, the EPA revised its Safe Drinking Water Standards for arsenic. Previously, arsenic levels were required to be below 50 micrograms per liter (µg/L) for municipal water supplies, today the concentrations must be below 5 µg/L. Arsenic naturally occurs in the Marshall Sandstone layer, and to a lesser extent the surficial aquifer above the Coldwater Shale confining unit. United States Geological Survey (USGS) groundwater quality monitoring has found that 61% of wells tested in Sanilac County were above the 5 µg/L recommendation (USGS, 2000).

Other contaminants found in community drinking water from groundwater sources are published by the EPA. The most common contaminant found in routine inspections in the Watershed was Coliform bacteria. Coliform bacteria may indicate that other potentially harmful bacteria, like *E. coli*, are present. Unprotected aquifers in agricultural areas not served by sewers are at risk of bacterial contamination. Of the nine community drinking water groundwater sources in the Watershed, six have had *E. coli* level violations.

The Village of Lexington has performed groundwater monitoring on drinking water wells west of the Village in Lexington and Worth Townships. The Village of Lexington obtained community drinking water from these wells before the construction of an intake on Lake Huron. Monitoring at some of these locations, dating back to 1938, has indicated that groundwater has exceeding drinking water standards for nitrogen, *E. coli*, and volatile organic compounds (VOCs).

The SCHD monitors groundwater at several locations in Lexington Heights on Burns Line Road. This site was the former location of a municipal dump that once accepted industrial and residential waste from several surrounding communities. Initial monitoring has revealed that this site is leaking VOCs. Community health risks are limited since this area is serviced with public water utilities.

Beach Health Monitoring

Nine beaches are monitored by the SCHD once every week throughout the summer. Each week the SCHD takes samples that are analyzed for the level of *E. coli*. If levels are higher than Michigan's allowable water quality standard for pathogens, the beach will be closed. During the summer of 2003, only four violations were recorded. Complete records can be accessed on the following MDEQ website, http://www.deq.state.mi.us/beach/default.asp?County=76. This site is updated every week to notify the public about the status of beach closings in Michigan.

3.1 POINT SOURCE POLLUTION

Point source pollution has been defined by 30 years of court litigation since the creation of the Clean Water Act of 1972. The best definition to date is provided by EPA as "any discernible, confined and discrete conveyance, such as a pipe, ditch, channel, tunnel, conduit, discrete fissure, or container and includes vessels or other floating craft from which pollutants are or may be discharged." This definition includes any discharge from a confined animal feeding operation. Point source discharge facilities are required to hold a National Pollutant Discharge Elimination System (NPDES) wastewater discharge permit. Point source discharges in the Watershed are listed in Appendix 4.

3.2 NONPOINT SOURCE POLLUTION INVENTORY

Accurate assessment of the conditions of the Watershed is best done by in-the-field observations. The Sanilac Conservation District staff conducted a field inventory (between the summer of 2002 and the summer of 2003), which primarily consisted of walking the length of the tributaries and recording observations. The methodology and results are described below.

Methodology

The survey was completed by walking streambanks or the stream channel to find evidence of NPS pollution. A data sheet was used to record instance of NPS pollution and define each instance using 12 categories: debris and trash, stream crossings, rill and gully erosion, livestock access, upland sources, tile outlets, streambank erosion, construction site runoff, urban sources, marinas, row-crop runoff, and other (site specific occurrence). At all observation points, basic information was recorded about the size of the stream, surrounding land use, current precipitation, and other information. Each NPS category contained descriptive subcategories that recorded the extent of pollution. This information was later used to group and prioritize these sites.

Each site was recorded geographically with a Global Positioning System (GPS) unit, when available, or its location was drawn on a map or described by distance from road crossings. A photograph was taken at most sites to document the “before” condition.

The sites were identified using a four-part code. The first part of the identification was based on the EPA’s Reach File number system. The Reach File numbering system gives a unique number to each branch of a stream. Smaller tributaries that were not included in the Reach File system were assigned a number based on the numbered tributary it fed into, plus an extension number. For example, an unnumbered stream that spilled into Reach File number 286 could be numbered 2861. Unnumbered streams were given extension numbers in a consecutive manner heading upstream. Using the example above, the second unnumbered stream flowing into Reach File number 286, upstream from Reach File number 2861, could be numbered 2862.

The second part of the site identification number was the first three letters of the township, city, or villages, in which the NPS pollution site was found. The third portion was the two-digit section number. Since Sanilac County is a coastal county, the townships are not typical 36 section townships. In coastal townships, there may be two sections sharing the same number. In this case, the section number is following by an “N, S, E, or W” to indicate whether the section is located in the north, south, east, or west section of the township. The final part of the identification was a two-digit site number. Site numbering started at 01 and each site number increased consecutively until the tributary entered another section. For example, the second NPS site in Reach File number 286, Bridgehampton Township, Section 13, would be numbered 286BRI1302. Benefits of using this number system are that sites can easily be geographically located and grouped. Each NPS site was entered into a database and sorted by NPS category. The categorized list can be found in Appendix 5.

The data collected during the stream survey was checked for inconsistencies and entered into a Geographic Information System (GIS). The GIS was used to map the distribution of NPS sites in the Watershed. Users of the GIS can sort the points by water body, type of pollutants, priority, etc. Inventory information and associated photographs can be accessed by using the GIS. All NPS sites are mapped on Figure 10.

Findings

Row Crop Runoff

The most common source of pollution in the Watershed was row crop runoff. Row crop runoff is a term given to a type of NPS pollution that is unique to the Watershed. Soils in the Watershed are easily eroded due to their high runoff potential, especially on steeper slopes. This has resulted in a complex drainage pattern of numerous shallow stream channels in the headwaters of many of the Lake Huron tributaries in this region.

Stream channels in the headwaters are shallow enough to allow tillage equipment to pass over and through the stream bottom. Tillage loosens the soil and fills in the stream channel. During rain events and snowmelt, runoff carries away the soils and the stream channel will reform. This process of channel formation and filling occurs a number of times throughout the growing season. Eroding stream channels through row crops were found on 139 fields.

As shown in Figure 4 most of the soils in the Watershed are classified as potentially highly erodible or not highly erodible land. The soils classified as not highly erodible land still suffer from severe erosion problems. This trend may not be an effect of the soil conditions, but may be due to land management practices like fall plowing, lack of stream buffers, and cultivating perpendicular to the land's slope.

Streambank Erosion

High volume, high velocity flows resulting from impermeable soils and steep topography have caused streambank erosion at many sites. Streambank erosion is the removal of the streambed substrate and streambanks by flowing water. When water velocity exceeds the resistance of the stream's soil material, erosion will occur. Conventional tillage in the headwaters removes vegetative cover and increases surface water runoff. Lack of riparian vegetation and unrestricted livestock access are common causes of streambank erosion. The NPS Inventory has identified 52 sites with streambank erosion.

Agricultural Upland Sources

Upland sources of NPS pollution include confined animal feeding operations, manure storage, manure application, and perpendicular plowing at the edge of streams. Pollutants from upland sources are classified as nutrients, sediment, and pathogens. These pollutants can travel a great distance via runoff or tile drains. Algal blooms and nuisance aquatic vegetation were used to identify areas that are

potentially influenced by upland sources of NPS pollution. Thirty sites were identified as upland pollution sources.

Tile Outlet Erosion

Groundwater drainage tiles from agriculture and basement footings can cause erosion if their outlets are installed incorrectly or are not properly maintained. The most common outlet failure occurs when seepage around the tile undermines the outlet structure. Seepage can saturate the embankment, causing slope failure or it may simply erode soil from around the tile causing sections of the tile to become unstable or broken. The other type of common outlet erosion occurs when the force of the outflow is not adequately dissipated. Plunge pools form below the outlet structure if the outlet is placed too high above normal water levels. Erosion around tile outlets was found at 54 sites.

Trash and Debris

Many sites have debris and trash accumulation that block or divert the flow of water. Illegal dumping at road crossings was also evident. Log jams occur naturally when dead timber falls into the stream channel. However, this process is accelerated if increased water volume during storm events causes severe erosion that undercuts the trees' root mass. Trees that fall into the channel sometimes divert water into the bank causing more erosion and more premature tree fall. Illegal dumping can have similar effects if trash restricts or diverts flow into the streambank. In some cases, toxic and unsanitary materials, such as oil filters, animal carcasses, and batteries, were found at road crossings. Trash and debris was found at 24 sites.

Road/Stream Crossing Erosion

There are a great number of road stream crossings in the Watershed that experience some form of erosion. Erosion occurs at road crossings when culverts and bridges are not maintained or are improperly designed or installed. During periods of high flow, culverts and bridges that are undersized can impede water and cause upstream flooding. Sedimentation in culverts can block water flow and divert currents into embankments. Misaligned culverts can also decrease conveyance efficiency and lead to future erosion hazards. Other problems occur if the culvert sinks below the normal high water line. Poorly designed road/stream crossings can adversely affect aquatic wildlife if the culvert is "perched" above the normal high water line. Perched culverts create a barrier to fish and aquatic organisms in the same way that a dam hinders up and downstream movement of aquatic wildlife. Problems with road/stream crossings were noted at 23 sites.

Rill and Gully Erosion

In general, three types of soil erosion are caused by water: sheet, rill, and gully. Sheet erosion is the uniform removal of soil without forming conspicuous channels. Sheet erosion is less apparent than rill and gully erosion and can be difficult to verify without long-term observations. For this reason, sheet erosion sites were not identified in this inventory. Rill erosion is the removal of soil by water cutting conspicuous channels into a slope. The channels that form are shallow enough that they are usually removed by cultivation. Gully erosion is the most severe form of accelerated soil erosion. Gullies form “V” shaped channels through the soil that are too deep for farm equipment to pass over.

Soils in the Watershed have high runoff potential and many are considered highly erodible land. Complicate these conditions with steep slopes and conventional tillage, and soil erosion is extremely accelerated. The NPS inventory uncovered 16 fields with severe rill and gully erosion. Because rill and gully erosion can be hidden by tillage, the frequency of rill and gully erosion is suspected to be higher than observed in the inventory.

Livestock Access

Livestock and dairy production are important economic factors in the watershed. The high number of livestock within the Watershed could potentially be a significant source of the sediment, nutrients, and pathogens impairing water use. Unrestricted cattle access to streams can affect water quality by denuding streambanks of vegetation, compacting soils, destabilizing slopes, disturbing sediment, and allowing manure discharge in or near surface water. The NPS inventory identified 26 unrestricted livestock access areas. Typically, these areas are also related to other types of NPS pollution like rill and gully erosion, streambank erosion, and upland sources.

Construction Site Runoff

Disturbed soil from construction sites may lead to sheet, rill, and gully erosion. When construction or grading projects remove vegetative cover and loosen the soil, erosion from wind and water will occur. Typically, erosion and sediment control practices are used to reduce soil erosion and offsite transport of sediment. However, 18 sites were found that were not using or had failing soil erosion and sediment controls.

Illicit Discharges

Illicit discharges are non-permitted discharges other than rain and groundwater from homes, businesses, and industry. Discharge from storm water sewer systems should only contain rain or groundwater. In some cases, there are illegal connections of sewer pipes to storm drains. Illicit discharges could also be in the form of illegal dumping of waste into creeks, streams, lakes, and wetlands. This includes household hazardous waste, automotive fluids, and yard waste. The inventory has documented a number of sites that are not using septic systems that discharge household waste directly to nearby streams. Four sites with illegal discharges and failing septic systems have been identified. These sources of NPS pollution are difficult to locate. More illicit discharges may be identified upon more intense screening in residential areas.

Marinas

A number of marinas are in operation along the Lake Huron shoreline. The Lexington Harbor and the Port Sanilac Harbor are the largest in the Watershed. Both harbors have sewage pump-out and fuel pumping facilities that are potential sources of NPS pollution. The harbors have taken the same precautions to ensure that water contamination from these sources will not occur. Attendants are on hand to assist in sewage and fuel pumping to avoid accidental spills. It is suspected that some boat operators are not using sewage pumping facilities and instead are illegally dumping sewage into state waters.

3.3 DESIGNATED USES

All waters of the state must meet the following eight designated uses, which have been identified by the State of Michigan. The following uses of surface water resources are required to be protected by Public Act 451 of 1994, Chapter I, Part 31, Part 4.

- Agricultural use
- Public water supply at point of intake
- Navigation
- Warmwater/coldwater fishery
- Other indigenous aquatic life and wildlife
- Partial body contact recreation
- Total body contact recreation (between May 1 and October 31)
- Industrial water supply

These designated uses provide a starting point for discussion about the goals for the Watershed project. The Steering Committee evaluated the designated uses to determine if they are being impaired by pollutants. Designated uses are considered impaired if the water does not meet the State's Water Quality Standards. Designated uses are considered threatened when water quality standards may not be met in the future. The impairment status of the designated uses are listed in Table 3.2.

The Technical Committee later analyzed the designated uses to prioritize each use based on the criteria listed below:

- How are the designated uses impaired in this Watershed?
- What are the ways in which the designated uses are part of the community?
- What is the feasibility of restoring the uses?
- Which restoration efforts will have the greatest cost-benefit ratio?

Consensus was reached in the Technical Committee yielding the following (listed from highest to lowest priority).

Total Body Contact Recreation

Water quality must meet standards of less than 300 count/100 ml in a sample of *E. coli* for areas to be safe for swimming from May 1 to October 31 (MDEQ, 1999). The Lake Huron tributaries in the Watershed are not of adequate depth to provide total body contact recreation; however, Lake Huron provides many of these total body contact recreational opportunities. Water quality monitoring at public beaches have found that most of the county parks have *E. coli* levels that exceed standards and are not meeting designated uses. Pathogens pose an immediate public health hazard; therefore, total body contact recreation is a high priority.

Partial Body Contact Recreation

Water related activities, like fishing and boating, that do not require full body immersion are referred to as partial body contact recreation. Water quality must meet standards of less than 1,000 count/100 ml of *E. coli* for recreational uses (MDEQ, 1999). The Watershed is not meeting its designated use for partial body contact recreation. The popularity of fishing and boating in Lake Huron necessitates the prevention of *E. coli* from entering any water bodies. Since pathogens impose an immediate human health risk, partial body contact recreation is a high priority.

Public Water Supply at Point of Intake

Municipal water supplies must have safe and adequate supplies of surface water. Water quality must be sufficient for conventional water treatment to produce safe and palatable water for human consumption and food processing. With the exception of certain areas within Lexington and Worth Township and the Village of Lexington, the communities in the Watershed use groundwater sources to supply community drinking water. As the Watershed's population expands, more communities will be relying on surface water supplies in the future. The Technical Committee has declared public water supplies from Lake Huron as threatened. Since more people will be relying on Lake Huron for drinking water in the future, this designated use was given a high priority.

Other Indigenous Aquatic Life and Wildlife

In addition to fish, other aquatic life and wildlife in the ecosystem should be considered in all management strategies. A stable and healthy habitat supports populations of wildlife that provide outdoor recreational opportunities like sport fishing, bird watching, and hunting. Healthy habitats have water conditions that are capable of supporting native plant and animal species. Near-shore habitats in the Great Lakes are extremely important to aquatic life and wildlife that depend on coastal habitat for feeding, spawning, and shelter. The Technical Committee has recognized aquatic life and wildlife as threatened and has assigned a moderate priority for this designated use.

Warmwater Fishery

A warmwater fishery is defined by the MDEQ as a water body that is capable of supporting fish species that thrive in relatively warmwater, including any of the following: Bass, Pike, Walleye, and Panfish. Generally, summer temperatures are between 60° F and 70° F and are capable of supporting warmwater fish on a year-around basis. During the spring, most tributaries will support warmwater fish; however, many of the streams are dry by late summer, through fall and winter. The MDEQ Biological Surveys indicate that the tributaries are important spawning areas for Lake Huron fish populations. For the tributaries that contain enough water to support a year-round fishery, the Technical Committee has affirmed the threatened status of the warmwater fishery and has ranked it as a moderate priority.

Agricultural Use

Surface waters used for irrigation, livestock watering, and produce spraying must be consistent and safe. In addition to farm water use, irrigation water supply is also a designated use for maintaining vegetative growth in nurseries, parks, and golf courses. Water resources should be free of pathogens and chemicals that could pose a health risk to livestock and humans. Due to the ephemeral nature of the streams in the Watershed, surface water is not commonly used for irrigation or livestock watering. Most agricultural water use comes from groundwater sources. The Technical Committee rated agricultural use as threatened and ranked it as a low priority.

Industrial Water Supply

Industry depends on large quantities of cool, clean water for material washing or as a coolant. Since ground and surface water resources are variable, there are no industrial water intakes in the Watershed; therefore, industrial water supply is not a designated use.

Coldwater Fishery

A coldwater fishery is considered to have summer temperatures below 60° F and to be able to support natural or stocked populations of brook trout. There are no designated coldwater streams in the Watershed, nevertheless, a 13-inch brown trout was found during a MDEQ Biological Survey in 1994. A coldwater fishery is not a designated use for any of the tributaries.

Navigation

Waterways that provide adequate depth and width for recreational canoeing and kayaking must maintain open, navigable conditions. Due to the intermittent and ephemeral conditions of the Watershed tributaries, navigation is not a designated use.

Table 3.2 - Designated Uses and Impairments

Designated Uses	Priority	Impairment	Pollutants	Evidence	Source	Causes
Total body contact recreation	High	Impaired: beach closures and water aesthetics	*E. coli*	Known: SCHD and MDEQ monitoring	Known: septic systems	Failing septic systems and illicit connections
					Suspected: wildlife	Excessive bird populations in shoreland areas
					Suspected: marinas	Illegal dumping of septic holding tanks
					Suspected: cattle and manure fertilizer	Unrestricted cattle access, manure storage failure, and misapplication of manure
			Sediment	Known: NPS inventory	Suspected: soil erosion	Poor tillage practices and poor soil conditions
					Suspected: road stream crossings	Undersized or misaligned culverts, unpaved road crossings, and berms along road ditches
					Suspected: streambank erosion	Tillage through streambed, unrestricted cattle access, and unauthorized drainage improvements
					Suspected: tile outlets	Improper tile outlet stabilization
					Suspected: construction runoff	Lack of soil erosion and sedimentation controls, lack of permit enforcement
					Suspected: coastal erosion	Failing erosion control devices and coastal development
			Nutrients	Known: MDEQ monitoring, excessive weed and algae growth	Known: septic systems	Failing septic systems and illicit connections
					Suspected: livestock	Unrestricted livestock access
					Suspected: fertilizer	Misapplication of fertilizer
					Suspected: manure storage and feedlots	Spills and feedlot runoff discharge

Table 3.2 - Designated Uses and Impairments

Designated Uses	Priority	Impairment	Pollutants	Evidence	Source	Causes
					Suspected: soil erosion	Poor tillage practices, poor soil conditions, Lack of riparian buffers and filter strips
					Suspected: storm water runoff	Lack of riparian buffers and filter strips, misapplication and disposal of fertilizers
Partial body contact recreation	High	Impaired: beach closures and water aesthetics	*E. coli*	Same as above		
			Sediment	Same as above		
			Nutrients	Same as above		
Public water supply	High	Threatened: clogged intakes and need for tertiary treatment	Sediment	Same as above		
			E. coli	Same as above		
Other indigenous aquatic life and wildlife	Medium	Threatened: state threatened mussel, bird, and plant species	Sediment	Same as above		
			Nutrients	Same as above		
			Habitat loss	Known: Sanilac County planning commission	Suspected: land development	Lack of open space and forest protection in ordinances
Warmwater fishery	Medium	Threatened: low fish populations and fish consumption advisories	Sediment	Same as above		
			Nutrients	Same as above		
			Unstable hydrology	Known: MDEQ biological survey, NPS inventory	Storm water runoff	Land use changes that increase imperviousness and remove permanent vegetation
Agriculture	Low	Threatened: potentially unsafe for livestock watering	*E. coli*	Same as above		
			Nutrients	Same as above		

Table 3.2 - Designated Uses and Impairments

Designated Uses	Priority	Impairment	Pollutants	Evidence	Source	Causes
Industrial use	Low	Not a use				
Navigation	Low	Not a use				
Coldwater fishery	Low	Not a use				

3.4 DESIRED USES

This Watershed Management Plan (WMP) concentrates on surface water quality and surface water resource uses; however, the Technical Committee has recognized the importance of protecting other resources that are equally important and have strong relationships to surface water quality. Water resources that are not listed as a designated use in the Clean Water Act may have significant local importance. These uses for the Watershed's resources have been included in this WMP as desired uses. Desired uses identified by the Technical Committee and Policy Committee are listed in Table 3.3.

Table 3.3 - Desired Uses

Desired Use	Description	Concerns	Goals
Aesthetics	Preservation of rural character and natural scenic beauty	Urban sprawl	Preserve existing forested areas and scenic vistas
Recreation	Preservation of undeveloped shoreline for public use	Rapid coastal development	Preserve remaining undeveloped shoreline with conservation easements and public parks
	Clear and clean water for recreation	Sediment in Lake Huron and tributaries	Create desirable water conditions for swimming and boating in Lake Huron
		Nutrients causing excessive plant growth and algal blooms	
Groundwater	Protection of drinking water	Nutrients infiltrating into groundwater	Private water supplies that meet state water quality standards for drinking water
		E. coli contamination of wells	
		Pesticide contamination of wells	
		Natural sources of arsenic contamination of wells	
Habitat preservation	Preserve existing forested areas in riparian and coastal zones	Urban sprawl	Create interconnected trail system or wildlife corridor in riparian areas
		Rapid development along lakeshore	Preserve remaining undeveloped shoreline with conservation easements and public parks
Stewardship	Enhance local support for protection of watershed resources	Illegal dumping of hazardous waste and trash	Create pride in water resources
		Limited recognition of water resources and their connection with the lakeshore	Enhance county waste collection programs
			Offer volunteer opportunities for stewardship activities

3.5 IMPAIRMENTS TO DESIGNATED AND DESIRED USES

NPS pollution affects water quality and impairs water resource use in many different ways. Storm water runoff may contain nutrients that cause excessive plant growth. Toxics like pesticides can interfere with aquatic organisms. Sediment can fill small pools and rocky areas that fish depend upon for spawning or feeding. Some pollutants can be found in the Watershed at levels high enough to pose a significant human health threat. Prioritization of the impairments will direct the implementation of Best Management Practices (BMPs) that will address impairments to the highest priority water uses. BMPs are land management strategies or structural devices that reduce water pollution (Marsh 1998). Not all BMPs are the most effective or efficient strategy for removing pollutants from all sources. BMP recommendations for each impairment can be found in Chapter 4.

Conclusions from the NPS inventory and past research depict a variety of current and future conditions that threaten and impair water quality in the Watershed. The Technical Committee identified impairments and linked them to the designated uses. The final step in the identification and prioritization of designated uses was to rank the pollutants within each designated use by the amount of degradation the pollutants were causing to surface water. Each identified pollutant was prioritized based on its known toxicity or impairment to water resources and the importance of the water resource use that it was impairing. Pollutants that were known to cause impairments in the Watershed were ranked higher than those that are only suspected to cause impairments. The linkage between the designated uses, impairments, sources, and causes are summarized in Table 3.2. The following pollutants are listed from highest to lowest priority.

***E. coli* Bacteria**

E. coli bacteria are used as indicator of other pathogens in the water. Viruses, bacteria, fungi, and parasites can thrive in the digestive systems of warm-blooded animals. Pathogens come from livestock, improper sanitary waste disposal or inadequate treatment, pet waste in storm water runoff, and wildlife. Water samples taken from Lake Huron and its tributaries indicate that the number of waterborne pathogens pose a significant health threat to recreational water users. Current MDEQ surveys concluded that illicit discharges are likely the primary sources of *E. coli* in Worth Township (Bauer, 2003). It is suspected that agricultural runoff and livestock access are the main source of pathogens north of Lexington. Pathogens are the principal impairment to partial and total body contact recreation and threaten public water supplies.

Sediment

Sediment originates from streambank erosion, cropland runoff, and runoff from unimproved roads. Soils in the Watershed, especially in the headwaters, have a high runoff potential and in some cases are classified as highly erodible land. Fall plowing and tillage through the streambeds in the headwaters leads to greater amounts of erosion and downstream sedimentation. Unrestricted livestock access denudes streambanks of vegetation and can destabilize soils, which leads to streambank erosion. Sediment is a major impairment to warmwater fisheries and other indigenous aquatic life when it covers stream substrate and degrades spawning habitat and feeding areas. Sediment is a moderate impairment to public water supplies and water recreation. The Village of Lexington's water treatment plant has reported that sediment, possibly from dredging activities, has caused premature intake failure. Water recreation is impaired by unpleasant aesthetic conditions in Lake Huron by causing murky, brown water. The NPS inventory identified many eroding streambanks and cropland areas that are adding sediment to the tributaries.

Nutrients

Elevated nutrients in surface water results in overpopulation of aquatic plants and algae that are able to absorb nutrients and grow quickly. Typically, water ecosystems remain in balance because essential nutrients plants need to grow and are limited in the water column. In fresh water ecosystems, phosphorus is the limiting nutrient. Since phosphorus will bond with soil particles, it will stay locked up in the soil and will not seep into ground or surface water. However, when fertilizer is over applied or if soil erosion occurs, phosphorus will runoff into surface water. Once phosphorus is available in the water column, plants and algae growth is no longer limited by a lack of phosphorus. This process is called eutrophication. The presence of excess plants and algae impairs partial and total body contact recreation by creating unsightly conditions and a danger of becoming tangled in weeds while swimming. Excess nutrients impair warmwater fisheries and aquatic life by creating conditions favorable to nuisance plant and algae growth, causing low dissolved oxygen (DO). Nutrient sources identified in the inventory are fertilizer application in or near streams, livestock access, inadequate manure storage, failing septic systems, and cropland runoff.

Low Dissolved Oxygen

Healthy fish and macroinvertebrate populations require DO levels to remain around 5 mg/L. When DO drops below 5 mg/L, fish and macroinvertebrate communities change to more tolerant species, and the stream or lake will no longer support game fish, like trout and salmon (MDEQ, 1999). Excessive amounts of nutrients and organic matter lead to unstable conditions by increasing available nutrients for plants,

algae, and bacteria. When plants and algae blooms reach nuisance levels, DO can drop considerably during hot weather and at night. This is due to plant respiration and oxygen consuming bacteria that are actively decomposing organic matter. Low DO levels for just a few hours can cause fish kills and algal blooms of anaerobic bacteria and algae. Some species of anaerobic bacteria and algae produce foul smelling gases and toxics that can impair water recreation and public water supplies. These conditions are problematic to the Watershed in localized hotspots and are impairing warmwater fisheries and aquatic life and wildlife. Low DO is evident by the types of fish and macroinvertebrates identified in the Watershed inventory and MDEQ Biological Surveys.

Hydrology (Flooding and Unstable Flow)

Erosion and sediment transport are naturally occurring, even in stable streams. Flooding and seasonal high peak flows are common and a stable stream can soon recover. However, changes in land use or dredging and channelization can significantly change flow regimes and permanently damage a stream's ability to recover. Impervious surfaces like parking lots, rooftops, roads, and compacted soil can increase runoff rates and cause severe erosion and sedimentation downstream. Channelization and dredging can reduce the immediate impacts of flooding by increasing stream velocity. However, increased velocity usually results in greater erosion and flooding problems downstream. MDEQ Biological Surveys indicate that high velocity flows, carrying large amounts of sediment, impact fisheries and aquatic life by scouring the stream bottom and flushing aquatic organisms into Lake Huron. Unstable flows pass through the Watershed quickly and drop sediment at the stream mouth. This sediment creates a barrier preventing migration of aquatic life back into the stream. Bare streambanks and local reports of flooding indicate that unstable hydrology may be affecting aquatic life and wildlife and warmwater fisheries.

Pesticides

Chemicals in pesticides intended to eradicate insects and weeds on lawns and crops are often captured in rainwater and washed into streams. Indigenous aquatic insect species are affected as well as the fish and wildlife that depend on them for survival. The abundance of cropland and golf courses in the watershed increase the potential for chemicals to impair designated uses. Although there has not been any water quality monitoring for pesticides in the Watershed, it is suspected to be impairing aquatic life and other wildlife and warmwater fisheries. A study in 1992, of the Saginaw Bay Watershed, found that a number of pesticides were above their State Water Quality Standard Rule 57 (2) Guideline Levels (Public Sector Consultants, 2000). Agricultural practices and soil conditions are similar in the Sanilac County Lakeshore Watershed and the MDEQ study areas. This suggests that water quality monitoring for pesticides may show results similar to the Saginaw Bay Watershed.

3.6 GOALS AND OBJECTIVES

In order to provide direction, the Technical Committee set goals and objectives based on the impairments and water quality improvements. They were then prioritized through a discussion that ascertained the most important issues with regard to each designated use. The goals below are listed from highest priority to lowest.

1. Prevent *E. coli* from entering surface waters and strive to meet applicable water quality standards.

2. Prevent soil erosion and reduce sedimentation in the Lake Huron tributaries.

3. Reduce nutrient loading of Lake Huron and its tributaries in the Watershed with particular attention to sources of phosphorus.

4. Stabilize stream flows to moderate hydrology and increase base flow.

5. Reduce potential for pesticide contamination of Lake Huron and its tributaries within the Watershed.

Objectives were created by examining the goals and determining how these goals would be met. The objectives describe methods of meeting the goals with thought given to land use and management practices, socio-political influences, and environmental limitations. All goals and objectives are intended to address the current watershed conditions and improve water quality over time. Goals and objectives are described in their relationship with the designated uses in Table 3.4.

Table 3.4 - Water Quality Goals and Objectives

Designated Use	Goal	Objective
#1 - Total body contact recreation (swimming) minimum water standard *E. coli* - 300 count/100 ml	**#1** - Maintain *E. coli* levels below Michigan water quality standard of 300 count/100 ml for swimming	Monitor high risk areas
		Find sources from residential areas and prevent them from entering surface waters
		Find sources from agricultural areas and implement BMPs to prevent contamination of surface waters
	# **2** - Prevent soil erosion and excessive sediment loading	Increase use and quality of filter strips and windbreaks
		Promote environmentally friendly agricultural practices
		Review soil erosion and sedimentation control (SESC) inspection and enforcement
	#3 - Reduce nutrient loading	Develop comprehensive nutrient management plan
		Increase use and quality of filter strips
		Promote environmentally friendly agricultural practices
		Address residential septic systems
#2 - Partial body contact recreation (fishing, boating) minimum water standard *E. coli* - 1,000 count/100 ml	**#1** - Maintain *E. coli* levels below Michigan water quality standard of 1,000 count/100 ml for fishing and boating	Monitor high risk areas
		Find sources from residential areas and prevent them from entering surface waters
		Find sources from agricultural areas and implement BMPs to prevent contamination of surface waters
	# **2** - Prevent soil erosion and excessive sediment loading	Increase use and quality of filter strips and windbreaks
		Promote environmentally friendly agricultural practices
		Review SESC inspection and enforcement
	#3 - Reduce nutrient loading	Develop comprehensive nutrient management plan
		Increase use and quality of filter strips
		Promote environmentally friendly agricultural practices
		Address residential septic systems

Table 3.4 - Water Quality Goals and Objectives

Designated Use	Goal	Objective
#3 - Public water supply	**#1** - Zero colonies of *E. coli* in 95% of drinking water samples	Monitor high risk areas
		Find sources from residential areas and prevent them from entering surface waters
		Find sources from agricultural areas and implement BMPs to prevent contamination of surface waters
	# **2** - Prevent soil erosion and excessive sediment loading	Increase use and quality of filter strips and windbreaks
		Promote environmentally friendly agricultural practices
		Review SESC inspection and enforcement
	#3 - Reduce nutrient loading	Develop comprehensive nutrient management plan
		Increase use and quality of filter strips
		Promote environmentally friendly agricultural practices
		Address residential septic systems
#4 - Warmwater fishery (bass, pike, walleye) minimum water quality standard DO ≥ 7 mg/l	# **1** - Prevent soil erosion and excessive sediment loading	Increase use and quality of filter strips and windbreaks
		Promote environmentally friendly agricultural practices
		Review SESC inspection and enforcement
	#2 - Reduce nutrient loading	Develop comprehensive nutrient management plan
		Increase use and quality of filter strips
		Promote environmentally friendly agricultural practices
		Address residential septic systems
	#3 - Stabilize stream flows to moderate hydrology and increase base flow	Promote environmentally friendly planning and development
		Promote environmentally friendly agricultural practices

Table 3.4 - Water Quality Goals and Objectives

Designated Use	Goal	Objective
#5 - Indigenous aquatic life and wildlife	**# 1** - Prevent soil erosion and excessive sediment loading	Increase use and quality of filter strips and windbreaks
		Promote environmentally friendly agricultural practices
(habitat condition and continuity)		Review SESC inspection and enforcement
	#2 - Reduce nutrient loading	Develop comprehensive nutrient management plan
		Increase use and quality of filter strips
		Promote environmentally friendly agricultural practices
		Address residential septic systems
	#3 - Stabilize stream flows to moderate hydrology and increase base flow	Promote environmentally friendly planning and development
		Promote environmentally friendly agricultural practices
	#4 - Reduce potential for pesticide contamination	Encourage use of Farm*A*Syst, Home*A*Syst, and Lake*A*Syst programs
		Establish monitoring and educational programs

3.7 WATER QUALITY SUMMARY

The water quality of the Watershed impairs many of the designated and desired uses due to nonpoin DO dissolved oxygen, pesticides, and unstable hydrology. Biological surveys and water quality monitoring conducted by the MDEQ have found a number of the tributaries have poor macroinvertebrate and fish communities and water bodies that do not meet water quality standards. The NPS inventory has also identified many eroding streams, nutrient hotspots, and sources of pathogens. High levels of *E. coli* bacteria have forced the SCHD to close public beaches generating negative public views about the safety of recreation in the Watershed.

The following Water Quality Summary lists impairments and identifies the designated uses that each are impairing. The impairments are prioritized as high, moderate, or low priority. Objectives associated with each impairment are prioritized as high, medium, and low priorities with an (H) representing high priority, (M) representing medium priority, and an (L) representing low priority.

Known Impairment: ***E. coli***

Description:

E. coli has been a documented problem in the Watershed, particularly in Worth Township. The health risks associated with this bacterium necessitates its inclusion in this WMP to prevent *E. coil* from becoming a continual problem.

Suspected Sources:

E. coli is found in the digestive system of warm-blooded animals and is spread through feces. The detection of *E. coli* in the water column often indicates that other dangerous types of pathogens may be present. *E. coli* cannot live for long periods outside of a host body; therefore, when found in surface water, the source must be relatively close. Potential sources include livestock, wildlife, septic systems, and manure storage areas.

Suspected Causes:

Unlimited access to streams allows livestock to spread bacteria. Leaking and undersized septic systems allow pathogens to enter surface and groundwater. Leaching or overflowing manure storage and over application of fertilizer can add bacteria to streams, particularly after rain events. Wildlife can also introduce pathogens in feeding and nesting areas.

Priorities:

E. coli can cause serious illnesses in humans and animals, and is therefore a high priority impairment to partial and total body contact recreation and public water supply.

Additional Monitoring:

Reducing public concern about the safety of water resources first requires identification of the source. There are many suspected sources of pathogens in the Watershed, and many have significant evidence of their presence. The MDEQ, SCHD, and the Sanilac Conservation District have visual documentation of cattle access, failing or inadequate septic systems, and wildlife in the Watershed; however, there has not been analysis the source of *E. coli*. DNA fingerprinting and extended monitoring in correlation to rain events will provide a definitive answer to the largest source of *E. coli*.

Goal:

- Prevent *E. coli* from entering surface waters and strive to meet applicable Water Quality Standards.

Objectives:

- Encourage continual testing and selective monitoring in high risk areas **(H).**
- Encourage sanitary sewers in areas serviced by water utilities **(H).**
- Limit livestock access with cattle exclusion fencing **(H).**
- Encourage proper management of manure storage areas **(H).**
- Encourage proper maintenance of septic systems **(H).**
- Create a volunteer monitoring program **(M).**
- Investigate use of DNA fingerprinting **(L).**
- Enforce existing septic system codes and investigate septic system ordnances **(M).**

Known Impairment: **Sediment**

Description:

Excess sediment covers stream substrate necessary for fish and macroinvertebrate habitat. Suspended sediment causes turbidity and complicates drinking water treatment.

Known Sources:

Sediment originates from upland and in-stream sources. The NPS inventory identified cropland, construction sites, gullies, and stream crossings as sediment sources.

Known Causes:

Conventional tillage practices that leave soil exposed to water and wind contribute to accelerated erosion. Since the headwater streams are shallow, a source of pollution unique to this Watershed is plowing through the streambed. This is suspected to be the largest source of sediment. Active gully erosion on fields without filter strips or stabilized tile outlets adds sediment to the tributaries. Unrestricted livestock and vehicle access to the stream can destabilize the streambank and cause erosion during rain events and peak flows. (Exposed soil also erodes from construction sites where proper SESC practices are not installed or maintained.)

Priorities:

Sediment is a high priority impairment to warmwater fisheries and indigenous aquatic life and wildlife. It is a moderate level priority to total and partial body contact recreation and public water supply.

Additional Monitoring:

Visual verification of erosion and sedimentation are adequate to establish sediment as a known source of pollution. Additional analysis of soil loss in the headwaters due to conventional tillage and streambed cultivation may help prioritize and establish critical areas.

Goals:

- Prevent soil erosion and reduce sedimentation in the Lake Huron tributaries.

Objectives:

- Enhance agricultural incentive programs that protect riparian areas and vulnerable soils **(H).**
- Promote conservation tillage **(H).**
- Increase use and quality of filter strips and windbreaks **(M).**
- Encourage cover crops **(M).**
- Work with county enforcing agency to ensure effective SESC inspection and enforcement **(M).**

Known Impairment: **Nutrients**

Description:

Excess nutrients, such as phosphorus and nitrogen, cause eutrophication, a cycle that increases plant and algae growth. When algae and plants are unable to photosynthesize, they consume oxygen. Accelerated plant and algal growth can deplete oxygen to the point where many species are unable to survive. Decaying plants, algae, and organic matter also increases biochemical oxygen demand (BOD) and can lead to fish kills and anoxic conditions that cause taste and odor problems in water. Phosphorus is the limiting nutrient of freshwater ecosystems and its presence in the water column can trigger algal blooms.

Known Sources:

Nutrients in fertilizers used in agricultural and landscaping applications enter ditches and streams via storm water runoff. Nutrients concentrated in human and animal wastes are introduced into surface waters through manure storage areas, septic systems, and direct discharges from livestock access. Phosphorus attaches to soil particles and will enter the water during soil erosion.

Known Causes:

Improper fertilizer and manure application and storage allow nutrients to enter surface water and groundwater. Septic system failures and direct discharges of sanitary wastes have been identified by the MDEQ, SCHD, and Sanilac Conservation District. Lack of buffer strips and streambed cultivation allow unfiltered field runoff and sediment to enter streams and drains.

Additional Monitoring:

Visual identification of nutrient sources has adequately proven that agricultural and landscape application of fertilizers is being released into the Watershed. Nuisance levels of plants and algae are evidence of excess nutrients in Lake Huron and its tributaries. Additional monitoring may be beneficial to quantify nutrient sources to increase the efficiency of BMPs.

Goal:

- Reduce nutrient loading of Lake Huron and its tributaries in the Watershed with particular attention to sources of phosphorus.

Objectives:

- Encourage development of Comprehensive Nutrient Management Plans **(H).**
- Encourage use of cattle exclusion fences and filter strips **(H).**
- Address residential septic systems **(H).**
- Encourage conservation tillage **(H).**

Suspected Impairment: **Low Dissolved Oxygen**

Description:

Warmwater fisheries depend on DO to maintain a healthy ecosystem balance. DO problems occur when nutrient levels are out of balance (see description of nutrients) or when organic matter enters the water. Aerobic bacterial decomposition of organic matter can significantly lower DO to the point where warmwater fish species cannot survive.

Suspected Sources:

Septic systems, fertilizer, and livestock contribute nutrients that lead to eutrophic conditions and low DO. Unfiltered storm water runoff from fields and turf also contains nutrients and organic matter.

Suspected Causes:

Over application or poorly timed fertilizer and manure application allow nutrients and organic matter to enter surface water and groundwater. Septic system failures and direct discharges of sanitary wastes have been identified by the MDEQ, SCHD, and Sanilac Conservation District. Lack of buffer strips and streambed cultivation allow unfiltered field runoff and sediment to enter streams and drains.

Additional Monitoring:

BOD requires extensive laboratory analysis. Visual identification of nutrient and organic matter sources provides adequate evidence that BOD is impairing aquatic life and warmwater fisheries, but it is unclear to what extent and the significant sources. DO monitoring is recommended.

Priorities:

Low DO is a moderate priority for indigenous aquatic life and wildlife and warmwater fisheries.

Goal:

- Reduce amounts of nutrients and organic matter entering Lake Huron and its tributaries in the Watershed.

Objectives:

- Encourage development of Comprehensive Nutrient Management Plans **(H).**
- Encourage use of cattle exclusion fences and filter strips **(H).**
- Address residential septic systems **(H).**
- Encourage conservation tillage **(H).**
- Create volunteer monitoring program **(M).**

Known Impairment: **Unstable Hydrology**

Description:

Most of the streams in the Watershed are characterized by swift moving high water immediately following rain events and very low levels during dry periods. Flashy flows are harsh on fish and macroinvertebrates and lead to streambank erosion.

Suspected Sources:

Alteration of drainage patterns and changes in land use affect the natural hydrology of a stream.

Suspected Causes:

Establishment of drains and stream channelization increases the speed of water transport from a site; however, it creates unstable hydrologic conditions downstream. Land use changes from forested and wetland vegetation increases soil imperviousness and destabilizes hydrology.

Additional Monitoring:

A hydrologic study may be beneficial to determine what BMPs are necessary to reduce the impact of development and agriculture on the Watershed. A hydrologic study is required for all streambank stabilization projects funded by the EPA or the MDEQ.

Priorities:

Unstable hydrology is a moderate impairment to indigenous aquatic life and wildlife and warmwater fisheries.

Goals:

- Stabilize stream flows to moderate hydrology and increase base flow.

Objectives:

- Encourage conservation tillage **(H).**
- Encourage conservation easements in riparian areas **(M).**
- Encourage use of cover crops **(M).**
- Work with townships to create ordinances that protect open space and forested areas and limit impervious surfaces **(M).**
- Explore low impact development concepts with county and township officials **(H).**

Suspected Impairment: **Pesticides**

Description:

Pesticides include all chemicals used to control or eradicate nuisance pest species. These compounds will break down in the natural environment; however, they are easily picked up by precipitation and washed into streams. Insecticides are usually the most problematic since they are very toxic to aquatic life, wildlife, and fish.

Suspected Sources:

Improper storage, transport, or application of pesticides can result in field and turf grass runoff to streams and ditches.

Suspected Causes:

Runoff from turf grass and fields are the most likely causes for contamination. Over application of pesticides or application just before a rain event can cause runoff into streams and ditches. Irrigation systems with pesticide delivery capability may fail and siphon pesticides back into the water source.

Additional Monitoring:

Pesticide monitoring has not been performed in the Watershed due to its high cost for performing laboratory analysis and the many types of pesticides that are used in the Watershed. Before habitat restoration BMPs are used, a pesticide screening may be beneficial to confirm that wildlife and aquatic life would not be impaired by pesticide runoff.

Priorities:

Pesticides are a low priority to indigenous aquatic life and wildlife.

Goal:

- Reduce potential for pesticide contamination of Lake Huron and its tributaries within the Watershed.

Objective:

- Increase number of Farm*A*Syst, Home*A*Syst, and Lake*A*Syst programs **(H).**
- Establish monitoring program **(M).**
- Encourage participation in Clean Sweep Program **(M).**
- Create model ordinances for pesticide use in riparian areas **(M).**

CHAPTER 4 - IMPLEMENTATION STRATEGY

4.1 CRITICAL AREAS

The Technical Committee designated areas considered as the most critical based on the project's goals and objectives. Critical areas of the Sanilac County Lakeshore Watershed (Watershed) are those areas that have specific nonpoint source pollution concerns that need to be addressed with Best Management Practices (BMPs). Certain land use practices, soil types, and agricultural operations define the area of water quality impact. These areas are identified as highly probable of discharging pollutants to surface water, for example, failing septic systems and agricultural areas without stream buffers. The Watershed has many different land uses that contribute different types of pollutants in many different ways. As a result, five categories of critical areas were created and are delineated in Figure 11.

Chapter 3 described water quality in the Watershed and the pollutants that are known and suspected to be impairing water resource use. Using the known and suspected pollutant sources developed by the Technical Committee, a classification of critical areas was identified and is described below.

4.2 DESCRIPTION OF CRITICAL AREAS

4.2.1 AGRICULTURAL *E. COLI* CRITICAL AREAS

The Watershed inventory has identified a number of concentrated animal feeding operations (CAFOs), illegal sewage connections to surface water, and livestock access sites that may be contributing *E. coli* to surface water.

Unrestricted livestock access, manure storage, and improper land application of manure have been identified in the Watershed inventory but they are difficult to place in a critical area, due to the transient and variable nature of these types of pollutant sources. The types of *E. coli* sources listed above can be installed, removed, or relocated and they tend to be sources of pollution due to their nature and not to incompatible land use and environmental conditions. Potential agricultural sources of *E. coli* identified in the Watershed inventory are included in the critical area and are shown as a cow symbol in Figure 11. Additional sources of *E. coli* may be found and included in future revisions of the Watershed Management Plan (WMP). *E. coli* sources will be addressed on a site-by-site basis during the implementation phase of this project.

4.2.2 RESIDENTIAL *E. COLI* CRITICAL AREAS

One of the major concerns in this Watershed is the high levels of *E. coli* that have been detected in some swimming areas and nearby tributaries. The Michigan Department of Environmental Quality (MDEQ) and the Sanilac County Health Department (SCHD) sampling have shown that *E. coli* is at levels high enough for immediate concern. Following a sanitary survey of Worth Township, the MDEQ has mandated that Worth Township build a sanitary sewer along M-25. Additional sanitary surveys completed in other areas of the Watershed may have similar results. Conditions may become worse in the future as water utilities are expanded. The expansion of utilities gives coastal residents access to abundant household water supplies and thereby increases loads on septic systems. Coastal areas with poor soil conditions, high-density plots, and no access to sanitary sewer utilities are high priority critical areas for *E. coli*. The residential *E. coli* critical area is included in the coastal zone/development critical area that is described below.

4.2.3 CRITICAL AGRICULTURAL HEADWATERS

Sediment has been identified as the second highest priority pollutant in the Watershed. Sources of sediment identified in the Watershed inventory include streambank erosion, construction runoff, row crop runoff, tile outlet erosion, rill and gully erosion, livestock access, and trash and debris. In addition to the direct impairments caused by sedimentation, the soil particles may contain attached pollutants like nutrients, pesticides, pathogens, and organic matter. Of the sediment sources listed above, it is suspected that row crop runoff and streambank erosion are the most significant. Although streambank erosion is a problem in the Watershed, the Technical Committee will first focus on areas with intense soil erosion.

Sediment and attached pollutants can travel great distances before reaching streams and ditches. Riparian buffers and filter strips can trap sediment before it reaches surface waters; nevertheless, it is recommended that prevention of soil erosion should be a higher priority since it is more cost effective and ensures protection of soil fertility. The Watershed inventory has shown that the majority of stream segments in the headwaters are shallow enough to allow cultivation through the stream channel. These conditions have resulted in a lack of riparian buffers in agricultural areas. Figure 11 shows critical agricultural areas that are most likely to contribute sediment. The critical agricultural headwaters are represented by a 1/4-mile sediment zone surrounding headwater streams in agricultural areas. The critical agricultural headwaters total 71,079 acres.

4.2.4 COASTAL ZONE/DEVELOPMENT CRITICAL AREAS

Coastal areas require protection from development and pollutant impacts to preserve cultural heritage, recreation potential, and sensitive habitats. Coastal communities in the Watershed are popular tourist locales because of their cottage charm and historic downtowns. Without careful planning, the character that draws tourism could be lost due to rapid development and water pollution. The coastal zone critical area is shown in Figure 11 as an approximate 1,000-foot buffer along the entire Lake Huron shoreline and route M-25. Land development is expected to occur along the M-46 and M-90 corridors that run east and west across Sanilac County. A 1,000-foot buffer along these highways is identified as a critical area. The Sanilac County Planning Commission has recommended the coastline and state trunk lines as urban service areas in the Sanilac County Master Plan. Therefore, additional protection of the coastline is necessary to prevent sever impacts from the inevitable development.

4.2.5 PRESERVATION CRITICAL AREAS

Stream corridors in the critical area are distinguished from the headwaters by having deep stream channels. The deeper channels make it difficult for cultivation and land development. As a result, these areas have forested buffers and natural channel morphology. The deep channels in the critical stream corridor areas have potential for stream restoration and habitat preservation. Michigan Department of Natural Resources biologists have indicated that the Lake Huron Tributaries in Sanilac County contain a great deal of near shore habitat for aquatic life and wildlife (Morse, 2003). There are over 15,000 acres of forested and wetland areas in the Watershed, however, there are very few north-south corridors to provide a connection between the forested streams that run east and west. Contiguous forested areas larger than 40 acres or adjacent to a stream or coastline are identified as critical preservation areas. Critical preservation areas are represented in Figure 11 as a green overlay and total 11,957 acres.

4.3 BEST MANAGEMENT PRACTICE RECOMMENDATIONS

BMPs can remove, reduce, or prevent water pollution. BMPs are classified in three groups: managerial, structural, and vegetative (MDEQ, 1998). Behavioral changes that lessen water quality impairments, conservation tillage for example, are managerial BMPs. Structural BMPs are physical systems that require the construction of devices that alter storm water flow to remove or reduce the impairments caused by certain land uses. Examples of a structural BMPs are check dams, detention basins, and rock riprap. BMPs that utilize plants to stabilize soils, filter runoff, or slow water velocity, are categorized as vegetative BMPs.

In some cases, the BMP will not fall into any category as described above. One such example is educational programs. Information and Education (I&E) strategies are a requirement of all BMPs. Without I&E, land owners, residents, and municipal officials will not have an understanding of why BMPs are needed. A detailed description of recommended I&E activities can be found in Chapter 5.

Recommendations for systems of BMPs are based on generalizations about the sources of water quality impairments. The Technical Committee has developed the systems of BMPs included in this document after review of the Watershed inventory and discussion about what practices will be socially acceptable or feasible in the Watershed's economy and existing conditions. BMP treatments may not work on all locations; therefore, it will be necessary to revisit each site before final plans are made for implementation. In addition to physical conditions of the site, a BMP will not work if the property owner has not been made a cooperative partner in the decision making process.

The following BMP recommendations are based on the sources identified in the Watershed inventory. Implementation of the following recommendations will be prioritized based upon the primary pollutant removed by the BMP. Since the Technical Committee identified *E. coli* as the highest priority pollutant, BMPs that address pathogen contamination will be given the greatest attention. An illustration of the relationship between critical areas, pollutant sources, and recommended BMPs, can be found in Table 4.0. The BMP recommendations for each critical area are listed below. Pollutants in each category are listed from highest to lowest priority. Goals for implementing the WMP's recommendations are based on the pollutant load reductions expected from each BMP. The action plan in Table 4.2 specifies the guidelines for BMP implementation. In some cases, the system of BMPs will mitigate more than one pollutant and may be included in the action plan more than once.

Table 4.0 - Recommended Systems of Best Management Practices

Critical Area	Pollutant	Source	Recommended BMP Systems
Agricultural *E. Coli*	*E. coli*	Livestock	Cattle exclusion, alternative water supply, buffer strips
		Fertilizer runoff	Comprehensive nutrient management plan, Michigan agriculture environmental assurance program, conservation easements, Field*A*Syst, winter cover crops, soil testing, liquid manure injection
		Manure storage and feedlot runoff	Comprehensive nutrient management plan, Farm*A*Syst, agricultural waste management system, spill containment, Michigan agriculture environmental assurance program
Urban *E. coli*	*E. coli*	Septic systems	Illicit discharge elimination plan, home transition inspection and enforcement, low impact development ordinances, education through Home*A*Syst
		Boats	Enforcement, marina facility upgrades, Education
		Wildlife	Riparian buffers
Agricultural headwaters	Sediment	Soil erosion	Conservation tillage, cover crops, conservation reserve program, filter and buffer strips, conservation easements, conservation tillage farmers association
			Winter cover crops, conservation reserve program, conservation tillage, field tile
		Road stream crossings	Pave road crossing, replace undersized or misaligned culverts with box culvert
			Turn outs along ditch, stabilize ditch outlet to stream
		Streambank erosion	Filter and buffer strips, conservation easements, field tiles
			Cattle exclusion, alternative water supply, buffer strips
			Enforce permit use, stream restoration
		Tile outlets	Outlet stabilization, revegetation, and stream restoration
	Nutrients	Livestock	Cattle exclusion, alternative water supply, buffer strips
		Fertilizer runoff	Comprehensive nutrient management plan, Michigan agriculture environmental assurance program, conservation easements, Field*A*Syst, winter cover crops, soil testing, liquid manure injection
		Manure storage and feedlot runoff	Comprehensive nutrient management plan, Farm*A*Syst, Agricultural Waste Management System, Spill containment, Michigan Agriculture Environmental Assurance Program

Table 4.0 - Recommended Systems of Best Management Practices

Critical Area	Pollutant	Source	Recommended BMP Systems
		Soil erosion	Conservation tillage, cover crops, conservation reserve program, filter and buffer strips, conservation easements, conservation tillage farmers association
			Winter cover crops, conservation reserve program, conservation tillage, field tile
	Pesticides	Field runoff	Continuous conservation reserve program, conservation easements
			Storage spill containment, hazardous waste collection, education
Coastal Zone / Development	Nutrients	Septic systems	Illicit discharge elimination plan, home transition inspection and enforcement, low impact development ordinances, education through Home*A*Syst
		Storm water runoff	Soil testing, Home*A*Syst, Lake*A*Syst, fertilizer ordinance
	Sediment	Streambank erosion	Low impact development ordinance, buffer ordinance, streambank restoration, upstream storage
			Adopt-A-Stream, Name-A-Stream, improved county waste disposal program, volunteer stream clean-ups
		Road stream crossings	Pave road crossing, replace undersized or misaligned culverts with box culvert
			Turn outs along ditch, stabilize ditch outlet to stream
		Construction runoff	Low impact development ordinance, SESC enforcement, buffer ordinance, road commission enforcement of ditch seeding
		Coastal erosion	Setback ordinance and groin and seawall removal
	Pesticides	Storm water runoff	Riparian buffers, hazardous waste collection program, Home*A*Syst, Lake*A*Syst, pesticide ordinance
Preservation	Sediment	Streambank erosion	Low impact development ordinance, buffer ordinance, streambank restoration, upstream storage
			Adopt-A-Stream, Name-A-Stream, improved county waste disposal program, volunteer stream clean-ups
		Road stream crossings	Pave road crossing, replace undersized or misaligned culverts with box culvert
			Turn outs along ditch, stabilize ditch outlet to stream
		Tile outlets	Outlet stabilization, revegetation, and stream restoration
	Nutrients	Septic systems	Illicit discharge elimination plan, home transition inspection and enforcement, low impact development ordinances, education through Home*A*Syst

Table 4.0 - Recommended Systems of Best Management Practices

Critical Area	Pollutant	Source	Recommended BMP Systems
		Field runoff	Continuous conservation reserve program, conservation easements
			Storage spill containment, hazardous waste collection, education
	Unstable hydrology	Storm water runoff	Low impact development ordinance, buffer ordinance, open space preservation

Table 4.1 - Best Management Practice Implementation Guidelines

Pollutant	Best Management Practice	Guidelines
E. coli from agriculture	Michigan Agriculture Environmental Assurance Program (MAEAP)	Dairy farms with over 250 animal units
		Farms within 500 feet of surface water
		Farm*A*Syst should encourage compliance with MAEAP
	Comprehensive Nutrient Management Plan (CNMP)	Farms with over 250 animal units
		Farms within 500 feet of surface water
		Farm*A*Syst should encourage development of CNMP
	Permanent vegetative cover	Highly erodible land, steep slopes, and riparian areas should be enrolled into Conservation Reserve Program (CRP)
		Fields that are too small for adequate buffer and filter strip
		Emergency soil protection in critical areas
	Cover crops	Encourage fall cover crops of wheat or rye to increase residue
		Aerial seeding into standing no-till corn and soybeans
		Highly recommended for fields with winter liquid manure application
		Not recommended for highly erodible land, steep slopes, or areas near surface water these should be enrolled into CRP and planted with permanent vegetative cover
	Soil and manure testing	Highest priority in critical agriculture headwaters
		Encourage as part of agriculture assistance programs
	Cattle exclusion	Prioritization based on pastures identified in the NPS pollution inventory
		Cattle exclusion will include adequate buffers

Table 4.1 - Best Management Practice Implementation Guidelines

Pollutant	Best Management Practice	Guidelines
		Provide technical and financial assistance for constructing alternate water supplies and reinforces cattle crossings
E. coli from urban	Point of sale inspection	Highest priority in coastal zone critical area
		Incorporate into Home*A*Syst program
	Low impact development ordinances	Encourage open space use for leach fields
		Encourage use of community septic systems or municipal sewage treatment
		Encourage higher density in urban service areas
	Buffer ordinance	Require drain fields to use a 50-foot setback from surface water
	Illicit discharge inspection ordinance	Grant townships and villages authority to inspect septic systems
	Beach signage	Signage at marinas and beaches about causes of beach closings
Sediment, nutrients, and attached pollutants	Conservation tillage	Highest priority in critical agriculture headwaters
		Zone or strip tillage
		Highly erodible land, steep slopes, and riparian areas should be enrolled into CRP
		Riparian areas should use buffer and filter strips
		Create conservation tillage alliance
		Create conservation tillage assistance program
	Buffers and filter strips	Highest priority in critical agriculture headwaters
		High priority in agricultural areas
		Moderate priority in urban areas
		Encourage agricultural landowners to enroll in CCRP
		Strongly encouraged in fields along road ditches and fields that are already divided
	Permanent vegetative cover	Highly erodible land, steep slopes, and riparian areas should be enrolled into CRP
		Fields that are too small for adequate buffer and filter strip
		Emergency soil protection in critical areas
	Cover crops	Encourage fall cover crops of wheat or rye to increase residue

Table 4.1 - Best Management Practice Implementation Guidelines

Pollutant	Best Management Practice	Guidelines
		Aerial seeding into standing no-till corn and soybeans
		Highly recommended for fields with winter liquid manure application
		Not recommended for highly erodible land, steep slopes, or areas near surface water these should have permanent vegetative cover
	Tile outlet stabilization	Education through Field*A*Syst and Farm*A*Syst
		Informational material for permit requirements
	SESC	County enforcement
		Informational material for permit requirements
		Road commission enforcement of seeding requirements for ditches
	Road/stream crossing improvements	Turn outs on gravel roads after regrading
		Paved road approaches
		Stabilize outlet from ditch to stream
		Use native vegetation in ditches
		Replace undersized or misaligned culverts with box culverts
Nutrients	Turf grass management	Highest priority for golf courses
		MSUE turf grass management certification
		High priority in coastal zone critical areas
	E. coli BMPs	Following BMPs that address *E. coli* issues will have similar effects on nutrients coming from waste sources
	Sediment BMPs	Following BMPs that address sediment issues will have similar effects on nutrients attached to soil particles
Urban nonpoint source pollution	Low impact development ordinances	Highest priority in coastal zone/development critical areas
		Discourage development of preservation critical area
	Coastal overlay district	Buffer ordinance requiring 50-foot setback from surface water
		Minimum lot width along shoreline
		Tree preservation ordinance along shoreline and M-25 corridor
	Green growth strategies	Investigate preservation of forested areas larger than 40 acres

Table 4.1 - Best Management Practice Implementation Guidelines

Pollutant	Best Management Practice	Guidelines
		Connect greenbelts with existing trail ways
		Prioritization based on natural features inventory and a land conservancy's recommendations
		Conservation easements in low impact development subdivisions
	Farmland preservation	Encourage enrollment of prime farmland into PA 116
		Investigate use of purchase of development rights and transfer of development rights in the coastal zone/development critical area
		Update master plans to identify goals for farmland preservation
	Stewardship	Enhance County waste collection options
		Adopt-A-Stream program
		Name-A-Stream fund raiser
		Pollution ordinance
		Volunteer stream monitoring and clean-ups

4.3.1 BEST MANAGEMENT PRACTICES FOR AGRICULTURAL *E. COLI* AREAS

The first step to combating an *E. coli* problem is finding its source. Since *E. coli* and its associated pathogens need warmwater to survive, they do not live long in surface water and are rarely found in moving streams for more than 24 hours after release from its source. In some cases, *E. coli* can survive for longer periods in stagnant warmwater and sediment. After rain events or sediment disturbance, *E. coli* can be resuspended, making *E. coli* monitoring more difficult. The most common sources of pathogens are livestock, failing septic systems, illicit sewage connections, and wildlife. Unfortunately, without knowing the source, it is difficult to prescribe a system of BMPs that will prevent all *E. coli* problems.

Accurately identifying the source of *E. coli* is very expensive and the results are sometimes vague, leading to inaccurate conclusions. Since *E. coli* is a self-replicating organism, it contains DNA. Laboratories are now able to examine a bacterial colony and make accurate assessments about the source species of the *E. coli.* Other agencies in Michigan are experimenting with other source indicators, for example, caffeine to identify human sources and antibiotics to identify cattle feed lot sources. Tests for these indicators are less expensive than DNA identification. This information greatly increases the likelihood of identifying the source and more importantly directing attention to the correct system of BMPs.

Manure Storage

Preventing animal waste from entering the streams requires removing risks of contamination and reducing likely impacts if contamination occurs. Feedlots, animal holding areas, milk house drainage, and manure storage should not be placed adjacent to a water body. Land owners who complete a Farm*A*Syst, CNMP, or a Manure Management Plan will receive proper guidance on handling animal waste and locating areas for waste storage. The most significant recommendation in a CNMP is a strategy to keep clean storm water free from contamination by reducing runoff over manure storage areas and feedlots. In addition, riparian buffers, filter strips, and spill containment, if applicable, should be used to block animal waste from reaching water bodies, thereby curtailing *E. coli* contamination, nutrients, and BOD.

Costs for CNMP design and implementation are unaffordable for medium sized farms. However, the Watershed most significant sources of agricultural *E. coli* are coming from medium sized farms. Funding for these projects could be available through the Environmental Quality Incentive Program (EQIP). Michigan Natural Resources Conservation Service (NRCS) estimates that the average medium sized farm would need $125,000 to design and implement a CNMP. If EQIP funding is available, the cost share for each farm would still be in excess of $30,000. This amount may still be prohibitive to a medium sized farm. The 25% non-federal dollars match requirement could be met by Clean Michigan Initiative (CMI) funds since CMI is a state bond program. Combining the EQIP and CMI funding is a strategy for farmers to implement a CNMP without financial risk.

Livestock Access

Unrestricted livestock access, inadequate manure storage, misapplication of manure fertilizer, and feedlot discharges are all possible sources of pathogens. Preventing animal waste from reaching water bodies will not only minimize *E. coli* contamination, but also lessen phosphorus, nitrogen, and BOD contamination. Sanilac Conservation District staff will visit landowners and operators at each site to address potential pollution sources and inform the landowner of options or programs that would reduce risks of bacterial contamination.

The effects of livestock access to streams can be severe. There is a twofold problem: waste elimination into the water, and destruction of streambanks. Livestock waste contaminates water with *E. col*i and excessive nutrients. Even if livestock are allowed near the bank, their waste can wash directly into a water body. As livestock climb streambanks or traverse ditches, they will compromise the integrity of riparian vegetation, compact soils, and cause banks to slump, leading to sediment problems and streambank erosion. Livestock should be excluded from streams by using fencing and alternative

watering systems. Fencing should be placed at a distance to provide adequate buffers from surface water, especially on a slope. If necessary, cattle crossings can be constructed of materials that will not erode under their weight. Cattle exclusion typically has high start-up costs, requires fence and buffer area maintenance, and results in some loss of pasture area. The benefits are compliance with the Generally Accepted Agricultural Management Practices (GAAMPs), which is a protection from litigation.

Manure Fertilizer

If mishandled or over-applied, animal manure may contaminate water supplies with pathogen, nutrients, and organic matter causing water quality impairments. Proper manure management is made difficult by the cost of manure transport, the suitability of the soil for application, and the costs of soil injection. In the future, regulations are likely to require approved manure management plans. Voluntary compliance would provide more flexibility and there are cost share options for manure managers to develop a CNMP and improve manure storage facilities. Farmers can reduce the risk of environmental contamination and legal suits by participating in the MAEAP.

Land application of manure is the oldest and most practiced method of animal waste processing. Manure may include animal excrement, wastewater, spilled feed, open feedlot runoff, and bedding. In addition to providing plant nutrients, manure applications improve soil structure, tilth, and other soil physical properties (Purdue, 2003). Most problems with land application of manure occur when application rates exceed the rate at which the soil can absorb liquids and incorporate nutrients. The rate that soil will absorb manure is dependant on tillage practices, timing of application, temperature, soil moisture, slopes, and soil types. Corn and soybean rotations do not provide enough post-harvest residue to hold liquid manure applications on the soil. Using a fall cover crop of winter wheat or rye is recommended for any fields that receive winter manure application. Steep slopes or fields that contain a watercourse should never have winter manure applications. Soils with a slope greater than “C” should be enrolled into the CRP and planted with permanent vegetative cover. (See Section 1.3 for a definition of slope erodibility class.)

Currently, land enrolled in the CRP cannot receive application of manure fertilizer. This condition may discourage some landowners from enrolling fields into CRP. It is a recommendation of the Technical Committee that the Sanilac County CRP Board remove this prohibition in light of criteria developed for landowners who wish to apply manure. Criteria proposed by the Technical Committee are: compliance with specified application rates, injection of manure, and avoiding slopes and riparian areas. Manure fertilizer applications that comply with these conditions would be allowed on land enrolled in CRP.

4.3.2 BEST MANAGEMENT PRACTICES FOR RESIDENTIAL *E. COLI* AREAS

Household sources of *E. coli* are typically from illicit sewage connections (direct discharges to surface water) or failing septic systems. Residential sources of *E. coli* are identified in the Watershed inventory as Urban/Residential NPS Pollution and are included in Appendix 5. The SCHD has been working with homeowners to properly maintain their septic systems. Currently, the SCHD performs a sanitary inspection when individuals apply for a building permit or a complaint is filed of a suspected septic failure. This program could be enhanced through sound enforcement and homeowner education. Addressing the primary concern of pathogen contamination should have ancillary benefits of reducing nutrients and BOD.

A good time to inform homeowners of septic system maintenance requirements is during the home buying process. Currently homebuyers are responsible to have septic systems inspected before the home is purchased. Unfortunately, many homebuyers opt out of inspections and choose to believe that the septic system is in perfect working order. Many times, especially in the densely population coastal area, the system is failing, and the homebuyer does not recognize the warning signs or understand the risks of owning a home with a failing septic system. A program to educate would be homeowners about septic systems would greatly reduce the likelihood of septic system failures.

The point of purchase is a perfect opportunity to provide the buyers with literature, show them where the septic tank and leach fields are located on the property, and explain the indicators of a failing septic system. Similar programs are being developed around the State of Michigan and successful components could be applied in the Watershed. This approach does have limitations since it requires a change of home ownership and many of the homes along the Lake Huron shoreline have been owned in the same family for multiple generations. A solution to this problem could be promoting the Home*A*Syst program where existing homeowners would receive curricula regarding proper septic system maintenance. One method for funding this program is to require a percentage of the home sale to go into a health and safety inspection fund. This fund would afford staff and the necessary field inspection equipment and tests. County health departments, realtors, mortgage companies, MSUE, or a cooperative effort of these groups could do these procedures.

Worth and Lexington Townships and the Village of Lexington have been required to submit storm water discharge permits to the MDEQ to comply with the National Pollutant Discharge Elimination System (NPDES) requirements. One of the permit requirements is to develop an Illicit Discharge Elimination Plan that actively seeks out and corrects illicit connections. These communities must perform an inventory of their municipal separate storm water system (MS4) and surrounding watershed to identify dry-weather outfall flow. A map of the regulated urbanized area is shown in Figure 1. Dry weather flow is a possible indicator of illicit sewage connections to surface water. When an illicit sanitary connection is found, the communities will exercise their enforcement powers to have the property owner correct the illicit connection.

Some municipalities may choose to upgrade sanitary sewer services. This would reduce septic failure problems and illicit connections. This may be the only solution to areas with high housing density and lot sizes insufficient for adequately sized leach fields. The need for sanitary sewers may be compounded by supplying a public water supply. Public water utilities increase water usage in areas that were limited by groundwater supplies. This situation occurred in Worth Township and shortly after the township found it necessary to install a sanitary sewer service to combat the escalating problem of failing septic systems.

Other options to reduce pathogen contamination of surface and groundwater are increasing the minimum lot size to provide room for adequately sized leach fields and requiring buffers between the septic system and drinking water intake. These solutions are not always recommended since they make extensions of public services more costly per capita. For example, to connect 10 homes to a sewer may require one mile of lines in a low-density development. The same number of homes in a high-density development could be connected to a sewer with only 1/4 mile of new lines. The low-density option provides only a short-term solution to reduce the chance of well contamination by septic fields.

Other sources of *E. coli* that are suspected in residential areas are wildlife and illegal dumping of boat wastes. Residents living in or near shore areas and visitors to public beaches need to be aware that *E. coli* is a concern for all recreational users of Lake Huron. The SCHD posts signs notifying beach visitors about water health and safety. Additional signage is needed at these beaches and the marinas to inform visitors and residents about causes of beach closings and ways to prevent future contamination by using proper boat operation and septic maintenance and not feeding waterfowl. Education of boat owners could be provided by the marinas at the time customers purchase boat slips.

4.3.3 BEST MANAGEMENT PRACTICES FOR CRITICAL AGRICULTURAL HEADWATERS

Sedimentation problems usually have the greatest impact much further downstream from their source. The largest sediment impacts in the Watershed occur in Lake Huron where sediment impairs the designated uses of water recreation and public water supply. It is suspected that the sediment is originating from soil erosion in the Watershed's headwaters where agricultural practices are the most intense. Preventing soil erosion not only reduces sedimentation downstream, but also reduces pesticides, and nutrients that are attached to soil particles. Agricultural soil erosion sites are identified in the watershed inventory as tile outlet erosion, streambank erosion, and row crop runoff.

Sediment from agricultural sources is the result of many processes working together to cause soil detachment and downstream deposition. The single largest cause of sedimentation in the Watershed is suspected to be from row crop runoff. Soil conditions in the Watershed's headwaters create many shallow stream channels. When these channels are plowed through, loose soil fills in the channel and washes out after a rain event or snow melt. The imperviousness of these soils has resulted in landowners performing drainage improvements like tiling or dredging. These two practices, when done improperly, can accelerate erosive processes.

Prevention of soil erosion and sedimentation can be accomplished using one, or a combination of two methods. The first, and most desirable method, is preventing soil erosion in the field. This can be done by maintaining crop residue, planting cover crops, reducing slope length or height, and reducing wind and water velocities with vegetation. The second strategy is to capture sediment in the field by directing runoff through BMPs that filter or trap sediments. Successful secondary strategies include filter strips and sediment retention basins. It is important to note that most BMPs for capturing sediment will not catch the smallest soil particles that are the most likely to carry attached pollutants (Thompson, 1989). Therefore, since two of the goals of this project are to reduce BOD and pesticide contamination, it may be more beneficial to focus on BMPs that prevent soil detachment rather than those that capture sediment.

Farm Bill

The United States Department of Agriculture (USDA) has set a standard for soils that are considered Highly Erodible Land (HEL). Under the USDA's definition of HEL, any farmers cultivating land that potentially has erosion rates higher than eight times the sustainable productivity rate will loose their federal farm subsidy benefits and cannot participate in any federal agriculture incentive programs. Farmers must demonstrate that they are protecting the soil against excessive erosion. The majority of the soils in the Watershed are not classified as HEL; however, it is evident that a great deal of erosion is occurring. The Technical Committee has suggested that soils with a slope range greater than a "C"

classification should be categorized as a having a high risk of erosion and given a higher priority in the Critical Agriculture Headwaters. Slope ranges for the Watershed are shown in Figure 4.

Conservation Tillage Farmers' Alliance

Conservation tillage has been recommended to agricultural producers for a number of years. However, the adoption of conservation tillage practices have had limited success in the Watershed due to crop rotations that include edible beans and sugar beets. If an agriculture incentive program were created to promote conservation tillage, it would become a more acceptable practice in the Watershed. The incentive program would have to provide cost share for the first five years to cover lost farm income that is common during the first two to three years of conservation tillage.

A conservation tillage program would have a greater likelihood of success if conservation tillage equipment and technical assistance was made available through a farmer's association or the Sanilac Conservation District. The Huron County Michigan State University Extension helped establish the 21st Century Alliance of Michigan (Alliance), formerly known as Innovative Farmers of Michigan. Since their inception, the Alliance has completed research on conservation tillage in local markets and soils that support rotations of corn, soybeans, sugar beets, and wheat. Members in Huron, Tuscola, and Sanilac Counties have discovered that conservation tillage is profitable in the thumb area's agricultural market and microclimates. The Alliance provides recommendations for zone or strip soil preparation in reduced tillage systems. These recommendations should be encourage in the Watershed. The process for promoting membership in a similar conservation tillage association is explained in more detail in Chapter 5 of this WMP.

Cover Crops

Cover crops can be very effective at preventing sheet and rill erosion and are relatively inexpensive to implement. Cover crops can provide additional benefits like soil improvement, wildlife habitat, and economic recovery if a crop is harvested. A BMP recommended by the Technical Committee is to use alfalfa and grasses as a permanent cover crop incentive program in the Critical Agricultural Headwaters. The combination of alfalfa and grass would be effective for soil erosion protection by providing a vegetative cover to slow water velocity, hold soil particles in place, and improve soil porosity. Cuttings of the alfalfa and grasses would provide some economic recovery to make the incentive program more appealing.

An innovative approach to establishing a winter cover crop is aerial seeding rye or wheat into a standing crop of corn or soybeans. Cover crops are important components of corn and soybeans fields that will have winter manure applications. The added residue of the cover crop will absorb liquid manure, decrease the likelihood of surface runoff, and improve soil tilth and fertility for the next growing season. Aerial seeding into a standing crop of soybeans or corn will reduce the erosion from fall tillage to establish a cover crop and it does not contribute to soil compaction (Michigan Agriculture Environmental Assurance Program, 2003).

Conservation Reserve Program Enhancement

The Farm Service Agency's CRP is an option for financing soil protection. The CRP provides financial and technical assistance to landowners who wish to protect highly erodible land by installing a permanent vegetative cover. Landowners enrolled in the program will receive annual payments based on agricultural rental rates; however, low rental rates and the 10-year contract may discourage wide scale use of this program. Enhancing the rental rate by supplementing CRP payments with CMI grant dollars would create a program similar to the Conservation Reserve Enhancement Program (CREP). CREP offers an additional 50% above CRP payments and a sign-up bonus for each acre enrolled. This enhanced payment would increase interest in CRP for landowners who cultivate land for high commodity produce like sugar beets.

Filter strips can be used to prevent sediment transport from the field to a water body. They are intended to provide a buffer between agricultural land uses and surface water, reduce sediment and dissolved contaminant loads in runoff, enhance habitat for wildlife and beneficial insects, and to maintain watershed functions (NRCS, 2003). Filter strips differ from buffer strips in that the type of vegetation selected for filter strips usually contain grasses or herbaceous plants that form dense root structures. In this way, filter strips provide more runoff filtration capacity.

Buffer and filter strips may be eligible for financial and technical assistance through the CCRP. Buffer and filter strips in riparian areas enrolled in the CCRP will sometimes receive an additional percentage to enhance the agricultural rental rate. Due to the shallow stream channels, buffers have not been widely used throughout the headwaters of the Watershed, and it may be difficult to persuade landowners to divide their fields. Stream channels that are not being cultivated and road ditches along headlands would be more favorable for landowners to enroll into CCRP. CCRP would become more favorable if contract length were reduced, buffer width requirements considered farm equipment sizes, and the possibility for buffer strips to be used as headlands. To create a 100-foot buffer between surface water and agricultural land use would require 11,736 acres of land to be enrolled into CRP.

Rill and Gully Erosion

Rill and gully erosion is generally found in agricultural areas where fields are tilled by conventional methods and plowed up to the streambank where no filter strip exists. Typical BMPs for rill and gully erosion include drop structures, weirs, grassed waterways**,** and stone spillways. All sites should be reviewed by qualified field technicians to ensure that the installed BMP will be adequate to handle flows and direct water to appropriate outlet structures. When riparian filter strips are installed, the site should be reviewed and the landowner educated to ensure that gully erosion does not occur in the buffer area.

Subsurface Drainage

Controlling the sedimentation requires an understanding of why the soil is eroding. The type of drainage networks found in the critical agriculture headwaters suggest that soil runoff potential is very high. Soil profiles in the Watershed show that surface layers are readily permeable but are underplayed by an impermeable clay layer. Once the soil becomes saturated above the clay layer, surface runoff and erosion occurs. Research completed by University of Minnesota has shown that tile drainage can have positive effects on reducing soil erosion by promoting subsurface drainage rather than surface runoff. Tile drainage may have other effects like increasing nutrient and bacteria transport to surface water. Using subsurface drainage as a BMP would need further analysis to determine the costs and benefits when used in the Watershed. This BMP could be evaluated in a paired watershed study (Chapter 6, Section 6.2).

Construction Best Management Practices for Sediment Control

Other sources of erosion and sedimentation occur outside of the critical agricultural headwaters, but they still need to be addressed by the WMP. Construction sites have the highest rates of soil erosion and sediment transport of any land use in residential areas. On nearly every construction site, vegetation and top soil are completely removed. Without proper SESC measures in place, tons of sediment can be washed into nearby streams and ditches. The watershed inventory found a number of home construction and road right of way ditches that did not have adequate SESC measures.

The Sanilac County Department of Construction and Land Use have undertaken the role of the County Enforcing Agency for SESC. Under the NPDES Phase II Storm Water Regulations, all construction activities disturbing 1 or more acres or within 500 feet from waters of the state must obtain a permit from the County Enforcing Agency. The Sanilac County Department of Construction and Land Use will review all sites to determine that they are complying with their permit and are using appropriate construction BMPs. The Technical Committee has foreseen the importance of supporting the Department of

Construction and Lane Use and has recommended that a brochure detailing what land use activities need permits and where to obtain them should be distributed during the implementation phase of the Watershed project.

Road/Stream Crossing Best Management Practices for Sediment Control

The Watershed inventory identified 23 road/stream crossings that needed repair or replacement. Most road/stream crossings suffered from moderate erosion of the embankments due to undersized culverts. A number of crossings were also blocked with sediment or debris. Undersized culverts tend to create erosion problems and impound water causing upstream erosion. When the road commission replaces undersized culverts, they should be replaced with box culverts or bridges. Box culverts and bridges allow the stream to keep its natural morphology and streambed. It is also recommended that a more extensive road/stream crossing inventory be completed in the summer of 2004 and be included in the updated version of this plan.

Road crossings also provide the entry point for pollutants and sediment to enter surface water via storm water runoff. A number of the roads in Sanilac County are low traffic gravel roads. Gravel roads are regraded every year to restore the crown and remove potholes. This practice improves drainage from the roadways; however, it may create a berm along the road ditch. The berm channels water down slope toward the stream crossing. Along the way, the runoff picks up sediment and possibly heavy metals from break dust and salt from de-icing.

The Technical Committee recommends that the Sanilac County Road Commission modify its procedures to improve water quality at road/stream crossings. One recommendation is for the road commission to install cutouts on berms following road grading. These cutouts would be placed on down slopes to encourage runoff to enter the road ditch. Vegetation in the road ditch would slow runoff and facilitate runoff filtration and infiltration. A second recommendation is for road stream crossings to be paved with turnouts draining into stable outlets. Paving the road surface over the road/stream crossing would prevent washouts on the crossing embankments.

4.3.4 BEST MANAGEMENT PRACTICES FOR COASTAL ZONE / DEVELOPMENT CRITICAL AREAS

Coastal zones are the lifeblood of economies and environmental health. Shoreline communities depend upon healthy coastlines for their water supply, recreation, public open space, wildlife habitat, and navigation. Coastlines are being developed at a rate 40% to 50% faster than noncoastal communities (Marsh, 1998). The types and rate of development can be controlled by the townships and municipalities located along the lakeshore through use of zoning ordinances and coastal overlay districts. A review of codes, master plans, and zoning ordinances was completed for communities that make up the Watershed.

Ordinances and master plans for the communities were analyzed for their effectiveness at protecting water resources. Using a workbook developed by the Southeast Michigan Council of Governments, each community's ordinances and master plans were assessed in each of the following categories:

- Storm water management
- Land conservation and development techniques
- Soil erosion and sediment control
- Sanitary sewer planning and infrastructure
- Preventing pollution using housekeeping practices
- Public education
- Impervious surface reduction

The assessment of each community's master plans and ordinances is included in a Policy Review Document. The review process looks for measures that provide communities with strategies to promote conservation and regulate how and where development occurs. The Policy Review Document will include model ordinance language and suggestions for updating the community master plan. A summary of the Policy Review Document is included in Appendix 6.

The Sanilac County Planning Commission is currently in the process of updating their master plan. The County Master Plan will contain an assessment of the County's natural resources and will seek to uphold the recommendations resulting from the Policy Review Document and the WMP. This master plan will provide a base for townships and municipalities to begin thinking about intergovernmental communication and planning to avoid conflicting land uses and development patterns. Each community should then consider adopting a watershed-based planning perspective that will transcend jurisdictional boundaries and focus on addressing the actual problems within the entire Watershed. A watershed planning perspective will encourage local planners to look at the entire area contributing to Lake Huron and

determine its needs for management and protection. Chapter 3 in this WMP outlines the goals and objectives to reduce nonpoint source pollution that should be taken into account by planning commissions when revising or updating ordinances and master plans.

4.3.5 BEST MANAGEMENT PRACTICES FOR PRESERVATION AREAS

Greenbelts

Forested and wetland areas make up over 10% of the Watershed land area. Contiguous forested areas greater than 40 acres provide excellent habitat for plant and animal life in a landscape fragmented by agricultural land. These areas should be protected to preserve viable wildlife populations and rare or threatened plant and animal species. Preserved forested land also serves as public open space, which improves a community's aesthetics, recreation options, and property values.

Preservation can be accomplished by purchasing the property or the property's development rights. The purchase is typically done through a land conservancy trust that can hold the property or the development rights in perpetuity. This process can be accelerated if a community identifies potential preservation areas and performs a natural features inventory of those properties. Properties with rare or threatened plant and animal specials (see Table 1.0) will have special interest to the land conservancy. The Saginaw Bay Land Conservancy currently serves the Watershed area.

Another option for preservation is through township and municipal ordinances that promote conservation design in their standards and Master Plans. Land that is preserved as open space in subdivisions and new developments can then be purchase by a land conservancy or the development rights could be purchased by the local government. Open space and forested lands could be used as part of a trail network connecting or greenbelt providing a connection between forested areas. Mill Creek, in Lexington Township, potentially could become a greenbelt providing a north-south forested corridor that could be connected to the existing bike path between Croswell and Lexington.

Stream Restoration

Stream gradients are very steep in the Watershed making instream BMPs to control flashy hydrologic conditions very difficult. Typical structures like check dams and streambank stabilization would be quickly washed out in intense rain events. These problems have to be corrected in the headwaters before water volumes are concentrated downstream. Slowing water velocity in the headwaters will also reduce the amount of waterborne sediment and attached pollutants that enter the streams. These practices are addressed in the BMP recommendations for agricultural critical areas. It is recommended that a

hydrologic analysis be performed to determine if conditions in the headwaters can be altered to accommodate downstream restoration.

Log jams and dams of trash and debris were commonly found in the stream corridor critical area. Debris and trash often causes flooding and erosion at the banks or in the streambed, on the other hand they may serve as a structure for aquatic habitat. Debris and trash obstructions should only be removed according to the woody debris principles developed by the MDNR and will be considered on a site-by-site basis. Volunteers can be used for stream clean-ups and restoration projects. Volunteers would receive education about stream ecology while developing a sense of responsibility and stewardship for their watershed thereby meeting one of the public participation requirements of the NPDES Phase II Storm Water Regulations.

Stewardship

Large amounts of trash and debris have been found at some road crossings in the Watershed. Forested stream channels are vulnerable to illegal dumping. Many of the streams in the Watershed are unnamed. When streams are unnamed, they are sometimes not included on public maps. In some cases, the streams that are unmapped or unnamed are not recognized as a water resource that deserves protection. Rather than creating strict penalties for illegal dumping, a recommendation is to create a program for naming streams and placing them on the map. Giving names to the streams may encourage more people to be better stewards of their local water resources.

The Technical Committee recommended that the stream naming program be incorporated into an Adopt-A-Stream network and fund raising campaign. A conservation and protection fund or endowment could be created at the Sanilac County Community Foundation. Donors who choose to name the stream would have the stream name submitted to the United States Geological Survey (USGS). Once accepted by USGS, the streams names would appear on future maps (USGS name report form can be found in Appendix 7). These maps would be available to any party interested in adopting that stream.

4.4 IMPLEMENTING BEST MANAGEMENT PRACTICES

Areas identified as critical areas are those contributing the majority of the pollutant loads. BMPs recommended for the critical areas are those that will provide the most pollutant load reduction for the smallest investment. Recommendations in this plan are guidelines for future work in the Watershed. Conditions are likely to change in the Watershed and future revisions of this WMP will be needed. Additional NPS pollution sites may be identified and included in future revisions of this plan, specifically,

pollution sources that pose an immediate environmental health risk. NPS sites with the highest priority located within the critical areas will be the first addressed during implementation.

Implementing the recommended BMPs will be completed on a voluntary basis since this WMP is not a regulatory mandate. The Sanilac Conservation District will encourage voluntary implementation of the recommended BMPs. This task will first be completed in the critical areas. Landowners who wish to voluntarily comply with the WMP recommendations will receive technical and financial assistance if funding is available. Available funds will be distributed first to interested landowners in critical areas. If any funds are remaining, they will be allocated to areas outside the critical area if the site is deemed a high priority.

Costs are given as estimates based on preliminary field investigations. Costs will change as each site is evaluated, and generally costs are lower when multiple sites are done simultaneously. The sites requiring immediate attention were determined to be high priority and the desired schedule is to begin these projects within 1 to 3 years. Those of medium priority are tentively scheduled to be implemented in 3 to 7 years. Those of low priority were scheduled to be implemented in 7 to 15 years. Cost estimates and priorities for each system of BMPs are included in Table 4.2.

Costs to implement every BMP on all sources of NPS pollution would too great to be feasibly completed within the desired schedule. Instead, the Technical Committee has suggested that goals be used for each BMP. For example, to implement permanent vegetative cover on all 9,600 acres of high priority soils would cost $2.9 million. Including rental payments over 10 years would bring the total to $8.6 million. Instead, a goal is to have 1,000 acres enrolled in the enhanced CRP by 2007. Goals and milestones for each BMP are listed in Table 4.3.

Table 4.2 - Best Management Practice Schedules and Costs

Pollutant / Impairment	Best Management Practice	Sites	Priority	Schedule	Cost/Unit*	Total Units	Total Costs
E. coli from agriculture	CNMP	There are 7 cattle feedlots housing approximately 250 cows or more, each needs upgrading	High	1 to 3 years	$125,000/farm	7	$875,000
	Cattle exclusion	Approximately 10 miles of streams in the Watershed have unlimited cattle access	High	1 to 3 years	$4/foot	52,000	$182,000
		The NPS Inventory found 26 cattle access sites that would need alternative water supply structures			$6,000/each	26	$156,000
		Along the 10 miles of livestock access there are 60 acres of riparian areas that require buffers			$100/acre	60	$6,000
	Permanent vegetative cover	There are over 9,600 acres of fields with slopes greater than a "C" slope. These fields should be enrolled in CRP rather than treated with a cover crops system	High	1 to 3 years	$300/acre	9,600	$2,880,000
		CRP enhancement payment for 10 year contract for fields in the critical agriculture headwaters			$90/acre/year	9,600	$8,640,000
	Cover crops	There are 4,500 acres of fields in the critical agriculture headwaters that need cover crops to absorb winter applied liquid manure and prevent soil erosion	Moderate	3 to 7 years	$10/acre/year	4,500	$450,000
	Soil and manure testing	There are 71,000 acres of fields in the critical agriculture headwaters that could benefit from soil and manure testing	Moderate	3 to 7 years	$4/acre/year	71,000	$2,485,000

Table 4.2 - Best Management Practice Schedules and Costs

Pollutant / Impairment	Best Management Practice	Sites	Priority	Schedule	Cost/Unit*	Total Units	Total Costs
E. coli from urban	Low impact development ordinances	There are 10 townships and municipalities in the coastal zone/development critical area that do not make provisions for low impact developments	High	1 to 3 years	$70,000/county	1	$70,000
	Beach signage	There are 9 public beaches and 2 marinas along the Watershed's coastline that need signage to inform beach users and boat owners about the cause of beach closures	High	1 to 3 years	$450/sign	11	$4,950
	Point of sale inspection	Approximately 1,500 homes in the coastal zone critical area use septic systems. It is suspected that 25% of these systems are inadequate	High	3 to 7 years	$75,000/study	1	$75,000
	Buffer ordinance	There are 10 townships and municipalities in the coastal zone/development critical area that permit septic system drain fields near riparian areas	Moderate	3 to 7 years	$8,000/county	1	$8,000
Sediment, nutrients, and attached pollutants	Permanent vegetative cover	There are over 9,600 acres of fields with slopes greater than a "C" slope. These fields should be enrolled in CRP rather than treated with a cover crops system	see above				
		CRP enhancement payment for 10-year contract					
	Cover crops	There are 71,000 acres of fields in the critical agriculture headwaters that need cover crops to prevent excessive soil erosion	see above				

Table 4.2 - Best Management Practice Schedules and Costs

Pollutant / Impairment	Best Management Practice	Sites	Priority	Schedule	Cost/Unit*	Total Units	Total Costs
	Conservation tillage	There are 71,000 acres of fields in the critical agriculture headwaters that need financial and technical assistance with conservation tillage	Moderate	3 to 7 years	$10/acre/year	71,000	$7,100,000
Sediment, nutrients, and attached pollutants (continued)	Buffers and filter strips	11,700 acres of riparian zones in agricultural areas without buffers or filter strips. These areas should be enrolled into CCRP	Moderate	3 to 7 years	$390/acre	11,700	$4,563,000
		CRP enhancement payment for 10-year contract for fields in the critical agriculture headwaters			$90/acre/year	11,700	$10,530,000
	SESC	The NPS Inventory found 18 construction sites with inadequate SESC controls	Moderate	3 to 7 years	$1,200/site	18	$21,600
	Road/stream crossing improvements	There are 2 road/stream crossings that need replacement and 5 that need repair. Box culverts are recommended for all replacements	Moderate	3 to 7 years	$75,000/replacement	2	$150,000
					$15,000/repair	5	$75,000
	Grassed waterway	There are 525.8 miles of streams in the critical agriculture headwaters. These streams are ephemeral and could be planted in grassed waterways	Low	7 to 15 years	$4/foot	846,168	$3,384,672

Table 4.2 - Best Management Practice Schedules and Costs

Pollutant / Impairment	Best Management Practice	Sites	Priority	Schedule	Cost/Unit*	Total Units	Total Costs
Nutrients	*E. coli* BMPs	BMPs that address *E. coli* issues will have similar effects on nutrient reduction	See above				
	Sediment BMPs	BMPs that address sediment issues will have similar effects on nutrient reduction	See above				
	Turf grass management	There are 2 golf courses in the Watershed that have 155 acres of turf grass that are conventionally managed. Managers need training in the MSUE turf grass short course	Low	7 to 15 years	$1,200/course/year	2	$24,000
Urban NPS Pollution	Low impact development ordinances	There are 10 townships and municipalities in the coastal zone/development critical area that do not make provisions for low impact developments	High	1 to 3 years	See above		
	Farmland preservation through ordinances	There are 35,500 acres of prime farmland in the Watershed that could have development rights purchased by a land conservancy	High	1 to 3 years	$8,000/county	1	$8,000
	Coastal overlay district	There are 7.1 miles of undeveloped shoreline areas that need additional protection to preserve open space and lake access	Moderate	3 to 7 years	$8,000/county	1	$8,000
	Green growth strategies	There are 12,000 acres of forested areas greater than 40 acres. These areas need to be preserved as greenbelts for habitat and human enjoyment	Moderate	3 to 7 years	$8,000/county	1	$8,000
	Stewardship	There are 24 sites that had excessive amounts of trash and debris totaling 15 miles of stream that need restoration and cleanup	Moderate	3 to 7 years	$2,000/site/year	24	$480,000

Table 4.2 - Best Management Practice Schedules and Costs

Pollutant / Impairment	Best Management Practice	Sites	Priority	Schedule	Cost/Unit*	Total Units	Total Costs
	Farmland preservation through purchase or transfer of development rights	There are 35,500 acres of prime farmland in the Watershed that could have development rights purchased by a land conservancy	Low	7 to 15 years	$2,000/acre	35,500	$71,000,000
						High Priority	$12,896,950
						Moderate Priority	$25,878,600
						Low Priority	$74,408,672
						Total	**$113,184,222**

*Programs that are listed with a per year price will require a 10-year contract with landowner to receive benefits. The associated cost are based on funds distributed over 10 years.

Table 4.3 - Best Management Practice Milestones and Costs

Pollutant / Impairment	Best Management Practice	Milestones	Cost/Unit*	Total Units	Total Costs	Funding Sources	Potential Partners
E. coli from agriculture	CNMP	Four feedlots are a high priority and will be encouraged to implement a CNMP using EQIP and CMI funds	$125,000/farm	4	$500,000	EQIP, CMI	NRCS
	Cattle exclusion	Complete 25% of cattle exclusion projects by 2007	$4/foot	13,000	$45,500	CMI, 319	NRCS, Sanilac Conservation District
			$6,000/each	6	$36,000		
			$100/acre	15	$1,500		
	Permanent vegetative cover	Establish permanent vegetative cover on more than 1,000 acres by 2007	$300/acre	1,000	$300,000	CRP, CMI	NRCS, MSU Extension
		Establish an incentive program that enhances CRP payments. More than 1,000 acres will be enrolled by 2007	$90/acre/year	1,000	$900,000		
	Cover crops	Establish an incentive program that encourages farmers to use fall cover crops. Goal is for 25% of all acres in critical agriculture headwaters using cover crops by 2011	$10/acre/year	1,125	$112,500	CMI	NRCS, MSU Extension
	Soil and manure testing	Provide soil and manure nutrient testing for all farmers in the Watershed. Goal for program is to test 5% of all acres in the critical agriculture headwaters by 2011	$4/acre/year	3,550	$124,250	CMI, 319	NRCS, MSU Extension

Table 4.3 - Best Management Practice Milestones and Costs

Pollutant / Impairment	Best Management Practice	Milestones	Cost/Unit*	Total Units	Total Costs	Funding Sources	Potential Partners
E. coli from urban	Low impact development ordinances	Complete a set of model ordinances for low impact development for the entire county by 2007	$70,000/county	1	$70,000	319, coastal zone management	Sanilac County Planning Commission
	Beach signage	Install signage at all public beaches and marinas by 2007	$450/sign	11	$4,950	CMI, coastal zone Management	SCHD
	Point of sale inspection	Complete a study of possible point of sale inspection programs that would be feasible for Sanilac County. The study should be completed by 2009	$75,000/study	1	$75,000	319, coastal zone management	SCHD
	Buffer ordinance	Complete a set of model ordinances and maps for each township in Sanilac County by 2011	$8,000/county	1	$8,000	319, coastal zone management	Sanilac County Planning Commission and drain commissioner
Sediment, nutrients, and attached pollutants	Permanent vegetative cover	See goals above	See above				
	Cover crops	See goals above	See above				
	Conservation tillage	Implement an incentive program that offers cost share for farmers who practice conservation tillage. Goal is for 10% of critical agriculture headwaters enrolled in program by 2011	$10/acre/year	7,100	$710,000	CRP, CMI Great Lakes Basin Program	NRCS
	Buffers and filter strips	Establish 2,500 acres of buffers by 2011 using CCRP cost share	$390/acre	2,500	$975,000	CCRP, CMI Great Lakes Basin Program	NRCS
		Implement an incentive program that offers an enhanced rental payment above amounts available for CRP	$90/acre/year	2,500	$2,250,000		

Table 4.3 - Best Management Practice Milestones and Costs							
Pollutant / Impairment	Best Management Practice	Milestones	Cost/Unit*	Total Units	Total Costs	Funding Sources	Potential Partners
	SESC	Install sediment and erosion control practices on one site every year as a demonstration	$1,200/site	10	$12,000	Great Lakes Basin Program	Sanilac County Construction and Land Use
	Road/stream crossing improvements	Replace or repair all failing culverts by 2011	$75,000/replacement	2	$150,000	319 Great Lakes Basin Program	Sanilac County Road Commission
			$15,000/repair	5	$75,000		
	Grassed waterway	Install grassed waterways on 25,000 feet of streams in the critical agriculture headwaters by 2019	$4/foot	25,000	$100,000	319 Great Lakes Basin Program	NRCS
Nutrients	*E. coli* BMPs	See goals above	See above				
	Sediment BMPs	See goals above	See above				
	Turf grass management	Train all golf course turf grass managers and employees using the Turf Grass Management courses offered through MSUE	$1,200/course/year	2	$24,000	CMI	MSU Extension
Urban NPS pollution	Low impact development ordinances	See goals above	See above				
	Farmland preservation through ordinances	Complete a set of model ordinances and maps for each township in Sanilac County by 2007	$8,000/county	1	$8,000	319	Sanilac County Planning Commission
	Coastal overlay district	Complete a set of model ordinances and maps for each township in Sanilac County by 2011	$8,000/county	1	$8,000	Coastal Zone Management	Sanilac County Planning Commission
	Green growth strategies	Complete a set of model ordinances and maps for each township in Sanilac County by 2011	$8,000/county	1	$8,000	Coastal Zone Management	Sanilac County Planning Commission

Table 4.3 - Best Management Practice Milestones and Costs							
Pollutant / Impairment	Best Management Practice	Milestones	Cost/Unit*	Total Units	Total Costs	Funding Sources	Potential Partners
	Stewardship	Select 15 sites that will host a stream clean-up activity every other year for 10 years	$2,000/site/year	15	$150,000	EPA Five-Star Program, 319 MDEQ	MSU Extension
	Farmland preservation through purchase or transfer of development rights	Use farm bill funds to purchase development rights on 5,000 acres in the Watershed by 2019	$2,000/acre	5,000	$10,000,000	Farm bill, Michigan Agriculture Preservation Fund	Sanilac County Planning Commission, NRCS
				High Priority	$1,940,950		
				Moderate Priority	$4,582,750		
				Low Priority	$10,124,000		
				Total	**$16,647,700**		

*Programs that are listed with a per year price will require a 10-year contract with landowner to receive benefits. The associated cost are based on funds distributed over 10 years.

CHAPTER 5 - INFORMATION AND EDUCATION STRATEGY

5.0 INTRODUCTION

Information and Education (I&E) Strategies are designed to involve the public by increasing awareness of water quality issues and motivating individuals to take action. Strategies must build on the concepts of watershed recognition, acknowledgement of water quality impairments, demonstration of watershed-friendly land use practices, and development and maintenance of partnerships.

5.1 PUBLIC PARTICIPATION PROCESS

Four Steering Committee meetings were held in the fall and winter of 2002 at the Sanilac County Michigan State University Extension office in Sandusky, Michigan. These meetings were publicized through a press release and invitations were mailed to key stakeholders like county commissioners, local government officials, and the foremost agricultural producers in the Sanilac County Lakeshore Watershed (Watershed). These meetings were well attended by many local residents, farmers, and township and village officials.

Each Steering Committee meeting proceeded through a three part agenda that focused on basic concepts of watershed management. The first meeting introduced the audience to the Watershed project staff and their role in the development of a Watershed Management Plan (WMP). Mr. Charlie Bauer spoke to the Steering Committee about the Clean Water Act Section 319 grant and what outcomes were expected from the Watershed's project. Approximately 29 people attended the first meeting. Most citizens were concerned about regulations and enforcement of agricultural operations and some made comments that flooding and erosion is threatening their property.

Guest speakers were invited to speak at the second, third, and fourth Steering Committee meetings. Ms. Kristen O'Reilly, from the St. Clair County Health Department, spoke at the second meeting, to an audience of 20 people, about similar watershed projects in St. Clair County. At the third meeting Mr. Richard Cannon of the Sanilac County Planning Commission updated the 36 Steering Committee members in attendance, about the County Master Plan and how a collaborative effort between the Watershed project and the Planning Commission could be mutually beneficial. Mr. Grant Carman of the Sanilac County Health Department, informed the 38 Steering Committee members attending the fourth meeting, about the beach monitoring program and septic system inspection policies.

At the fourth Steering Committee meeting, the audience was asked to complete a survey of what their concerns were about water quality in the Watershed. This survey was delivered in a table format that they could evaluate each of the Watershed's designated uses and prioritize its importance. They were then asked to state their opinions on what was impairing these uses and how they would suggest to remedy each impairment.

By the fourth Steering Committee meeting the audience seemed more interested in the project outcomes and less wary of state government regulations being imposed on the Watershed. Capitalizing on the interest in developing a WMP, the steering committee split into three committees that could focus on specific requirements of developing an approvable WMP. These committees were:

- **Technical Committee**: Agricultural experts, engineers, scientists, and residents with a great deal of knowledge of the watershed characteristics. Primary focus on systems of Best Management Practices (BMPs) and technical review of the WMP.

- **Policy Committee**: Local officials, zoning and planning officials, and politically active citizens. Primary focus was on storm water management, land use policies, ordinance development, and analysis of the Policy Review Document.

- **I&E Committee**: Media and public relation experts, local officials, and concerned citizens. Goal was to produce an I&E strategy for the WMP.

In addition to the public meetings mentioned above, the Sanilac Conservation District utilized existing local media to broadcast information about the Watershed project. Mr. Joseph Kautz, the Watershed technician, gave presentations at six township and three village meetings, three school presentations, a presentation at Camp Ozanam, and participated in an interview on WMIC radio. The Sanilac Conservation District also published articles about the WMP in their annual newsletter and submitted two press releases to the Sanilac County News.

5.2 GOAL OF THE INFORMATION AND EDUCATION STRATEGY

The goal of the I&E Strategy for the Watershed is to adopt land use activities that reduce the negative impacts on water resources within the Watershed. To be successful, this strategy must identify target audiences and choose the appropriate outreach methods. This I&E Strategy will serve as a guide to outline major steps and actions that will be needed to successfully improve and maintain high water quality in the Watershed. This guide was created by the I&E Committee using the information created through inventory and recommendations by the Technical and Policy Committees. The I&E Strategy may

be revised to use new information and tools which are not available at the time of the implementation of this plan.

5.3 WATERSHED LOGO

The logo was designed to represent the Watershed as a symbol. This will create the sense of “brand identification.” This logo will be used on signage, letterhead, and other materials appropriate to watershed recognition. The Watershed logo is on shown in Figure 12.

5.4 INFORMATION AND EDUCATION ACTION PLAN

The I&E Strategy for the Watershed will be focusing primarily on a few key targets. First, the plan will address animal agriculture in the Watershed. Research has shown that *E. coli* and manure runoff are present throughout this Watershed. The Sanilac Conservation District will focus education on specific producers about the impacts created by livestock. In addition, the Sanilac Conservation District will provide guidance to these producers so that they may become more environmentally friendly to the Watershed.

The second issue to be addressed in the I&E Strategy will be sediment. 71,000 acres of land are being cultivated on fields without riparian buffers on potentially highly erodible land and coastal areas are being consumed by rapid development without proper soil erosion and sediment control. Agriculturists and developers both require education on soil erosion control. The following tables dedicated to sediment pollution focus on conservation tillage initiatives and low impact development.

The third and fourth issues to be addressed will be nutrients and pesticides. These problems often co-exist with the manure and sediment issues. While the Sanilac Conservation District and their partners are implement the I&E Strategies for *E. coli* and sediment, they will simultaneously address the issues of nutrients and pesticides.

Each contaminant listed in the I&E Strategy has many different audiences and sources of pollution. The I&E Committee has decided that prioritizing the audiences would be the most effective implementation strategy. If only portions of this strategy can be funded, the Sanilac Conservation District will provide outreach to the largest sources of contamination in the Watershed. Estimated costs to implement each portion of the strategy can be calculated from this table based on future work plans.

5.4.1 INFORMATION AND EDUCATION DELIVERY METHODS

The objectives of the I&E Strategy will be met by the following delivery methods:

- Use of the Watershed logo to create awareness of the project
- Articles to be sent to local newspapers for press coverage
- Displays at fairs, special events, and meetings
- Presentations at county, township, and village meetings
- Volunteer water quality monitoring
- Communicate results from paired watershed study
- Adopt the Farm *A*Syst, Home*A*Syst, and Lake*A*Syst program
- Watershed tours
- United States Department of Agriculture conservation programs outreach
- Educate planning commission & local government on low impact development and zoning
- Michigan State University Extension Citizen Planners Program
- Landscaping for water quality demonstration projects
- One-on-one technical assistance
- Radio announcements
- Watershed Summary Report
- Public meetings
- Public announcements on local cable television

5.4.2 DEVELOP PARTNERSHIPS

Sanilac Conservation District)

The Sanilac Conservation District has the active roll of implementing the WMP.

Michigan Department of Environmental Quality (MDEQ)

The MDEQ Water Division will provide guidance to the Sanilac Conservation District during the implementation phase of the management plan. The MDEQ district office, located in Bay City, can provide the Sanilac Conservation District with examples and materials that have proven effective in other watersheds.

Other potential partnerships will be developed with local agencies and government organizations. A list of these partnerships can be found below in Table 5.0.

Table 5.0 - Potential Partners for Information and Education

Local Agencies and Organizations	Townships
MSUE (Sanilac & St. Clair)	Burtchville
Natural Resource Conservation Service (NRCS)	Grant
St. Clair County Conservation District	Worth
St. Clair County Health Department	Lexington
The Lakeshore Guardian / Other Newspapers	Sanilac
Clubs / Youth Groups: Future Farmers of America, 4-H, Master Gardeners	Washington
Churches	Bridgehampton
Schools	Forester
Marinas	Marion
Shoreline Residents	Delaware
Community Foundation	Minden
Municipal Storm Sewer Separation System Communities (MS4)	Sherman
Michigan Municipal League	
Michigan Townships Association	**Villages**
	Lexington
State Government	Forester
Michigan Department of Natural Resources	Port Sanilac
Michigan Department of Agriculture	Forestville
Michigan Department of Transportation	Forestville
Sanilac County Government	
Board of Commissioners Road Commission	
Drain Commissioner	
Health Department	
Building and Land Use Department	
Planning Commission	
Department of Parks and Recreation	

5.4.3 IDENTIFY TARGET AUDIENCES

The I&E Committee has reviewed the sources of pollution within the Watershed and created a list of groups that are known to impact water quality. Specific educational plans were developed for each of these groups. Educational plans will focus on minimizing impact to the watershed by utilizing BMPs. A prioritized list of target audiences can be found below in Table 5.1.

Table 5.1 - Target Audience Prioritization

Target Audience	Priority
Agriculture *E. coli*	**First**
Livestock / dairy producers	
Manure applicators	
Agriculture	**Second**
Row crop producers	
Commercial herbicide applicators	
Rural residents (non farm)	**Third**
Development	**Fourth**
Building departments Zoning departments Health departments	
Contractors / builders	
Realtors	
Lakeshore Critical Zone	**Fifth**
Village and Township residents	
Lawn maintenance companies	
Vacationers	
Septic maintenance companies County, Township, & Village Officials including: Building departments Zoning departments Health departments	
Recreational	**Sixth**
Marinas	
Boaters	
Golf courses	

5.4.4 DEVELOP MESSAGES

Messages to reach target audiences range from broad to specific, depending on the character of the audience. In order to get the target audience to change “old habits”, they need to have an understanding of how their actions affect water quality. The myth of “what little I do can’t affect anything” needs to be changed. Changing the pollution causing behaviors involves a three step educational process:

1. Awareness - Public recognized that there is a problem
2. Education - Public understands the problem and its causes
3. Action - Public makes behavior changes that improve water quality

5.5 SCHEDULE AND COSTS

The following pages contain a series of tables that outline each component of the I&E Strategy and how it relates to water resource use impairment.

- Table 5.2 lists and estimates costs for all components in the I&E Strategy.

- Tables 5.3a through 5.6b outline the strategy for implementing each component and how it addresses each of the primary pollutants addressed in Chapter 3 - Water Quality.

Table 5.2 - Cost Estimates

I&E Projects	Quantity	Estimated Cost Each	Total Estimated Costs
Watershed Logo (signs)	20 public signs in the Watershed	$75	$1,500
Articles to be sent to local newspapers	5 articles and advertising space	Variable	$8,000
Displays at fairs, special events, and meetings	3 displays	$500	$1,500
Presentations at county, township, and village meetings	26 presentations	$75	$1,950
Volunteer water quality monitoring	4 sites ($1,000 each) 10 years	$4,000	$40,000
Communicate results from paired watershed study	10 promotions through various communications	$1,000	$10,000
Farm *A*Syst program	50 Farm*A*Syst	$50.00	$2,500
Home*A*Syst and Lake*A*Syst program	100 Home*A*Syst	$50.00	$5,000
Tours	3 Tours	$1,000	$3,000
Newsletters	8 Newsletters 1,000 copies each	$0.50	$8,000
Low impact development & zoning workshop	1 Workshop	$3,000	$3,000
Citizens Planner Program	1 Program	$6,000	$6,000
Demonstration plots	2 Plots	$2,000	$4,000
One-on-one technical assistance	20 visits	$300	$6,000
Public service announcements (radio)	40 PSAs 1 every quarter for 10 years	$60 $30/30 seconds/radio add.	$2,400
Public announcements on local cable	4 PSAs 1 every year for 4 years	$400	$1,600
Watershed summary report	100 Books	$7	$700
Hold meetings on specific topics	(8)5 Meetings	$500	$2,500

Table 5.2 - Cost Estimates

I&E Projects	Quantity	Estimated Cost Each	Total Estimated Costs
Public meetings / existing meetings	(8)5 Meetings	$500	$2,500
Brochures	3 Brochures 1,000 copies each	$0.85	$2,550
USDA conservation programs outreach			Covered in Chapter 7
Conservation tillage initiative			Covered in Chapter 7
Buffer strip initiative			Covered in Chapter 7
Soil testing initiative			Covered in Chapter 7

Table 5.3a - Pollutant *E. coli*

Source/Cause	Message	Target Audience	Component	Delivery Methods
Concentrated animal feeding operations Livestock access to streams Improper manure storage and application	Managing manure can be beneficial to your farm in many ways. Managed manure will decrease disagreements between neighbors, improve herd health by reducing exposure to pathogens, and cut fertilizer costs.	Livestock / dairy producers Manure applicators	Education Action	Farm *A*Syst, Field*A*Syst One on one technical Assistance Radio Press Meetings on manure Management Brochure Watershed logo
Illegal sewage connection Malfunctioning septic systems	A properly functioning sewage system will reduce the health risks for your family and neighbors as well as increase your property value.	Developers Lakeshore critical zone residents and stakeholders Rural residents	Education Action	Press Radio Adoption of the Home*A*Syst and/or Lake*A*Syst Programs Beach monitoring Public meetings Citizen planner program
Other sewage discharges		Recreational boaters	Awareness Education	Use of the Watershed logo to create awareness of the project. Brochure

Table 5.3b - Pollutant *E. coli*

Delivery Methods	Tasks	Potential Partners with SCD	Evaluation Method	Timeline		
				Year 1 to 3	Year 3 to 7	Year 7 to 15
Farm *A*Syst, Field*A*Syst	Make appointments with farmers and complete Farm*A*Syst self-evaluation program	Ground water stewardship program	Keep record of participants and follow up with farmers to determine which changes have been made	X	X	
Public meetings	Hold meetings on manure management within the Watershed	DEQ MSUE MDA	Keep record of attendees at the meetings	X	X	
One-on-one technical assistance	Meet with farmers/property owners and talk with them about manure management and related topics	NRCS	Increased completed applications for Equip, CNMP, and manure analysis	X		
Radio announcements	Use the local radio station that airs the Farm radio network and submit public service announcements on issues related to manure management, sewage, and *E. coli*	WMIC radio	Determine number of individuals who enroll in programs based upon hearing the PSAs. Get statistics of broadcast	X		
Brochure	Design two brochures to target livestock owners and boating community	MSUE Marina operators	Increased requests for Farm*A*Systs, Lake*A*Systs or other assistance			X
Citizen Planner Program	Assist MSU Extension with the citizen planner program. Help with planning, promoting, and running the activity	MSUE	Keep record of registrants. Percentage of Watershed attendees vs. countywide attendees. Determine who becomes active in policy, planning or makes changes to their personal property	X		

Table 5.3b - Pollutant *E. coli*

Delivery Methods	Tasks	Potential Partners with SCD	Evaluation Method	Timeline		
				Year 1 to 3	Year 3 to 7	Year 7 to 15
Press	Submit existing articles to newspapers about *E. coli*. Also, submit articles about how effective the implementation has been	Lakeshore guardian Others papers	Readership response by receiving phone calls	X		
Home*A*Syst and Lake*A*Syst	Make appointments with homeowners to complete the Home*A*Syst self-evaluation program	MS4 communities Villages Townships	Keep record of participants. Follow up with participants to determine which changes were made due to the program	X	X	
Beach monitoring	Assist the Health Department in receiving funding to check *E. coli* levels on public beaches	County health department MDEQ	*E. coli* counts and frequency of beach closings		X	
County, township and village meetings	Present at local government meetings about malfunctioning septic systems and encourage enforcement of health codes to reduce the illicit connections. Make presentation to every Municipality in the Watershed	County health department Townships Villages MS4 communities	Track the number of septic permits issued for existing buildings		X	
Watershed logo	Create and install signs containing the Watershed logo along roadways and near public buildings. This will create “brand identification”	MDOT County road commission	Logo recognition	X		

Table 5.4a - Pollutant Sediment

Source/Cause	Message	Target Audience	Component	Delivery Methods
Conventional tillage Tilling through drainage ways	As a stakeholder in the Watershed, it is your duty to help keep soil erosion to minimal amounts when performing activities that disturb the stability of soil. When disturbing soil, placing erosion control barriers will save topsoil and help preserve the fertility of soil	Row crop producers	Education Action	Newsletters Farm*A*Syst, Field*A*Syst Displays at county fairs, SCD open house Create displays for use at e agriculture meetings Use available USDA Programs that promote land conservation. Conservation tillage initiative (promote usage of conservation tillage) Promote buffer strip initiative
Construction		Low impact development	Awareness Education	Low impact development and zoning workshop MSUE citizen planners Tour Brochure

Table 5.4b - Pollutant *E. coli*

Delivery Methods	Tasks	Potential Partners with SCD	Evaluation Method	Timeline		
				Year 1 to 3	Year 3 to 7	Year 7 to 15
Newsletters	Create and mail a newsletter twice per year updating stakeholders within the Watershed of activities and projects	NRCS	Track telephone calls, requests, and comments on the newsletters, program information and completion of programs		X	
Farm*A*Syst, Field*A*Syst	Make appointments with farmers and go through the Farm*A*Syst self-evaluation program	Michigan groundwater stewardship program	Keep record of participants and follow up with farmers to determine which changes are being made	X	X	
Displays at county fairs, special events and meetings	Design and build a display that will represent good water quality, during the 4-H fair and the SCD's open house	MSUE Michigan groundwater stewardship program	Have a person present at the events to determine the interest level of people viewing the display	X		
Create displays for use during agriculture meetings	Prepare and give sediment versus surface water quality presentations Use the Watershed logo to achieve program recognition	MSUE Michigan groundwater stewardship program	Individual inquiries for soil erosion programs with the conservation district	X	X	
USDA conservation programs outreach	Meet with landowners informing them about CCRP, CRP and other conservation programs that become available	Sanilac FSA NRCS St. Clair Conservation District	Participation in various conservation programs	X	X	X
Conservation tillage initiative	Meet with farmers that are less receptive to change and guide them to change practices by providing assistance of "test plots" on their land so they can judge the benefits of conservation tillage	Farmers	Increase acreage under no-till or reduced tillage systems		X	

Table 5.4b - Pollutant *E. coli*

Delivery Methods	Tasks	Potential Partners with SCD	Evaluation Method	Timeline		
				Year 1 to 3	Year 3 to 7	Year 7 to 15
Buffer strip initiative	Design and promote a filter strip program that uses alfalfa as crop	MDEQ St. Clair Conservation District NRCS	Track number of acres enrolled		X	
Educate local governments on zoning and low impact development	Provide a low impact development workshop utilizing local contractors who have completed low impact developments.	MDEQ Local government officials	Follow up with local governments to determine creation of coastal community ordinances	X		
Tour	Locate an area that has been implementing low impact development and arrange a tour with stakeholders to show them what can be done	MDEQ Local government officials	Local governments to change zoning laws that would accommodate development, but		X	
Citizen planner program	Assist MSUE with planning, promoting, and implementing the Citizen Planner program.	MSUE	Percentage of attendees from the Watershed	X		
Brochure	Create a brochure that provides information about obtaining required permits.	Construction and Land Use Department Local governments MDEQ	Increase number of permits obtained and increased soil erosion control practices being utilized.	X		
Water quality monitoring	Set up monitoring sites in the Watershed and keep records of water quality throughout the monitoring process.	MDEQ Schools MSUE MDNR	Water quality analysis		X	X

Table 5.5a - Pollutant Nutrients

Source/Cause	Message	Target Audience	Component	Delivery Methods
Fertilizers (residential use)	Nutrients reaching water cause algae growth. Clean water can be maintained by properly fertilizing plants	Lakeshore critical zone residents Rural residents	Awareness Education	Home*A*Syst and Lake*A*Syst program Watershed Tour Demo plots
Fertilizers (agriculture)		Row crop producers Commercial herbicide applicators Recreational	Education Action	Farm *A*Syst, One on One Technical Assistance Displays at fairs, special events, and meetings Paired watershed study Presentations at public meetings Watershed Tours Soil testing USDA conservation programs
Livestock manure Silage	The Watershed is very susceptible to manure runoff and silage leachate. Proper storage and disposal is an asset to the farmer as well as the Watershed	Livestock / dairy producers Manure applicators	Education Action	Farm*A*Syst One-on-one technical assistance Displays at fairs, special events, and meetings USDA conservation programs
Sewage	Sewage has negative effects on water quality. Illicit discharges or connections can cause health problems in animals and humans. Proper handling of sewage maintains animal and human health	Lakeshore critical zone residents and stakeholders Low impact development Rural residents Recreational	Awareness Education	Home*A*Syst Lake*A*Syst Radio announcements Press articles Brochure to boaters

Table 5.5b - Pollutant Nutrients

Delivery Methods	Tasks	Potential Partners with SCD	Evaluation Method	Timeline		
				Year 1 to 3	Year 3 to 7	Year 7 to 15
Home*A*Syst and Lake*A*Syst	Make appointments with homeowners and go through the Home*A*Syst self-evaluation program.	MS4 communities Homeowners	Keep records of how many people complete Home*A*Syst and Lake*A*Syst Program Follow up to determine number of changes made	X	X	
Tours	Conduct a watershed tour of environmentally improved sites Make before and after comparisons	Local governments	Number of attendees from the different communities Number of new enrollees for environmental programs		X	
Demonstration plots	Complete a yard landscaped with plants to help water quality. This landscaping demonstration could be completed at a park or on other public lands	Parks MSUE MDNR	Adaptation rate of usage of native plants in landscapes	X		
Farm*A*Syst, Field*A*Syst	Make appointments with farmers to complete the Farm*A*Syst self-evaluation program	Michigan groundwater stewardship pProgram	Keep record of number of participants and follow up with farmers to determine which changes are made	X	X	
One-on-one technical assistance	Meet with landowners that have released excessive quantities of nutrients in the creeks. Talk with landowners about programs available to reduce nutrient loading (filter strips, soil testing, etc).	NRCS MSUE	Track quantity of acreage signed up in filter strip and soil testing programs			

Table 5.5b - Pollutant Nutrients

Delivery Methods	Tasks	Potential Partners with SCD	Evaluation Method	Timeline		
				Year 1 to 3	Year 3 to 7	Year 7 to 15
Displays at county fairs, special events, and meetings	Design and create a display that promotes water quality safeguards, during the Sanilac County 4-H Fair and the SCD's open house	MSUE Michigan groundwater stewardship program	Have a person present at the event to determine the interest level of the people viewing the displays. Track the effectiveness by determining the number of new enrollees into conservation programs	X		
Paired watershed study	Use the designed paired watershed study as an educational tool. Conduct tours, create test plots, communicate results with the public, etc.	Farmers MDEQ MSUE NRCS	Track usage of water quality management practices used in the paired watershed study		X	X
County, township, and village meetings	Make water quality presentations at local government meetings showing the negative impacts of nutrient loading. Include a "How to" spot the source of excess nutrients in the water section. Make a presentation to every municipality in the Watershed	DEQ Michigan groundwater stewardship program	New ordinances being developed to address water quality issues		X	
Soil testing initiative	Promote soil testing of fields before apply fertilizers or manure. Assist with the sampling and testing	MSUE	Increased testing and decreased fertilizer inputs		X	
USDA conservation programs outreach	Meet with landowners informing them about CCRP, CRP and other conservation programs as they become available	FSA NRCS St. Clair Conservation District	Sign up and participation in conservation programs	X	X	X

Table 5.5b - Pollutant Nutrients

Delivery Methods	Tasks	Potential Partners with SCD	Evaluation Method	Timeline		
				Year 1 to 3	Year 3 to 7	Year 7 to 15
Press	Submit articles to local newspapers about proper lawn care, without excess chemicals	MS4 communities	Increased requests for non-phosphate fertilizers. Who will you contact	X	X	X
Radio	Submit various public service announcements on nutrient and water quality	WMIC radio	Track number of requests for information for conservation programs			X
Water quality monitoring	Set up monitoring sites in the Watershed and keep record of water quality throughout the monitoring process	MDEQ Schools MSUE MDNR	Track changes in water quality		X	X

Table 5.6a - Pollutant Pesticides/Herbicides

Source/Cause	Message	Target Audience	Component	Delivery Methods
Sprays (residential)	Pesticides are very effective for controlling nuisance insects, plants, etc. If pesticides are over sprayed, sprayed near surface water, or improperly disposed they can contaminant surface water and kill native aquatic life	Lakeshore critical zone residents Rural residents	Awareness Education	Watershed logo Radio announcements Home*A*Syst Demonstration plots
Sprays (agriculture individual and commercial)		Row crop producers Commercial herbicide applicators	Education Action	Farm*A*Syst Displays at fairs, special events, and meetings Water quality monitoring program Radio announcements One on one tech assistance Paired watershed study
Sprays (home owner and commercial)		Lakeshore critical zone residents Recreational	Education Action	Home*A*Syst

Table 5.6b - Pollutant Pesticides/Herbicides

Delivery Methods	Tasks	Potential Partners with SCD	Evaluation Method	Timeline		
				Year 1 to 3	Year 3 to 7	Year 7 to 15
Watershed logo	Use signage with the logo throughout the Watershed. Create "brand" identification	Michigan Department of Transportation county road commission	Survey local citizens to determine public recognition of logo	X	X	X
Radio announcements	Do public service announcements about the chemicals and where and when to dispose of them	Michigan groundwater stewardship program WMIC radio	Get statistics of broadcast. Track household hazardous waste and clean sweep information requests		X	
Home*A*Syst	Make appointments with homeowners to complete the Home*A*Syst self-evaluation program	MS4 communities	Keep record of participants. Follow up with homeowners to determine which changes were made	X	X	
Demonstration plots	Create native landscapes on public lands to benefit water quality. Create a desired look for people to want to install yards	Clubs / youth groups Churches Schools	Increased homeowners planting native vegetation for landscaping instead of manicured lawns	X		
Farm*A*Syst Field*A*Syst	Make appointments with farmers and completer the Farm*A*Syst self-evaluation program	Michigan groundwater stewardship program	Keep record of participants and follow up with farmers to see if changes are being made for the better	X	X	
Displays at county fairs, special events, and meetings	Design and build a display that will represent good water quality, during the 4-H fair and the CD's Open house	MSUE Michigan groundwater stewardship program	Have a person present at the event to determine the interest level of the people viewing the displays	X		
Water quality monitoring program	Set up monitoring sites in the Watershed and keep record of water quality throughout the monitoring process	MDEQ Schools MSUE MDNR	Changes in Water quality		X	X

Table 5.6b - Pollutant Pesticides/Herbicides

Delivery Methods	Tasks	Potential Partners with SCD	Evaluation Method	Timeline		
				Year 1 to 3	Year 3 to 7	Year 7 to 15
Paired watershed study	Use the designed paired watershed study as an educational tool. Conduct tours, do test plots, communicate results with the public, etc.	MDEQ MSUE	Usage of practices used in the paired watershed study		X	X
One-on-one technical assistance	Assist chemicals applicators with questions in the Watershed. Help them understand negative impacts of spraying directly into the streams	Michigan groundwater stewardship program	Requests of assistance.	X		

CHAPTER 6 - EVALUATION METHODS

The evaluation of a project is a means of measuring its effectiveness. It is a way of learning from experience and identifying areas in need of improvement. Methods of assessment are varied and different types of evaluation should be combined to gain the most insight about why elements of a project may have succeeded or failed. An evaluation process should be formed at the conception of the project, and should be used as a learning tool until completion. Setting measurable goals to be achieved by a certain date allows progress to be continually gauged and a dynamic plan can adjust to meet changing demands or specified goals.

The most difficult task in developing a Watershed Management Plan (WMP) is the transition from the planning phase to the implementation phase. For this reason, once the implementation phase begins a completion schedule should be formalized to make certain that programs are implemented on schedule. The completion schedule should contain a vision statement and a list of long-term goals and the short-term objectives needed to immediately expedite the project's recommendations addressing the highest priority impairments.

6.1 PROJECT EVALUATION CRITERIA

The first phase of the Sanilac County Lakeshore Watershed (Watershed) project was to gather stakeholders to devise a plan to improve the water quality in the Watershed. Local involvement is key to establishing the basis for identifying problems, sites, sources, corrective actions, and partners. A Steering Committee provided the initial project focus, while an Information and Education Committee, Technical Committee, and Policy Committee provided expertise and additional work to produce products for the WMP.

The Watershed project has an extensive work plan outlining tasks that need to be accomplished through the planning phase. Progression through the work plan will serve as an evaluation during the planning phase. Each quarter a report is due to the Michigan Department of Environmental Quality (MDEQ) that describes the progress made within the work plan's schedule and budget. The quarterly review not only helps the MDEQ recognize that grant funds are being used to complete the original goals and scope of the project, but it helps everyone involved to adhere to time tables in a project focused manner and achieve milestones set forth in the project work plan.

The WMP gives recommendations of Best Management Practice (BMP) systems and the critical areas where implementation should occur. The number and distribution of BMPs installed within the critical area will give an indication of whether the goals are being met across the Watershed and in the critical areas. The schedule for implementing BMPs can be found in Chapter 4 in Table 4.2. Milestones for interim measurement of BMPs will be created before the implementation phase. The interim milestones will be used as a measurement to determine if the plan is being implemented on schedule and is moving in the right direction.

Calculating pollutant reductions for each BMP, helps assess the overall impact on the Watershed and water quality. One way to assess their impact is to compare the cost of the BMPs to the amount of pollutant reduced. This information will be used to determine the most cost effective BMPs and the number or extent of the management measures needed to reduce pollutants to the desired levels to achieve the project goals. Before implementation, the pollutant load reduction for each BMP will be estimated and a set of criteria for determining whether the necessary loading reductions are being achieved will be developed.

The criteria used to determine if loading reductions are being achieved does not have to be based on analytical water quality monitoring. The MDEQ gives examples of non-analytical criteria like fewer beach closings as an indicator of reduced *E. coli* and increased time between dredging harbors as an indicator of reduced sedimentation rates. Table 6.1 outlines the evaluation measures for determining effectiveness of each BMP. Ongoing and recurring physical and biological water quality monitoring is taking place. *E. coli* is measured by the MDEQ and the Sanilac County Health Department (SCHD) as part of a beach health program and sanitary survey. The MDEQ also conducts biosurveys approximately every five years. Other studies can be done by a variety of groups, for example students from the Sanilac County Math and Science Center or volunteer water quality monitors. A number of nonpoint source (NPS) pollution sites were photographed during the watershed inventory. These pictures could be inserted into a portfolio of before and after photographs. After a BMP is installed, photographs will be taken to journal the results. Sites should be visited and landowners interviewed to determine what unforeseen problems or ancillary benefits were encountered. These simple tests give a qualitative assessment of stream conditions and are even more valuable when testing is done regularly at the same location to establish trends. Using the results of these existing programs will be used as indicators of overall water quality.

The goals of implementation should be revisited and compared with the BMPs that have been installed to make sure they are meeting the goals in Table 6.1. If the pollutant reduction goals are not being met, it may be necessary to adjust the WMP to find better methods for reaching water quality goals. The plan should be updated at a minimum of once every five years.

Table 6.0 - Summary of Evaluation Techniques

Pollution/Impairment	Evaluation Technique	Priority of Evaluation	Unit of Measures	Measurable Goals
E. coli	Water quality monitoring	High	Bacteria counts/100 mL	Meet water quality standards for total body contact recreation (130 count/100 mL) in all water bodies in the Watershed
	Beach closings	High	Number of beach closings	Eliminate all beach closings in the Watershed
	Complaints to SCHD	High	Number of complaints	Reduce number of complaint about failing septic systems and agricultural discharges by 25% three years after implementation of point of sale inspection
	Agricultural discharge	Moderate	Number of discharges reported to MDEQ	Avoid regulatory control of manure management by assisting all potential sources of *E. coli* with the Michigan Agriculture Environmental Assurance Program
	Cost/benefit compensation	Low	Cost and health risks of eliminating source and pollutant load reduction	Economic impact and health risk reduction of *E. coli* reduced outweighs cost of BMP implementation
Sediment	Marina and harbor dredging	High	Number of years between required dredging	Double the number of years between dredging
	Volunteer water quality monitoring	High	Suspended solids	25% reduction of suspended solids in 5 years
	Macro invertebrate surveys	Moderate	Water Quality Rating	Increase rating of water quality in 5 years
	Photographs of BMPs installed to reduce sediment	Moderate	Before and after photographs	Portfolio showing visual reductions in suspended sediment and streambank erosion
	Paired watershed study	Low	Suspended solids	75% reduction of suspended solids in treatment watershed
Nutrients	Volunteer water quality monitoring	High	Phosphorus and nutrient concentrations	25% reduction of phosphorus and nitrogen entering surface water in 5 years
	Macro invertebrate surveys	Moderate	Water quality rating	Increase rating of water quality in 5 years. Species diversity should not be low oxygen tolerant only
	Community survey	Low	Overall satisfaction with beach aesthetics	50% increase in overall satisfaction in appearance of water and beaches

Table 6.0 - Summary of Evaluation Techniques

Pollution/Impairment	Evaluation Technique	Priority of Evaluation	Unit of Measures	Measurable Goals
Urban NPS	Stream clean-ups	High	Pounds of trash cleaned up per person per hour	Decrease the rate of trash picked up per person per hour by 75% after 5 years
	Volunteer participation	High	Number of participants in volunteer monitoring or stream clean-up projects	Increase number of volunteers 50% in five years
	Prime farmland inventory	Moderate	Acres of prime farmland protected	25% of prime farmland enrolled in PA 116 or protected by purchase or transfer of development rights after 5 years
	Natural features inventory	Low	Number of rare or threatened species	No loss of rare or threatened species in the Watershed
	Demographics	Low	Development to population ratio	Percent change in developed land use should not be greater than percent change in population

6.2 PAIRED WATERSHED STUDY

Pollutant load reductions will only be an estimate of the effectiveness of each BMP implemented in the Watershed. Soil types, climate, and land use patterns are expected to alter the pollutant removal effectiveness of each BMP. Therefore, a measurement of the actual pollutant removal efficiency for BMPs in the Watershed would be helpful to determine if the BMP is achieving the desired level of pollutant load reduction.

A paired watershed study is a method to compare a watershed with BMPs against a control watershed without BMPs. The paired watershed method is superior to the traditional “before and after” study because it only required 3 to 5 years to complete, and corrects for annual climate variations. A paired watershed study works by creating a baseline level of pollutants in each of the paired watersheds. This baseline is plotted on a chart showing the amount of pollutants found in the runoff of each watershed. After the 1 to 3 year calibration period, BMPs are installed on one of the watersheds and the other watershed remains unchanged. The watersheds are then monitored for another 1 to 3 years during the treatment period. The pollutant data for each watershed is graphed and compared to the data collected during the calibration period. If the BMP treatment has successfully reduced pollutant loading, the change will be shown in the comparison between the calibration period and treatment period graphs.

The accuracy of a paired watershed study depends on proper selection of watersheds for the treatment and control treatments. The Watershed offer an excellent opportunity for conducting a paired watershed study since there are so many small watersheds in close proximity and with similar land uses. Watersheds should be located in relatively close proximity to ensure that they receive similar amounts of rainfall. Similar land uses, soil types, slopes, and vegetation are helpful, but are not essential. The most critical characteristic of each watershed is the ability to coordinate with landowners. Ideally, the land use and land management practices should remain the same throughout the entire study. By maintaining the same land use and land management practices it is possible to attribute any change in pollutant load reductions to the BMPs installed in the treatment watershed and not changes in land management. Therefore, smaller watersheds with the fewest landowners would be the best selection for the paired watersheds.

CHAPTER 7 - SUSTAINABILITY

The recommendations in this Watershed Management Plan (WMP) are options that can be voluntarily implemented to achieve water quality goals. It will be important to sustain the voluntary implementation of the plan's recommendations to ensure that the conditions in the Sanilac County Lakeshore Watershed (Watershed) improve, thereby avoiding the need for state regulations and mandates. Success of the WMP depends on consistent support from local governments, citizens, and agri-business. Each of these communities has distinct needs that will require different strategies. However, to remain committed to a common water quality goal will require the coordination of all these groups.

The Sanilac Conservation District has formed a Steering Committee that would be able to serve as the forum for discussing many of the needs and recommendations in the WMP. The Steering Committee was divided into the three groups: Policy, Technical, and Information and Education (I&E). Members of these committees provided information about existing water quality projects, programs, and ordinances in the Watershed throughout the planning process. The Michigan "Thumb" area has many organizations that are working toward a common goal of land and water conservation and improved water resources. Building upon and coordinating with these identified programs will help meet the goals of this WMP.

Long-term sustainability is possible for restoring water quality in the Watershed if involvement in preserving and protecting the unique coastal and rural resources of the Watershed is strengthened. The Steering Committee will be able to join forces with these efforts to continue its own mission of providing direction for the development of a community-based, sustainable WMP.

7.1 LONG TERM PLANNING

The WMP outlines the actions that stakeholders can take to continue the implementation of the plan over the next 20 years. Immediate and short-term remedies need to fit into the overall long-term planning for a community. Growth and development can be guided in ways that are sustainable and appropriate for the community. Policies can be put in place that can collectively shape how and where development occurs. Specific rules and regulations can be implemented through zoning and other ordinances that address those long-term concerns.

Long-term improvements to water quality through physical improvement depend on the type of structures and the operation and maintenance plans. Often, ongoing maintenance is neglected, resulting in shortened life spans of Best Management Practices (BMPs) or even detrimental conditions depending on the type of BMP. Costs and responsibilities should be revisited on a regular basis, such as when annual

budgets are recalculated. This evaluation process is explained in detail in Chapter 6 - Evaluation. BMPs implemented on private land must have strategies to ensure that time and money is allocated to maintain structures and practices.

Information and education strategies and recommended systems of BMPs will be implemented over a 20-year period (schedule is detailed in Chapter 4 and 5). Changing conditions in the Watershed may make it necessary to update parts of the WMP. The Steering Committee should revisit the WMP at a minimum of once every five years. Before implementation of this plan, the Steering Committee will adopt a watershed vision and mission statement. These tools will be used to create a comprehensive action plan for implementation of BMPs and evaluating the completion of tasks.

7.2 EXISTING MANAGEMENT STRATEGIES

Prior to the Watershed project, organizations have participated in watershed management in the Watershed without the use of a comprehensive watershed management plan. Their efforts include development of planning and zoning ordinances, environmental education, and land conservation. The coordination of these efforts would build a stronger coalition to improve the Watershed and surrounding areas.

Sanilac County has the unique opportunity to preserve its rural character while improving its ability to add value to farming and tourism. The county is unusual that it has maintained its rural character while being very close to metropolitan areas. This WMP, as well as the Sanilac County Master Plan, wishes to preserve, protect, and improve agricultural economies and natural resources. A list of the Sanilac County Planning Commission's goals and objectives for the county master plan is included in Appendix 8.

The Lake Huron Initiative was established by representatives from the Michigan Office of the Great Lakes, federal and local agencies, and interest groups with a common goal "to restore and maintain the chemical, physical, and biological integrity of the waters, tributaries, and nearshore terrestrial and aquatic ecosystems of Lake Huron (Lake Huron Update, 2001)." The Lake Huron Initiative is a management plan that includes input from private and government interests to restore the Lake Huron environment through pollution prevention and ecosystem restoration. The Lake Huron Initiative is not as detailed as other Lakewide Management Plans prepared for the other Great Lakes. However, the Lake Huron Initiative has brought key governments and agencies from Canada and the United States to the table to begin to identify issues of common concern.

7.3 WATERSHED ORGANIZATION

Coordination between existing efforts could take place in a watershed organization involving the existing Steering, Technical, I&E, and Policy Committee and representatives from local governments, agri-business, education, and community development agencies and organizations. The organizational structure that develops from these stakeholders would provide a venue for the stakeholders to discuss their current activities and needs as well as ideas for implementing the WMP. A watershed organization with tax-exempt status could be eligible for grant funding to implement recommendations in the WMP. Full-time or part-time staff could be housed at the Sanilac Conservation District.

A watershed organization operating in the Watershed would find that the needs of each group of stakeholders are very diverse. Along the lakeshore, communities are more urbanized and their economies depend on tourism and seasonal recreation. In contrast, inland areas are very agrarian and have different needs to meet the goals of the WMP. It is recommended that the watershed organization would consist of four committees: agricultural, urban, I&E, and sustainability and funding. These four committees would represent stakeholder groups and would be contained under the umbrella of the larger watershed organization.

7.3.1 AGRICULTURE COMMITTEE

The Technical Committee spent a great deal of time considering agricultural best management practices during the planning phase of the Watershed project. The same members serving on the Technical Committee during the planning phase would be invited to serve on the Agriculture Committee.

Many of the recommendations in the WMP are for agricultural producers. Successful implementation of the plan with sustainable results will require support from the agricultural community and interest from farmers and landowners in improving water quality resources and soil fertility. A recommendation of the Technical Committee was the creation of a Conservation Farmers' Association that would work cooperatively to implement WMP recommendations. This Farmers' Association would be similar to the Innovative Farmers of Huron County that was created by the Huron County Michigan State University Extension. The Innovative Farmers, now know as the 21st Century Alliance, collected membership dues, conducted research, and published newsletters and reports.

Creating a nonprofit alliance of agricultural producers would open the doors for greater experimentation of innovative farming practices in the Watershed. Nonprofit groups are able to receive grant monies and tax-exempt status. Grants could be used to conduct research on test plots within the Watershed. This would allow participants to realize economic and environmental benefits of adopting conservation tillage, manure management, or cover crops within their agricultural market, climates, crop rotation, and soils.

7.3.2 URBAN COMMITTEE

The existing Policy Committee members would be invited to serve on the Urban Committee during the implementation phase of the Watershed project. During the planning phase, the Policy Committee identified storm water pollution and failing septic systems as the primary concerns for water quality in urban areas. These concerns will be addressed in communities that are required to submit a National Pollutant Discharge Elimination System (NPDES) Storm Water Discharge Permit. These areas include the Village of Lexington, portions of Lexington Township and Worth Township, and all county roads within these areas. These communities have worked together to develop a watershed-based strategy to pursue compliance with these regulations.

The NPDES is designed to regulate the discharge of pollutants into public waterways and groundwater. This system provides the Michigan Department of Environmental Quality (MDEQ) with a means to monitor the quantity and types of pollutants that are discharged into waters of the state. The United States Environmental Protection Agency (EPA) has identified storm water pollution as the single largest source of pollution in the Unites States today. To address these concerns, the EPA now requires urbanized areas to obtain NPDES permits to discharge storm water from their Municipally Separate Storm Sewer System (MS4). Each community with an MS4 will be required to develop a Storm Water Pollution Prevention Initiative (SWPPI) in accordance with NPDES Phase II Storm Water Regulations.

This WMP will serve as a guide for communities to understand water quality concerns and voluntary actions needed to meet water quality goals. The NPDES Phase II Storm Water Regulations creates an opportunity for communities to implement recommendations of the WMP as compliance standards in their SWPPI. Components may include illicit discharge elimination, road stream crossing improvements, and storm water pollution education.

The SWPPI component of the NPDES Phase II Storm Water Regulations require each jurisdiction to identify significant sources of storm water pollution and to develop an action oriented strategy to address each pollutant. The SWPPI will be designed to reduce the discharge of pollutants to the maximum extent practicable and will be consistent with the goals and objectives set forth in this Watershed Management Plan. Once submitted to the MDEQ, the SWPPI will be used to evaluate each community's actions toward

mitigating impairments caused by storm water pollution. The Steering Committee has proposed that these responsibilities would be owned by the Urban Committee. This would give the MS4 communities the ability to coordinate their NPDES permit compliance with goals of the Watershed Management Plan. The Steering Committee has also suggested that communities outside of the regulated urbanized areas be included in the Urban Committee. In this way, communities outside the MS4 areas could prepare to adopt policies before they become regulatory and the water quality benefits would be felt throughout the Watershed.

7.3.3 INFORMATION AND EDUCATION COMMITTEE

A great deal of support is required for this WMP to be successful. Increasing public and government support for water quality protection is accomplished through public outreach and education. The I&E Committee has assembled newsletter articles, radio announcements, and press releases that have garnered increasing public support through the planning phase of this Watershed project. Chapter 5 of this WMP outlines how these efforts will be expanded and continued to increase public involvement and interest in the Watershed.

7.3.4 SUSTAINABILITY AND FUNDING COMMITTEE

Promoting the conservation or preservation of water resources will involve extensive education to create a stewardship ethic in the Watershed's population. Behaviors and attitudes will not change overnight; therefore, a long-term strategy is needed to make certain that the goals of this WMP are still a target for future generations. Maintaining the Watershed activities for a 20-year period is often difficult to do with grant funding. This situation usually results in a great deal of time spent seeking grant monies and not on implementing the plan's recommendations. Creating an endowment fund would supply a sustainable income for staff and office costs.

The Technical Committee proposed a method to raise endowment funds by accepting donations in return for naming a stream. The majority of streams in the Watershed are unnamed. It was the feeling that unnamed streams do not inspire stewardship. Naming the streams would spark excitement for a resource that would otherwise not even be on a map. Donors would be given a packet of information about their stream that includes resource concerns, natural features inventory, and a map of the stream's watershed. Signs would be placed along major arterial roads designated the streams name and the adoptive owner. The Sanilac County Community Foundation could hold other donations to the endowment. Once the endowment reached a critical size, it would be able to support day-to-day operations of a watershed organization.

7.4 WATERSHED TECHNICIAN

A Watershed technician was hired by the Sanilac Conservation District during the planning phase of this project. The Sanilac Conservation District hopes to keep the Watershed technician on full time to oversee the implementation of the plan. The primary role of the Watershed technician was coordination of the Watershed committees, the nonpoint source pollution inventory, and drafting the I&E. After the WMP is completed, the Watershed technician will meet with 75 landowners to discuss conservation options for their property. While discussing conservation plans with the landowners, the Watershed technician will promote the WMP recommendations.

Sustainability of the WMP will be more likely if the Watershed technician is able to continue uninterrupted service for the Sanilac Conservation District. Maintaining the status of this position will allow the implementation of the WMP without loosing any of the momentum that has accumulated during the planning process. Watershed technician responsibilities during the implementation phase are shown in Table 7.0.

Table 7.0 - Watershed Technician Tasks

Task	Goal
Revisit Watershed Management Plan	
Develop Vision and Mission Statement	Revisit Watershed Management Plan and develop a Vision and Mission Statement by the end of 2004
Create BMP Action Plan	Develop an action plan to implement BMPs with available funding
Update goals and objectives	Create goals and objectives for each project being implemented during funding cycle
Create a Watershed Organization	
Form subcommittees	Form subcommittees from the Steering Committee that will be capable of implementing BMPs
Facilitate meetings	The Watershed technician will host subcommittee meetings, coordinate between subcommittees, and prepare agendas and minutes

Table 7.0 - Watershed Technician Tasks	
Task	Goal
Implement Information and Education Strategy	
Support Farm*A*Syst, Lake*A*Syst, and Home*A*Syst programs	Existing programs through the groundwater stewardship program will be supported by the Watershed technician
Support USDA farm bill programs	USDA farm bill programs will be promoted while assisting landowners with conservation plans or Groundwater Stewardship Programs
Conduct workshops, tours, and public meetings	The Watershed technician will provide oversight for all tasks identified in the I&E Strategy
Host stewardship activities like stream clean-ups and water quality monitoring	The Watershed technician will provide oversight for all tasks identified in the I&E Strategy
Create publications and announcements about the Watershed project	The Watershed technician will provide oversight for all tasks identified in the I&E Strategy
Attend public meetings and workshops for ordinance development	The Watershed technician will serve as a liaison between the Sanilac County Planning Commission, the Watershed's communities, and the subcommittees
Provide Oversight for BMP Implementation	
One-on-one technical assistance with landowners	Public relation tasks will be accomplished by the Watershed technician who will also serve as the primary contact for water quality concerns for the Sanilac Conservation District
Promote use of USDA farm bill programs	USDA Farm Bill programs will be promoted while assisting landowners with conservation plans or Groundwater Stewardship Programs
Seek funding for local watershed projects	The Watershed technician will continuously seek funding for future projects identified in the WMP

7.5 ONGOING PROGRAMS AND OPPORTUNITIES

Generally Accepted Agriculture Management Practices (GAAMPs)

This program is administered by the Michigan Department of Agriculture to provide education to producers and complainants about the relationship between the environment and agricultural operations. It provides legal protection to any producer who follows GAAMPs procedures. GAAMPs ensure compliance to environmental laws and supplies guidance for corrective measures.

Michigan Agriculture Environmental Assurance Program (MAEAP)

The MAEAP is a proactive strategy for producers to ensure compliance with Michigan's environmental laws. This voluntary program ultimately leads to a comprehensive evaluation of a farming operation's potential environmental risk. Completing the Farm*A*Syst program and a Comprehensive Nutrient Management Plan are tools associated with the MAEAP.

United States Department of Agriculture (USDA)

The USDA Farm Services Agency (FSA) and Natural Resources Conservation Service (NRCS) provides technical and financial assistance to landowners to address resource concerns of soil, water, air, plants, and animals. The agencies offer cost-share opportunities through many federal programs and coordinate with state and local programs to maximize benefits. http://www.mi.nrcs.usda.gov/

Highly Erodible Land (HEL) and Wetland Conservation Compliance

The purpose of these provisions is to remove USDA benefits from landowners farming drained wetlands or HEL. These provisions define HEL as land that has potential erosion rates greater or equal to eight times which the soil can sustain productivity. To maintain the USDA commodity benefits and conservation program eligibility, fields designated as HEL must be protected from excessive soil erosion.

Environmental Quality Incentives Program (EQIP)

The EQIP is a voluntary compliance program administered by the FSA with technical support from the NRCS. Landowners with eligible land can receive technical assistance and cost share to implement managerial and structural conservation practices. Contracts with the NRCS vary from 1 to 10 years and some landowners will be eligible for 90% cost share.

Conservation Reserve Program (CRP)

The CRP was created in 1985 as part of the Food Security Act. A farmer may enter into a long-term contract to set aside land and establish a permanent cover. In return, the farmer receives an annual per acre rent and up to half the cost of establishing cover on land that has recently been farmed and is highly erodible or environmentally sensitive. In the first five years of the program, 33.9 million acres were enrolled in the CRP. Additional Acts in 1990 and 1996 have allowed continued enrollment and expanded the scope from reducing soil erosion to include habitat conservation. Participants may sign up at any time to perform the following practices on their land:

- Filter Strips
- Riparian Buffers
- Shelterbelts, Field Windbreaks, and Living Snow Fences
- Grass Waterways
- Shallow Water Areas for Wildlife
- Salt-Tolerant Vegetation
- Certain Approved Public Wellhead Protection Areas

Conservation Security Program (CSP)

Amendments to the Farm Security and Rural Investment Act in 2002 authorized the USDA to create the CSP. Not all details about general operating procedures for the NRCS to implement the CSP have been established. Once in place, the CSP will be a voluntary program that provides technical and financial assistance to farmers who show significant efforts toward resource protection. The intent of the program will be to identify those farmers who meet the highest standards and to encourage other producers to meet those same performance standards.

Wetland Reserve Program (WRP)

The WRP receives technical assistance through NRCS. The landowner controls access to the land and may use it for recreational activities such as hunting and fishing. There are three options for the WRP.

1. 10-Year Cost Share Agreement: This agreement is a cost share program where the NRCS pays 75% of the restoration costs and the landowner signs an agreement to keep the wetland in place for 10 years. This option is very similar to the U.S. Fish and Wildlife Service's Partners for Wildlife Program.

2. 30-Year Easement Option: The NRCS "purchases" a 30-year conservation easement over the property. The NRCS will pay 75% of all restoration costs and pay the landowner 75% of the appraised agricultural value of the property under the easement.

3. Permanent Easement Option: The NRCS "purchases" a permanent conservation easement over the property. The NRCS will pay 100% of all restoration costs and pay the landowner 100% of the appraised agricultural value of the property under the easement.

An example of a successful wetlands restoration is the Mullet Muck Farm Restoration in Sanilac County. The 836-acre restoration was originally under a 30-year easement, but has now been transferred to the MDNR. Serpentine channels were created in the previously leveled farm field, which resulted in more shoreline for wading birds. http://www.nrcs.usda.gov/

Today, the Environmental Benefits Index is used to prioritize land offered for enrollment. Scores are based on a cost factor, plus six environmental factors, as follows:

- Wildlife
- Water Quality
- Erosion
- Enduring Benefits
- Air Quality Benefits from Reduced Wind Erosion
- State or National Conservation Priority Areas. The Great Lakes, along with Long Island Sound, the Chesapeake Bay, the Longleaf Pine region, and the Prairie Pothole region comprise the national CPAs.

Farmland Protection Program

The Farmland Protection Program in the recently enacted Farm Bill has up to $50 million in funds to assist in the purchase of development rights on agricultural lands. Development pressure on the urban fringe causes large amounts of land to be converted to non-agricultural uses. Proposals must be submitted to the NRCS state offices. The American Farmland Trust is an organization that works toward sustainable agriculture through education and financial assistance to communities and landowners. http://www.farmland.org/.

Michigan State University Extension (MSUE)

The MSUE utilizes the resources of Michigan State University and works on community outreach, especially with agriculture and families. MSUE offers a wide variety of technical assistance and employs individuals with high levels of expertise in their area of concentration to meet specific needs of producers. They are also involved with research to better the services and technology available. Demonstration plots and training workshops involve the landowners in the implementation of practices they can adopt to address resource concerns.

4-H

4-H is delivered locally by the MSUE with national support from USDA. The partnership with land grant colleges and USDA ensures that 4-H lessons are backed by strong scientific research. Agricultural management practices taught through 4-H have been very successful in changing the course of agricultural sustainability by teaching the future generation of farmers innovative skills that promote soil fertility and sustainability productivity.

Future Farmers of America (FFA)

The FFA involves youth in farming activities and teaches them skills they will need to be farmers including soil identification and livestock care. There is an opportunity to involve them in implementation of BMPs on farms in the Watershed.

7.6 RESOURCE LIBRARY

A library of the documents used to create this WMP will be made publicly available by the Sanilac Conservation District. The following publications will be housed at the Sanilac Conservation District:

Bauer, Charles. 2003. Michigan Department of Environmental Quality. Report of Sanitary Wastewater Survey Conducted May 1, 2003, at Worth Township, Sanilac County.

Bennett, Thomas and Erica Staton. 2002. The Great Lakes: Are We Destroying our Shoreline? Challenges for the 21st Century. Wetland and Coastal Resources, Inc. Lansing, MI.

Brown, E., Peterson, A., Kline-Robach, R., Smith, K., and Wolfson, L., 2000. Developing a Watershed Management Plan for Water Quality: An Introductory Guide. Michigan Department of Environmental Quality.

Michigan Department of Environmental Quality. 1998. Guidebook of Best Management Practices for Michigan Watersheds.

Morse, D. 1994. Biological Surveys of Selected Lake Huron Tributaries, Huron and Sanilac Counties, June 7-9, 1993 and June 3, 1994. Michigan Department of Natural Resources, Surface Water Quality Division, Report # MI/DNR/SWQ-94/025.

Ohio State University Extension. 1998. Agricultural Drainage: Beneficial and Adverse Water Quality Impacts of Drainage. Bulletin 871-98.

Sanilac County Planning Commission. 2000. Sanilac County Plan for Planning. June 16, 2000.

United States Department of Agriculture (USDA). 1953. Soil Survey Sanilac County Michigan. Series 1953, No. 10. Issued 1961.

United States Department of Agriculture (USDA). 1976. Supplement to Soil Survey, Sanilac County, Michigan.

United States Department of Agriculture (USDA). 1974. Soil Survey St. Clair County Michigan. U.S. Government Printing Office. Washington D.C.

United States Department of Agriculture (USDA). 1977. Soil Survey Huron County Michigan. U.S. Government Printing Office. Washington D.C.

United States Geological Survey. 2000. Arsenic in Groundwater in Sanilac County, Michigan. USGS Fact Sheet FS-132-00.

Van der Guilik, T. W. et al. 2003. Managing Excess Water. Report 10. Environment Canada.

Walterhouse, M. 1999. Biological Surveys of Selected Lake Huron Tributary Streams, Huron and Sanilac Counties, Michigan, June 29-30, 1998. Michigan Department of Environmental Quality, Surface Water Quality Division, Report # MI/DEQ/SWQ-99/063.