

# **The Kent Lake/Upper Huron River Watershed Management Plan**

*Submitted in compliance with the  
Watershed-Based Permit*

**Phase II NPDES Storm Water Permit  
General Permit No. MIG619000**

**Prepared by the Kent Lake  
Subwatershed Advisory Group  
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# Executive Summary

This Watershed Management Plan has been developed to document the current conditions of water quality in the Upper Huron/Kent Lake Subwatershed, to determine goals and objectives related to the use, protection and restoration of the subwatershed, and to identify actionable activities to protect, preserve and enhance the subwatershed for the enjoyment of residents and visitors in the region.

The plan builds on previous research, analysis and planning activities facilitated by the Huron River Watershed Council during the period 2000-2002, as well as the Shiawassee & Huron Headwaters Resource Preservation Project (SHHRP) published in March, 2000.

Briefly, the planning process involved a subwatershed advisory group (SWAG) made up of representatives from local government and community agencies who worked together to develop a plan by:

- Affirming the stakeholder groups previously identified with interest in protecting and improving our water resources
- Gathering available water quality, storm water flow and habitat information
- Identifying areas of concern with the watershed, as well as uses that are considered threatened or impaired
- Identifying probable sources of pollution
- Establishing goals and objectives for the watershed
- Identifying the actions for which the subwatershed partners would accept responsibility
- Involving the public at appropriate points throughout the process, including presenting the final plan to stakeholders

The result is this management plan, which is submitted to the Michigan Department of Environmental Quality to fulfill each partner's obligation under the Phase II Watershed-based Storm Water Permit.

## Introduction to the Kent Lake Subwatershed

The Kent Lake Subwatershed is located in southwestern Oakland County, extending into Brighton and Green Oak Townships in Livingston County. The drainage area is 556 square-mile (100,000 acres), extending from the headwaters of the Huron River downstream to the Kent Lake impoundment in the Kensington Metropark. The subwatershed contains nearly 700 individual lakes comprising approximately 9,000 acres, Pettibone and Norton Creeksheds, and innumerable wetlands. In Oakland County the subwatershed covers all or portions of Commerce Township, Highland Township, Lyon Township, Milford Township, Springfield Township, Village of Milford, Village of Orchard Lake, Village of Wolverine Lake, Waterford Township, West Bloomfield Township, White Lake Township, the City of Walled Lake, and the City of Wixom. Land use in the Kent Lake Subwatershed ranges from heavily commercial and residential areas in the east and south to small rural farms and housing in the north and

west. There are two Metroparks and four state recreation areas in the subwatershed, along with numerous county, city, and village parks, totaling roughly 22,000 acres of publicly owned land. So exceptional is ecological value of this area that The Nature Conservancy recently deemed portions of the subwatershed as “Globally Significant.”

## Problem Statement

Based on water quality monitoring studies, in 1998 the Michigan Department of Environmental Quality (MDEQ) listed Kent Lake as *threatened* on the State’s 303(d) list of impaired waters requiring Total Maximum Daily Load (TMDL) establishment. The reason for the threatened status was cited as excess nonpoint source phosphorus loading in the subwatershed that eventually enters Kent Lake.

The Huron River Watershed Council (HRWC), working with an advisory group of local government representatives and citizens, completed a Watershed Management Plan in 2002, designed specifically to document water quality issues related to the phosphorus loading and devise goals and objectives to reduce, eliminate or reverse negative impacts related to phosphorus. Water quality data documented in the appendices of that plan have not been repeated here.

Subsequent review of water quality data from a variety of sources, including HRWC’s “Adopt-a-Stream” program, Oakland County Beach Monitoring Program data, Lake Sherwood’s annual water quality studies and the Management Plan for Wolverine Lake indicate a variety of other issues. These include declining fish and macroinvertebrate populations, persistent toxins (including metals and PCB’s), reduced water quality (such as low dissolved oxygen and high suspended solids), bacterial contamination resulting in beach closures, as well as nitrates and chlorides in water supplies. These water quality concerns are among issues to be addressed in this Watershed Management Plan prepared as part of the National Pollutant Discharge Elimination System, Phase II Stormwater Permits required of the partner communities and agencies located in the subwatershed.

One-third of all lakes monitored within the subwatershed have been closed one or more times in the period of 1995-2003 due to bacterial contamination. Stream locations near the City of Wixom were characterized as poor habitat through the HRWC “Adopt-a-Stream” program. Tests in Lake Sherwood and Wolverine Lake show moderate levels of enrichment due to nitrates and phosphorus.

Of particular concern in the watershed is pollution attributed to nonpoint sources. Simply stated, nonpoint source pollution is defined as a diffuse source of pollution that cannot be traced to a particular discharge such as an industrial or wastewater treatment plant. Rainfall or snowmelt moving over and through the ground is the main cause of nonpoint source pollution. As the runoff travels, it picks up and carries pollutants to lakes, rivers, and wetlands, or even to underground sources of drinking water. Pollutants often found in stormwater runoff are numerous and include phosphorus and nitrogen, dirt and sediments, oils/greases, vehicle lubricants, herbicides and insecticides, metals, and garbage.

The intensity and frequency of nonpoint source pollution is directly related to the amount of hard (impervious) surfaces in a subwatershed because these areas facilitate the travel of water over ground. The anticipated increase in development and subsequent hard surfaces in the Kent Lake Subwatershed, combined with the loss of unaltered land, is expected to cause an increase in already excessive nonpoint source pollution situation.

## Watershed Concerns

The SWAG presented the water data quality results to the stakeholders and general public in meetings held July, 2004. The public was asked to comment on their concerns about the watershed, as well as identify desired uses. Volunteers also solicited input at other events. The concerns identified for the Kent lake subwatershed include nutrient and bacterial loading, decreased water quality, erosion and sedimentation, issues which were confirmed through evaluation of water quality data. Other concerns include flooding, trash and litter on roadways and within stream corridors.

Stakeholders in the subwatershed are concerned with striking an appropriate balance between economic development and environmental protection, and believe that there are many opportunities to promote natural connections to the watershed for recreation. Communities could also capitalize on their natural water resources as an attractive amenity in commercial areas.

Many stakeholders are concerned about the loss of open space and natural features as development paves its way through the communities within the subwatershed. The Michigan Natural Features Inventory has identified substantial natural areas within the subwatershed, much of which is protected by state, regional, and local park systems. However, a great deal of sensitive land is not protected.

Finally, stakeholders are concerned that the public is not educated about the value of the natural and water resources within the Kent Lake subwatershed and what their individual role is in protection of these resources. Since the majority of land within the subwatershed is owned by private individuals, public education is critical to the future status of water resources.

The SWAG explored each of these concerns in greater depth to identify possible sources and causes. This analysis was utilized in determining goals and objectives, as well as identifying potential actions to address each of the issues.

## Goals and Objectives

Goals and objectives were developed to address each of the concerns identified within the subwatershed. These goals and objectives were developed during a stakeholder workshop, in which stakeholders broke up into small groups, developed a set of goals and objectives, and then came back together to compare results. The output from this initial workshop was combined and refined through additional discussion.

These goals and objectives are guidelines for each community to follow as they develop their Stormwater Pollution Prevention Initiative (SWPPI) document, which is the enforcing document of the Phase 2 stormwater permit. Each community will identify their own unique solutions for addressing the goals and objectives presented here, based upon their own unique situations, opportunities, and resources. The objectives were further identified as long-term (LT) or short-term (ST) objectives, to document the partners' expectations regarding progress towards the goals and to help partners establish priorities.

### **Goal # 1: Promote and maximize community assets and recreational opportunities related to water resources.**

Objective # 1-1: Provide information to the public on access to the water resources and riparian lands in the watershed, and available uses and recreational opportunities. (ST)

Objective # 1-2: Improve and maintain fisheries and wildlife habitat. (LT)

Objective # 1-3: Pursue harmonious economic development approaches through intentional connection with the natural environment. (LT)

**Goal # 2: Enhance and improve protection of open space, greenways, and natural features.**

Objective # 2-1: Coordinate planning approaches with neighboring communities using a systems approach to protection of natural features. (ST)

Objective # 2-2: Identify planning opportunities for protection of open space, greenways, and natural features and investigate the implementation of tools appropriate to each community. (ST)

Objective # 2-3: Develop and maintain a working relationship with a local land conservancy, if applicable. (ST)

**Goal # 3: Reduce water quality degradation and address the Kent Lake TMDL (Total Maximum Daily Load).**

Objective # 3-1: Investigate sources of water quality degradation, including bacterial and nutrient loading, erosion, and sedimentation. (LT)

Objective # 3-2: Develop and evaluate methods for source reduction. (LT)

Objective # 3-3: Promote public awareness of the effects of pollutants such as trash, litter, and fertilizer on the water quality and aesthetic conditions. (ST)

**Goal # 4: Educate, engage, and empower the public to protect water resources.**

Objective # 4-1: Faithfully implement Public Education Plans (PEP). (ST)

Objective # 4-2: Identify, promote, and encourage participation in educational opportunities targeting land-use decision-makers in their role in protecting water resources. (ST)

Objective # 4-3: Promote participatory experiences to foster a personal connection and sense of responsibility between the public and local lakes, rivers, streams, and wetlands. (ST)

**Goal # 5: Improve management of stormwater and watershed hydrology.**

Objective # 5-1: Consider the function of natural hydrologic systems through coordinating stormwater management with neighboring communities when appropriate. (LT)

Objective # 5-2: Identify watershed-wide and community-scale planning, design, and engineering alternatives to manage stormwater, protect wetlands, floodplains, and other natural features that protect water quality and quantity, and incorporate those alternatives where appropriate. (LT)

Objective # 5-3: Develop and maintain a working relationship with the Huron River Watershed Council. (ST)

## **Goal # 6: Develop resources to address the concerns, goals, and objectives outlined in the subwatershed management plan.**

Objective # 6-1: Continue regular operation of the Kent Lake Subwatershed advisory Group and incorporate additional stakeholder interests as appropriate to share resources. (ST)

Objective # 6-2: Form a subcommittee to investigate potential funding options/sources and opportunities to leverage resources for addressing watershed concerns, goals, and objectives. (ST)

## Best Management Practices and Community Action Plans

The Goals and Objectives identified previously in this plan can be addressed by a number of Best Management Practices (BMP's). BMP's may include public education programs, policies and regulations to encourage more environmentally sensitive site design, municipal "housekeeping" practices and even structural improvements to improve water quality.

The SWAG prepared a "menu" of options, some of which can be addressed through cooperative action, and some of which require initiative of each individual agency or government. The BMP's identified in the plan will form the basis for each partner to create their Stormwater Pollution Prevention Initiatives Plan or SWPPI.

The BMP's have been loosely grouped in the following categories:

- *Ordinances, Regulations and Standards:* including such issues as local fertilizer ordinances, onsite sewage disposal system, native landscaping, natural features setbacks, soil erosion and sedimentation control improvements, wetlands, woodlands and tree replacement ordinances.
- *Coordinated Planning Activities:* including such opportunities as recreation plans, working with conservancies to acquire conservation easements, integrating natural resources protection into land use planning practices, and utilizing a comprehensive planning process for wastewater treatment facilities.
- *Public Education and Stewardship Opportunities:* these include programs designed to address specific stewardship messages or to target specific stakeholder groups such as lawn care behavior programs, animal/pet waste programs, household hazardous waste collection, litter and debris cleanup, recycling programs, support of local river groups, golf course turf management and promotion of generally accepted agricultural management practices (GAAMPS)
- *Municipal/Organization Housekeeping Practices:* includes programs such as training and education for employees and decision makers, identifying and eliminating illicit discharges, maintaining detention basins, street sweeping and catch basin cleaning, reducing fertilizer, pesticide and herbicide, and improved management of other public facilities.
- *Structural Improvements:* includes specific construction, maintenance or repair projects associated with storm water management, sediment control devices, streambank stabilization and similar projects.

The subwatershed partners also agree to commit to meeting regularly to share information, coordinate public education activities and events, and identify ways to share resources where appropriate to more effectively implement the plan than would be possible on a jurisdiction by jurisdiction basis.

## Methods of Evaluating Progress

Much of our hope for a sustainable, healthy watershed lies in changing public perceptions and modifying human behavior. Except in light of a perceived crisis, these changes occur gradually over time, and may not be immediately manifested in terms of measurable improvements in water quality. The evaluation program will therefore include some measurement of effort, not only measurement of results.

To provide a means of gauging public awareness of and sensitivity to watershed issues, as well as the “willingness to change”, SEMCOG conducted a Regional Water Quality Survey in the summer of 2004. The survey was designed to provide a benchmark to determine the effectiveness of public outreach campaigns. Results have been compiled on a watershed basis. The study will presumably be updated in the future to provide a means of evaluating progress.

Each community will monitor its own progress in meeting the obligations of its Stormwater Pollution Prevention Initiatives (SWPPI). This will likely be “task-based” evaluation.

The Subwatershed Advisory Group (SWAG) will periodically take up the question of whether we are making satisfactory progress as a group, based in part on the individual partner’s annual reports. The SWAG is responsible for updating the watershed management plan every two years. Additional evaluation methods will be needed to determine if we are meeting our goals and objectives. This will include a review of which best management practices have been adopted, and how well they have been received by the decision makers and public. It will also include an assessment of which best management practices were not implemented, and what obstacles or barriers must be eliminated for future progress.

# CHAPTER 1. INTRODUCTION


## 1.1 Value of Watershed Protection


Healthy watersheds are important to all communities as they embody our sense of place in the landscape, protect economic and personal interests (e.g., flood protection), provide sources of drinking water and recreation, and support wildlife and sensitive plant species habitat, among other benefits. As a result, communities quickly find a vast number of reasons to take an interest in and protect local watersheds.

However across the nation, scientists and communities are finding that their water resources are degrading in response to past and present growth and development methods. They now find themselves facing billions of dollars in expenses in order to restore our waters because of the impact of our actions. They are also discovering that they can only protect these local water resources by thinking on a new level—a watershed level. Numerous diverse local watershed management efforts have begun to be initiated in recent years in response to the observed water quality degradation. In the Huron River area, communities surrounding Ann Arbor and Ypsilanti have sought to reduce and prevent lake degradation caused by excess phosphorus loading that resulted in recreational and property value loss for Ford and Belleville Lakes since the late 1990s.

Each community often has their own unique rationale for protecting watersheds. Some may place a high value on the aquatic biological community living in waters or wildlife protection for sensitive mammals and amphibians, while others may be more concerned about reducing flood events or stream channel erosion to the real estate in their back yard. Regardless of the reasons, it is clear that most communities are recognizing the value of local watersheds and are taking steps to restore and protect these resources (CWP, 1999).

Healthy watersheds provide millions of dollars worth of protection due to their natural attributes and functions. Some benefits from healthy watersheds include:

- ***Human Life and Property Protection.*** Estimates indicate the United States loses billions of dollars each year from flood damage to buildings, not including loss of life (CWP, 1999). Wetlands, floodplains, and undeveloped open spaces in watersheds help protect adjacent and downstream properties from potential flood damage and even death by collecting and slowly releasing floodwater. The cost of replacing natural flood control function in a watershed can sometimes be several million dollars.
- 
- ***Recreation.*** More than half of all U.S. adults hunt, hike, fish, canoe, birdwatch, or photograph nature, spending billions of dollars annually. Recreational fishing by Americans alone generates at least \$37.8 billion annually in revenue (CADFG, 2002. Kent Lake, and the associated Kensington Metropark, receives approximately 2 million visitors each year that spend money at local restaurants and other local businesses (Schafer, 2000).
  - ***Water Supply.*** Healthy watersheds provide clean drinking and recreational waters. Wetlands, kettle lakes, prairie potholes, and other open spaces have significant water storage and groundwater recharge. However, groundwater supplies are sensitive to activities that alter watershed hydrology. Improper development lowers the water table and reduces the groundwater recharge and discharge.

- **Water Quality.** Healthy watersheds maintain and improve the water quality of our nation's streams, rivers, lakes, and wetlands. As runoff and surface water pass through these systems, pollutants are removed or transformed through physical, chemical, and biological processes. This cycle helps protect the water we drink, and uses for recreation, as well as the water animals and plants depend on to survive.
- **Erosion Control.** The native trees and plants surrounding lakes, streams, and wetlands in healthy watersheds protect soil from the erosive energy and flows of water. These areas help protect water quality, reduce the need and dependence on seawalls and dredging, and provide valuable habitat for wildlife.
- **Culture.** Watersheds have archeological, historical, and cultural values. Most societies traditionally formed along bodies of water. The cultures of Egypt, Louisiana, and the Chesapeake Bay formed as a result of their vibrant watersheds. Many painters and writers have used watershed landscapes as their subject matter. Now, people with cameras and camcorders spend billions of dollars to capture the scenery that healthy watersheds provide.
- **Economic Vitality.** A study by the American Farm Trust looked at the local government costs and revenues associated with different land uses in Marshall, MI. They found that for every \$1.00 in revenue generated by residential development, \$1.47 was required in public services (e.g. schools, fire and police protection, infrastructure, and road maintenance). For every \$1.00 generated by farms and open land, only \$0.27 was required for associated services, and for every \$1.00 of revenue from commercial/industrial uses, \$0.20 was spent in services (AFT, 2001). Healthy watersheds provide a basis for commercially important products harvested from them. This includes fish, shellfish, agriculture, timber, and even some medicines derived from soils and plants.
- **Habitat.** Diverse species of plants, insects, amphibians, reptiles, birds, fish, and mammals depend on healthy watersheds for food, breeding, habitat, and shelter.
- **Scientific Advancement.** Scientists are only beginning to understand the complex processes of watersheds. Because most watersheds have been significantly altered, protecting what is left for study and understanding is a prime concern for many water-quality professionals. 

In addition to the cultural benefits of healthy watersheds, watershed planning and protection holds notable benefits to local governments. Most significantly, watershed planning can:

- **Address** federal and state regulations on Total Maximum Daily Loads and watershed plans,
- Allow communities opportunities to progress towards requirements of the **Michigan watershed-based Phase II stormwater permit**,
- Give local governments access to specialized state and federal **grant programs** (e.g., Clean Michigan Initiative, Clean Water Act Section 319 funds, etc.),
- **Reduce costs** of remedial actions by preventing future problems,
- Maintain **quality of life** within region,
- Heighten **public awareness and support**,



- **Enhance decision making** on land use requests,
- **Streamline development review** process,
- **Enhance coordination** of government resources and programs in the watershed, and
- **Reduce** potential of legal actions within TMDL watersheds.

## 1.2. Problem Statement

The Huron River supplies drinking water to nearly 140,000 people, supports one of the Michigan's best smallmouth bass fisheries, and is the State's only designated Scenic River in Southeast Michigan. However, numerous waterbodies in the Huron River Watershed are encountering increasing pollution levels, particularly phosphorus levels, which threaten to alter the structure of flora and fauna, decrease dissolved oxygen in the water, and degrade designated uses for waterbodies by causing recreational loss, fish kills, and other environmental and human health consequences.

In recent years, the Kent Lake Subwatershed and the Huron River Watershed as a whole have experienced amplified developmental pressures. According to SEMCOG, the Southeast Michigan Council of Governments, the 2000 population of the Huron River Watershed, which consists of the majority of the Kent Lake subwatershed in Oakland County, was 161,000 individuals. Projections to the year 2030 estimate a 65% increase in population in the area from 2000 levels, or an additional 81,000 individuals.

The projected increase in development and corresponding hard (impervious) surfaces combined with the loss of unaltered land is of particular concern since these areas are significant contributors of nonpoint source pollution (NPS). Simply stated, NPS is defined as a diffuse source of pollution that cannot be traced to a particular discharge such as an industrial plant. For instance, when rain or snowmelt occurs on impervious surfaces such as parking lots, rooftops, lawns, and roads or disturbed land like found on construction sites, the resulting water runoff—called stormwater runoff—picks up pollutants that may be on these surfaces and carry them, often untreated, to local streams, lakes, or wetlands. Pollutants often found in stormwater runoff are numerous and include phosphorus and nitrogen, dirt and sediments, oils/greases, vehicle lubricants, herbicides and insecticides, animal wastes, metals, and garbage. But because there are hundreds of thousands of small sources of stormwater runoff in the subwatershed, addressing NPS is often complex and problematic.

As a result of findings based on water quality studies performed on Kent Lake in 1979 and 1999, the Michigan Department of Environmental Quality (MDEQ) designated Kent Lake as *threatened* on the State of Michigan's 1998 303(d) list of impaired waters requiring Total Maximum Daily Load (TMDL) establishment due to excess nonpoint source phosphorus in the subwatershed. A TMDL is the maximum amount of a particular pollutant a waterbody can assimilate without violating numerical and/or narrative water quality standards. The Kent Lake Subwatershed Management Plan was originally written to develop a schedule for TMDL program development.

The Kent Lake Subwatershed Management Plan has since been updated to address the U.S. Environmental Protection Agency's Stormwater Phase II Permit of the National Pollutant Discharge Elimination System (NPDES) Program issued in 2003. The primary goal of the federal Phase II Stormwater Permit is to reduce the discharge of pollutants to protect water quality through stormwater management. The Phase II Stormwater requirements include the following plan components:

- **Public Education Plan (PEP):** A plan to promote, publicize, and facilitate watershed education and to encourage the public to reduce the discharge of pollutants in stormwater.

- Illicit Discharge Elimination Plan (IDEP): A plan that prohibits and effectively eliminates illicit discharges, including sanitary wastewater, to the permittee's drain system.
- Watershed Management Plan: A plan that assesses the current nature and status of the watershed, identifies short and long-term goals for the watershed, the actions needed to meet goals, and the costs associated with those actions.
- Public Participation Plan (PPP): A plan that develops a process to involve the public throughout the development and implementation of the stormwater management plan.
- Stormwater Pollution Prevention Initiative (SWPPI): An action plan and schedule for implementing solutions to stormwater quality problems identified in the Watershed Management Plan. Communities need to address pollution prevention, good housekeeping practices, construction site runoff control and post-construction runoff control.

### 1.3 Purpose of the Kent Lake Subwatershed Plan

The updated Kent Lake Subwatershed Management Plan represents a broad effort to restore and protect the water quality integrity of Kent Lake and the upstream waterbodies that drain into the lake. The purpose of this subwatershed plan is to diminish the adverse effects of nonpoint source pollution to the lake and meet the established federal Phase II Stormwater Permit regulations.

The communities in the Kent Lake Subwatershed that are required to obtain a state or federal permit for stormwater runoff under the National Pollutant Discharge Elimination System (NPDES) Phase II program are Oakland County, the Townships of Commerce, Highland, Lyon, Milford, Springfield, Waterford, West Bloomfield, and White Lake, the Villages of Milford and Wolverine Lake, and the Cities of Novi, Orchard Lake Village, Walled Lake, and Wixom. The Huron Valley School District is also required to obtain a Phase II Stormwater Permit and meet the necessary stormwater management requirements.

### 1.4 Establishment and Role of Community Liaison Workgroup

Community-based partnerships are key to effective watershed management. Through a partnership, different people and organizations work together to address common interests and concerns. As such, partnerships represent the easiest way to develop and implement a successful watershed management plans because everyone is involved from the initiation. Consequently, the final plan achieves input and consensus of all parties who have a stake in the watershed.

In order to facilitate development of the original Kent Lake Subwatershed Plan to develop a TMDL strategy, a community liaison-working group (Workgroup) was formed between the Spring and Fall 2000 in order to understand the water quality and environmental concerns for the subwatershed by local communities and residents, and to garner grassroots support for the watershed management process. Overall, the goal of the Workgroup was to guide the creation of a watershed management plan to meet TMDL targets for the Kent Lake Subwatershed. To facilitate this goal, key stakeholders throughout the subwatershed were identified and contacted about possible participation. Invitees included representatives from all local governments within the subwatershed, county health, road, drain, and planning department representatives, state agency employees, environmental interest groups, concerned citizens, development interests, chambers of commerce representatives, and community engineers. It is important to note that while all communities were invited, not all chose to participate. The Kent Lake Subwatershed Workgroup organized to begin development of the updated plan upon receiving their Phase II Watershed Permit in

March 2003. Workgroup members include representatives from the following communities and organizations:

Oakland County, Commerce Township, Highland Township, Lyon Township, Village of Milford, Milford Township, the City of Novi, the City of Orchard Lake Village, Springfield Township, Walled Lake, Waterford Township, West Bloomfield Township, White Lake Township, the City of Wixom, Village of Wolverine Lake, the Huron River Watershed Council, the Huron Valley School District, the Huron Clinton Metroparks Authority, The Michigan Department of Environmental Quality, the Wolverine Lake Group, White Lake Resident's Care, and SEMCOG.

# CHAPTER 2. MAJOR CHARACTERISTICS OF THE KENT LAKE SUBWATERSHED

## 2.1 Kent Lake Subwatershed

The drainage area that provides water to Kent Lake is located in the upper Huron River Watershed and is designated the Kent Lake Subwatershed (Figure 1). This 156 square-mile (100,000 acres) area, which extends from the headwaters of the Huron River downstream to the Kent Lake impoundment in the Kensington Metropark, contains nearly 700 individual lakes comprising approximately 9,000 acres, and innumerable acres of wetlands providing water quality and aesthetic value. The vast majority of the subwatershed lies within Oakland County and comprises all or portions of thirteen municipalities which make up approximately 37,000 acres of built land. Included in the Subwatershed are two Metroparks and four state recreation areas, along with numerous county, city, and village parks, totaling roughly 22,000 acres of publicly owned land.

The exceptional ecological value of a portion of this area is such that The Nature Conservancy recently deemed it as “Globally Significant.”

### History and Demographics

Oakland County began as a settlement in the year 1818 where the Saginaw Trail crossed the Clinton River. A year later on January 12, 1819, Oakland County was officially organized and was named for its abundance of large oak trees. However, the area was not heavily wooded enough to attract many lumbermen, and settlement was slow at first. But agriculture was productive, and when roads and railroads to the north were built, the county grew as trade with the lumber areas expanded.

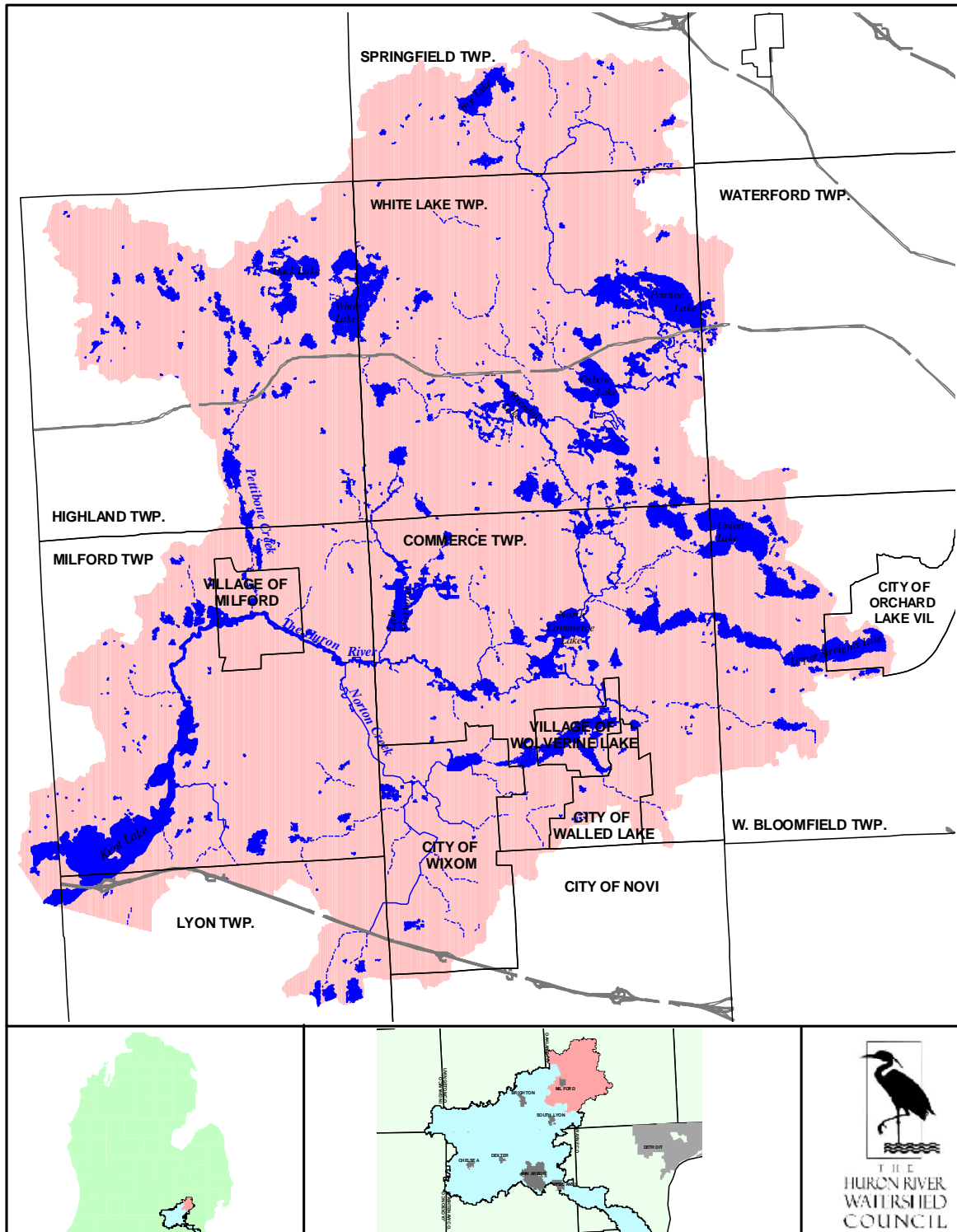
Oakland County consists of 910 square miles and is located 20 miles north of downtown Detroit. According to the U.S. Census Bureau, today Oakland County is the second most populated of Michigan's 83 counties and is part of the Detroit Metropolitan Area. The 2000 population of the county was 1,194,156, with almost 500,000 households. In 2001, the county had a per capita personal income of \$46,282. Oakland County ranked fifth in per capita income in the nation for counties with over 1 million in population. This income figure was 52% higher than the national figure of \$30,413. The largest industries in 2000 were services (48% of firms) and retail (13% of firms).

### Political Structure

The subwatershed is located in the southwest portion of Oakland County and comprises all or portions of eight municipalities and five cities or villages (Figure 1). This includes the townships of Commerce, Highland, Lyon, Milford, Springfield, Waterford, West Bloomfield, and White Lake. Also included in the subwatershed are the Villages of Milford and Wolverine Lake and the Cities of Novi, Orchard Lake Village, Walled Lake and Wixom.

Each jurisdiction is zoned and holds regularly scheduled meetings of governmental bodies where rulings are made on policy additions and changes, budgets, land use issues, and other important local business. Working with the guidance of statewide procedures, local municipalities have the power to formulate land management, land use and development policy, among other important activities. Public road maintenance and road drainage in each township, however, is the responsibility of the Road Commission of Oakland County.

Figure 1. Location of the Kent Lake Subwatershed



Land and water regulation, management, and protection within the Kent Lake Subwatershed are the responsibility of the state, county, and local governments. Private residents undertake specific non-regulated actions such as yard maintenance, landscaping, and waste disposal on a daily basis.

In some cases, essential regulatory and enforcement responsibility for water quantity and quality regulation lies with the United States Environmental Protection Agency (USEPA) and MDEQ. However, county government assumes responsibility for carrying out certain state policies. For instance, in most cases the Oakland County Drain Commissioner's Office (OCDC) has the responsibility of enforcing the state erosion control policy, under the Michigan Soil Erosion and Sedimentation Control Act 347 of 1972 and Part 91 of Act 504 of 2000, although local governments may also administer this program. Communities in the Kent Lake Subwatershed that currently administer their own soil erosion program are the townships of Commerce, West Bloomfield, and White Lake, the Village of Wolverine Lake, and the Cities of Novi, Walled Lake, and Wixom.

While state and county governments take an active role in many local policies, local governments at the city, village, and township level take a significant leadership capacity in land and water management by passing and enforcing safeguards that can be more protective than state laws. Working under numerous established procedures, local governments may enact ordinances to control stormwater runoff and soil erosion and sedimentation, protect sensitive habitats such as wetlands and woodlands, establish watershed-friendly development standards and lawn care and landscaping practices, and so forth. Under these circumstances the local government oversees enforcement.

## Land Use Trends

Grasslands of oak barrens and openings and forests of several species of oaks, beeches, and maples dominated the landscape of the Kent Lake Subwatershed before it was settled by permanent residents, according to Michigan Resource Information System (MIRIS) Land Cover. Multiple types of nontidal wetlands, such as emergent and forested, could also be found throughout the landscape (Figure 2).

Upon permanent settlement, the land began to be used for human benefit. Initial activities on the land centered on the transformation of grasslands for agricultural production and the use of forested areas for wood and wood by-products. By 1995, SEMCOG aerial photographic data indicates the landscape of the subwatershed had changed significantly (Figure 3). Permanent mixed density residential, agriculture, and grass and shrublands dominated the landscape. Forested lands, grasslands, and to a lesser extent wetlands, experienced moderate to significant reductions in coverage as the area developed in the mid-1800s to late 1900s.

Current land use figures from 1990 and 2000 provide insight into the potential development patterns and rates of the Kent Lake Subwatershed in the future. Oakland County developed 38,000 additional acres of land for a variety of land uses between 1990 and 2000. Open space areas that once maintained active agriculture uses saw a 35% decrease in acreage, and grasslands and shrub areas decreased by 26%. Increased development and loss of these natural areas result in increased levels of impervious surface and increased stormwater runoff.

Figure 2. Kent Lake Subwatershed Pre-settlement Land Use

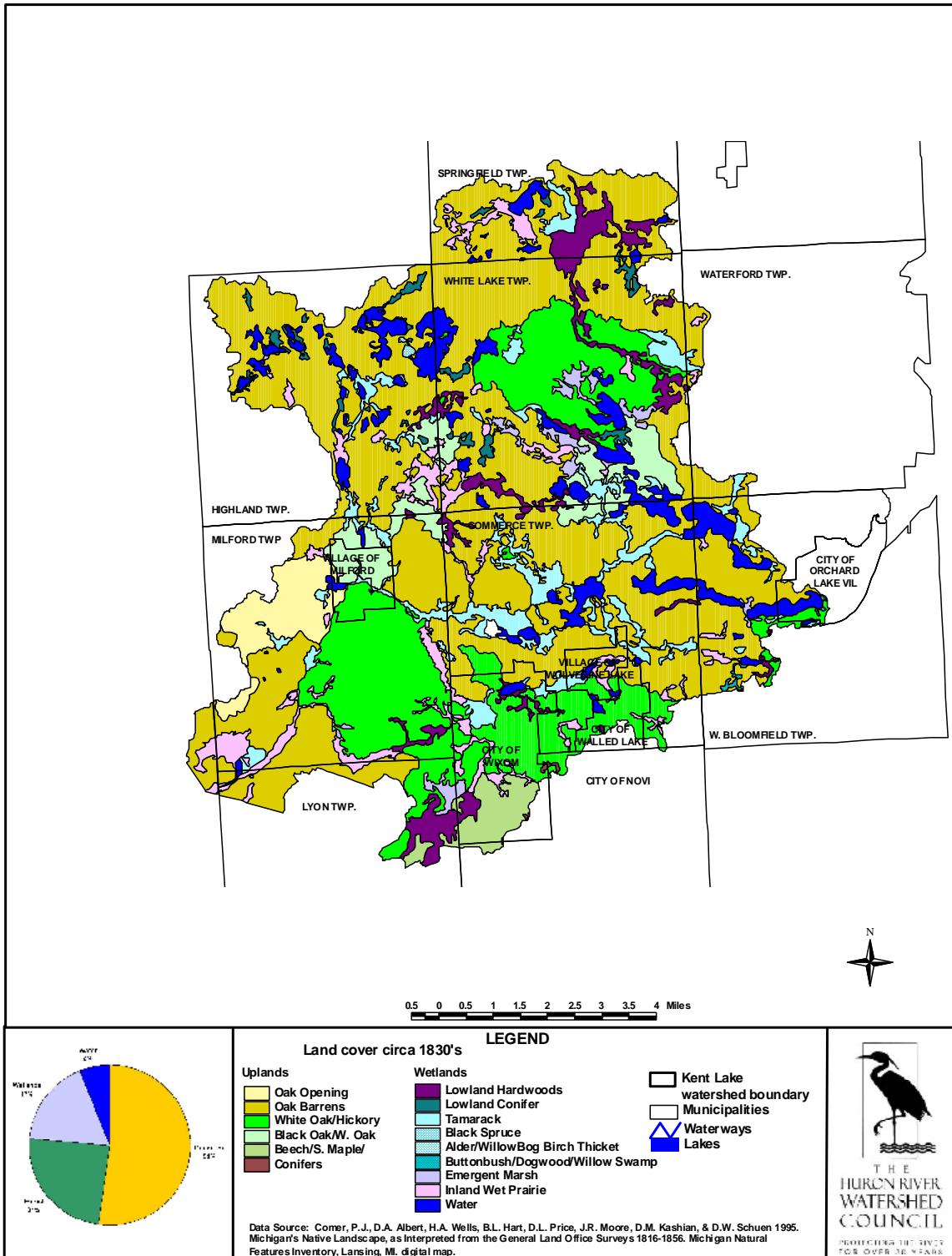
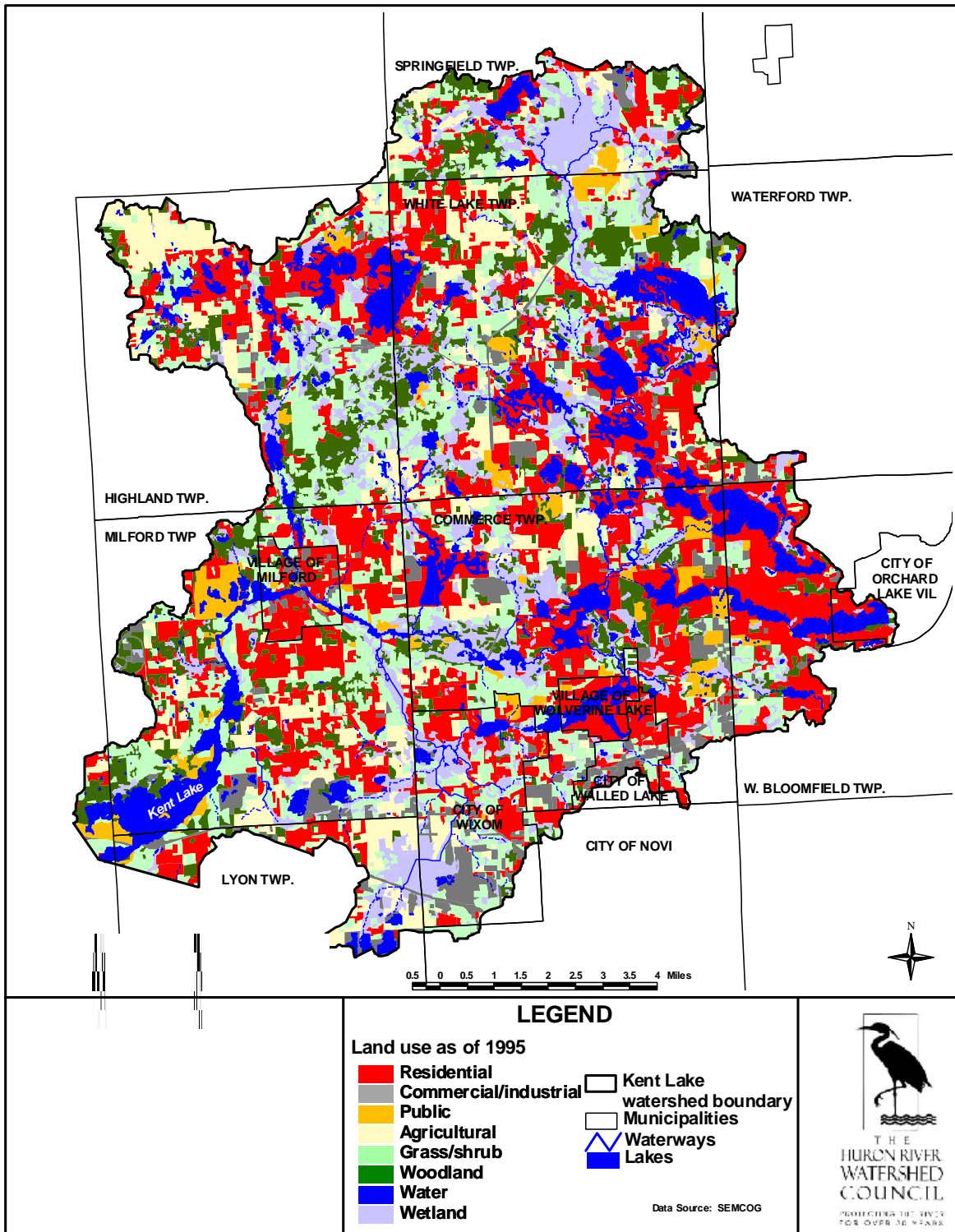


Figure 3. Kent Lake Subwatershed 1995 Land Use





## Imperviousness of the Subwatershed

When native open spaces and features are converted to residential, commercial, and industrial land uses, the result is an increase in the impervious surfaces. Roads, parking lots, rooftops, and to a lesser degree managed lawns, all add to the amount of these surfaces in a subwatershed. Many of these can be directly connected—areas that drain directly to a waterbody—without the benefit of water quality improving treatment such as detention or infiltration.

The amount of impervious surface in a subwatershed is directly related to its water quality. It is now thoroughly documented that, as the amount of these surfaces increases in a subwatershed, the velocity, volume, and pollution of surface runoff also increases (Schueler, 1994). Subsequently, flooding, erosion, and pollutant loads in receiving waters also tend to increase while groundwater recharge areas and water tables decline, streambeds and flows are altered, and aquatic habitat is lost.

As of 1995, aerial photographic SEMCOG data indicated a Kent Lake Subwatershed imperviousness rate of approximately 15% (Figure 4). Research reveals that water quality degradation is first notable as impervious surfaces in a subwatershed achieve 10% of the total landscape (Schueler, 1994). Our area, however, starts to exhibit such water quality degradation at an imperviousness rate of only 8% (Wiley and Martin, 1999). When a subwatershed achieves this percentage, the impacts of incremental increases in surface runoff begin to affect the aquatic macroinvertebrate and fish populations and subsequently the recreational value of waterbodies.



Using SEMCOG master plan information from each community in the subwatershed, which can change over time, we can predict that when each land area meets its zoning code (i.e., build-out) the overall Kent Lake Subwatershed imperviousness rate may double. However given the uncertainty of such analyses, future economic and population trends can significantly alter this prediction.



Since these predicted increases in impervious rates threaten to have a critical impact on the quality of Norton Creek, Tibone Creek, and the Huron River, significant efforts to mitigate these effects should be a priority for applicable communities (Figure 5).



## Current Sewer Service and Privately Owned Septic System Areas

The Kent Lake Subwatershed has a diverse mix of households whose waste discharges are treated by publicly owned wastewater treatment plants or on-site decentralized wastewater systems (privately-owned septic systems). Sanitary sewers rely on the connection of pipes from residential, commercial, and industrial sites that ultimately are received at a wastewater treatment plant where treatments are applied before discharge. Privately owned on-site septic systems or septic tanks allow wastewater from a single, or sometimes multiple, entity to be treated via biological and infiltration processes.

Both technologies are effective methods of wastewater treatment if maintained and operated properly; however, impairments do occur. If either system is designed, constructed, or maintained improperly, it can be a significant source of water pollution and a threat to public health. As such, most county health divisions regulate the design, installation, and repair of private septic systems. However, only a relatively small portion of these health divisions requires regular maintenance and inspection to assure proper functioning of these systems (e.g., Washtenaw County, Michigan).

Figure 4. Kent Lake Subwatershed 1995 Imperviousness

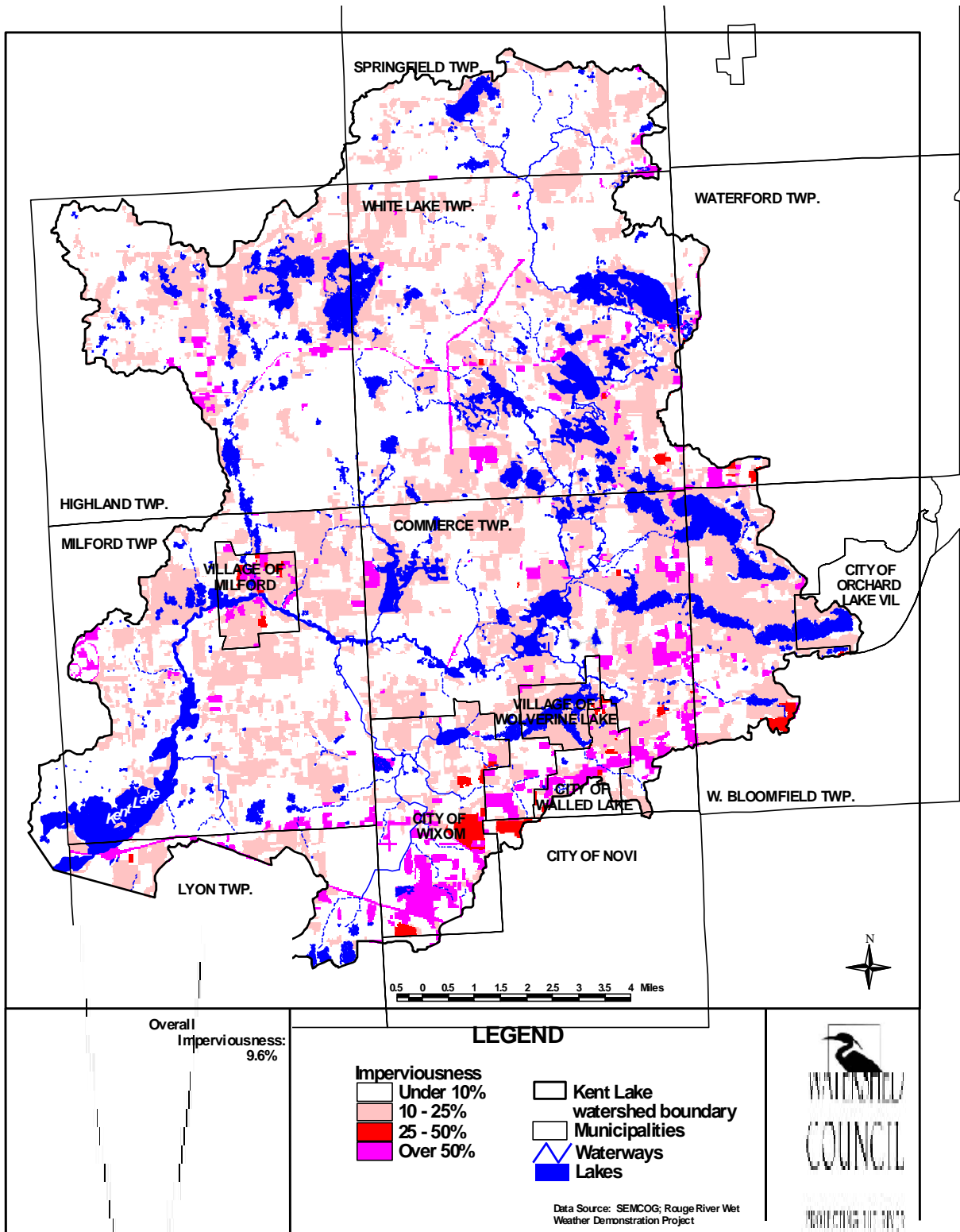
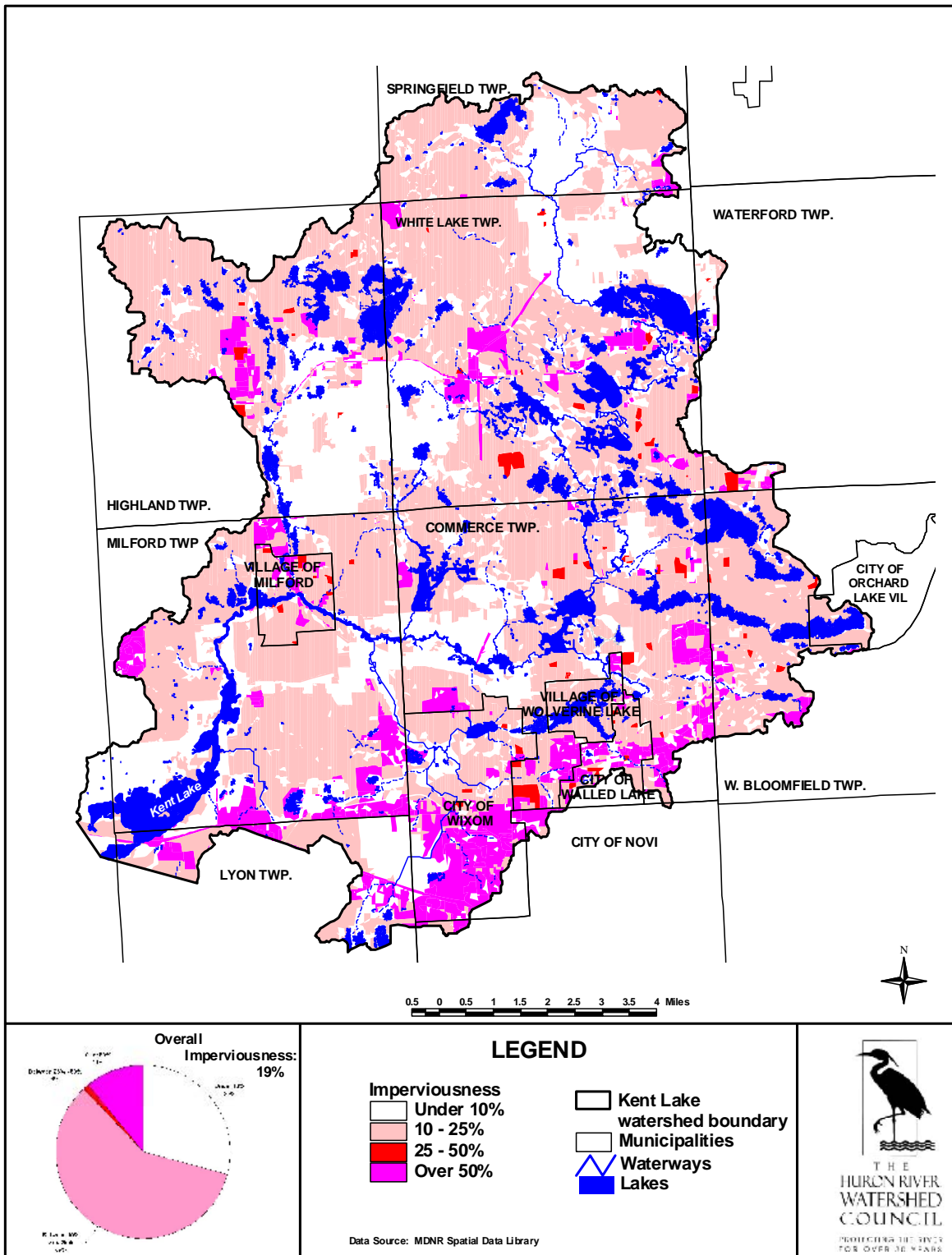


Figure 5. Kent Lake Subwatershed Build-out Imperviousness



In general, in 2001 households served by sewers were located in the eastern and urbanized areas of the subwatershed while the less developed western portions are typically served by on-site septic systems (Figure 6).

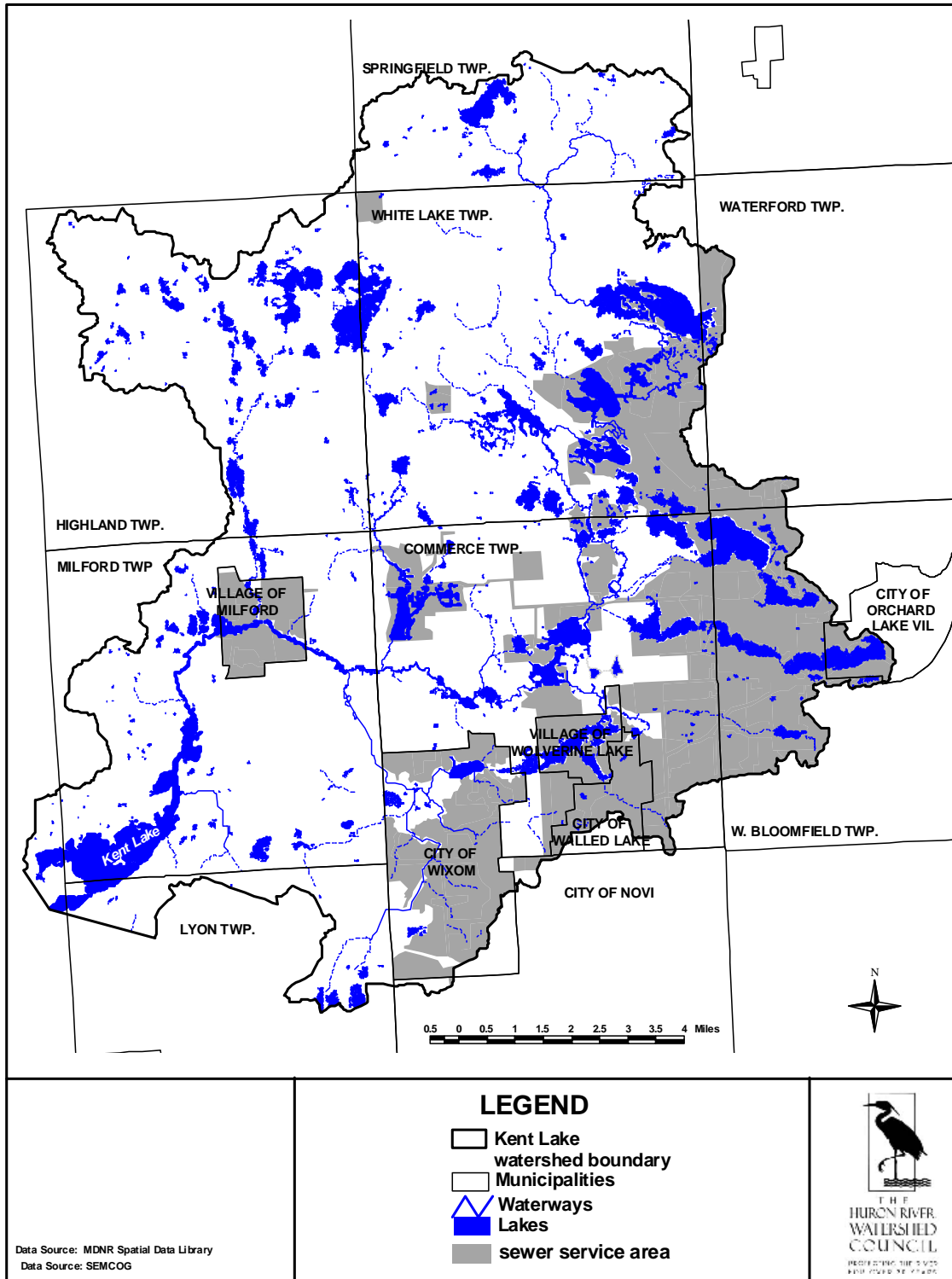
According to Oakland County Health Division (OCHD) estimates approximately 57,400 (51%) of the total subwatershed population of 118,000 individuals rely on sewer systems for waste treatment. The remaining residents use approximately 32,200 on-site septic systems for wastewater treatment. On average 1,548 new on-site septic systems are installed annually in the county. And a review of reported system failures from 1956 to 1999 indicates that on average 252 failures occur per year in the county. For Kent Lake Subwatershed communities, from 1956 to 1999 a total of 5,551 septic system failures were reported. However, this cannot be considered a complete representation of on-site septic system failures as current law limits the Health Division's ability to investigate system functioning on private property. For absence of property owner permission or a court authorized warrant, Health Division staff is prohibited from investigating such systems on private property.

The OCHD is responsible for licensing the properties for installation and for enforcement of privately owned septic systems determined to be discharging bacteria to the environment (whether surface water or ground water). The Oakland County Health Department also issues and records permits and conducts construction and final inspections for the installation of residential and non-residential on-site sewage disposal systems.

The Oakland County Drain Commissioner's office and municipalities operate and maintain the municipal systems to insure that they do not impact water quality. When any discharges occur, the OCDC provides proper public notice and corrective action to eliminate the discharge.

Nonetheless, impaired or compromised septic systems can have a profound impact on the water quality in a subwatershed. By carrying nutrients (phosphorus and nitrogen), bacteria, sediment, and chemical agents, and other pollutants to waterbodies with little or no treatment, these systems can cause a loss of recreational value of water bodies because of the resulting unhealthful conditions to humans (i.e., bacterial contamination) that result.

Figure 6. Current Sewer Service Areas of the Kent Lake Subwatershed



## Existing Point Sources

Within the Kent Lake Subwatershed, there are two point sources present that discharge measurable concentrations of phosphorus. These sources are the Wixom Wastewater Treatment Plant (WWTP) and the Milford WWTP. Based on MDEQ water quality monitoring data of discharges, between April 1998 to March 1999, the Wixom WWTP discharged a total of 1,112 pounds of phosphorus, or 16% of the total phosphorus load, to the subwatershed. During the same period of study, the Milford WWTP discharged 261 pounds of phosphorus or 4% of the subwatershed total phosphorus load. Both facilities are in compliance with the NPDES I program (Alexander, 1999b).

## Hydrological Conditions

This region of the Huron River Watershed is one of the most densely concentrated areas of lakes in the United States. This unique attribute of the area results from the recessional moraines, till plains, and outwash deposits formed during the last ice age (Hay-Chmielewski, et al., 1993). The resulting landscape harbors approximately 700 lakes, 126 of which are greater than five acres in size with 57 greater than 20 acres in size.

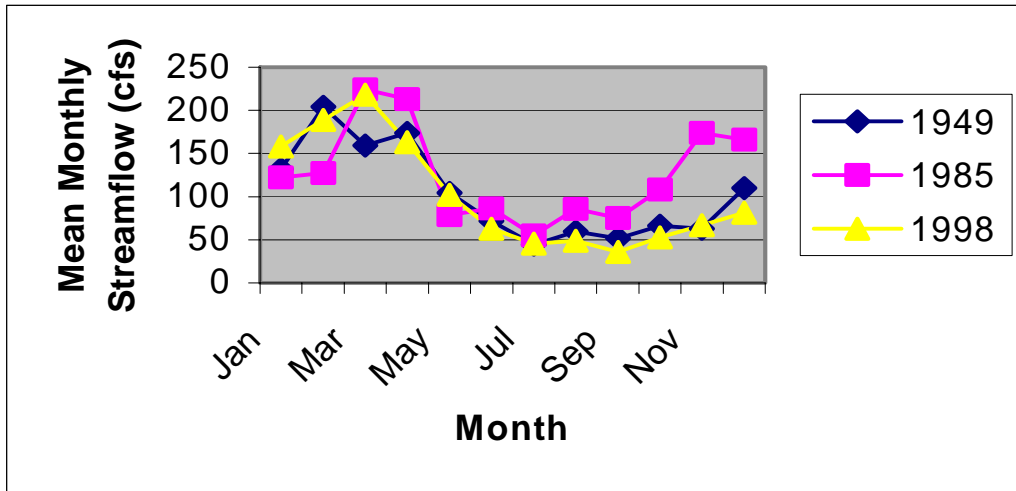
The mean monthly streamflow in cubic feet per second (ft<sup>3</sup>/sec), according to the U.S. Geological Survey (USGS) gage station at Huron River at Milford (#04170000), is presented in Figure 7. The information presented represents the monthly mean streamflow for three typical rainfall years of 1949, 1985, and 1998. The data represent a drainage area of 132 square miles or one-fifth of the Kent Lake Subwatershed. As illustrated by Figure 7 flow conditions of the subwatershed have remained relatively similar over the last 60 years although specific year flow conditions may vary. One possible reason for this observation is the large number of lakes, wetlands, and impou<sup>l</sup>ments in the subwatershed that act as stormwater and flood control storage.

In general, as land is developed, flows in the rivers become “flashy”, with increased volume and velocity of flow, which impact water quality in numerous ways (Table 1). Groundwater hydrology is also impacted with development and can impact flow within rivers and lake levels as the systems interconnect. In Kent Lake, the groundwater is connected at numerous points with the wetlands and lakes.

Other subwatershed ambient factors important in reviewing and understanding the hydrology of the subwatershed are the direct drainage, Darcy’s Law, the depth to groundwater, and soil permeability maps that reflect either the potential passage or infiltration potential of groundwater in the subwatershed (Figures 8, 9, 10, and 11).

The Darcy’s Law map utilizes its namesake’s hypothesis to predict the probability of groundwater recharge areas in subwatersheds. As illustrated in Figure 9, the Darcy’s Law predicts that, in general, areas adjacent to the river and tributary streams hold the greatest probability of having groundwater recharge. Figures 10 and 11 illustrate the depth to groundwater and soil permeability characteristics for the subwatershed. Such information is useful when considering the applicability of certain stormwater control structures (i.e. best management practices or BMPs), especially infiltration-based, and the appropriateness of certain development proposals that may require added water quality precautions within the subwatershed (i.e., gas stations, chemical storage facilities, etc.).

Figure 7. Mean Monthly Streamflow (Huron River at Milford)



Three typical hydrologic years for USGS Gage Station #04170000 (Huron River at Milford)

Table 1. Impacts of Development on Hydrologic Conditions

<b>Half-acre Undeveloped Forest</b>			
Storm Frequency (yr)	24-hour Rainfall (in)	Estimated Runoff (in)	Runoff as Percentage of Rainfall
2	2.8	0.14	5
10	4.0	0.53	13
100	5.0	1.4	24
<b>Half-acre Residential</b>			
2	2.8	0.60	21
10	4.0	1.33	33
100	5.0	2.64	66

(source: MOSAG, 2001)

Figure 8. Direct Drainage Area of the Kent Lake Subwatershed

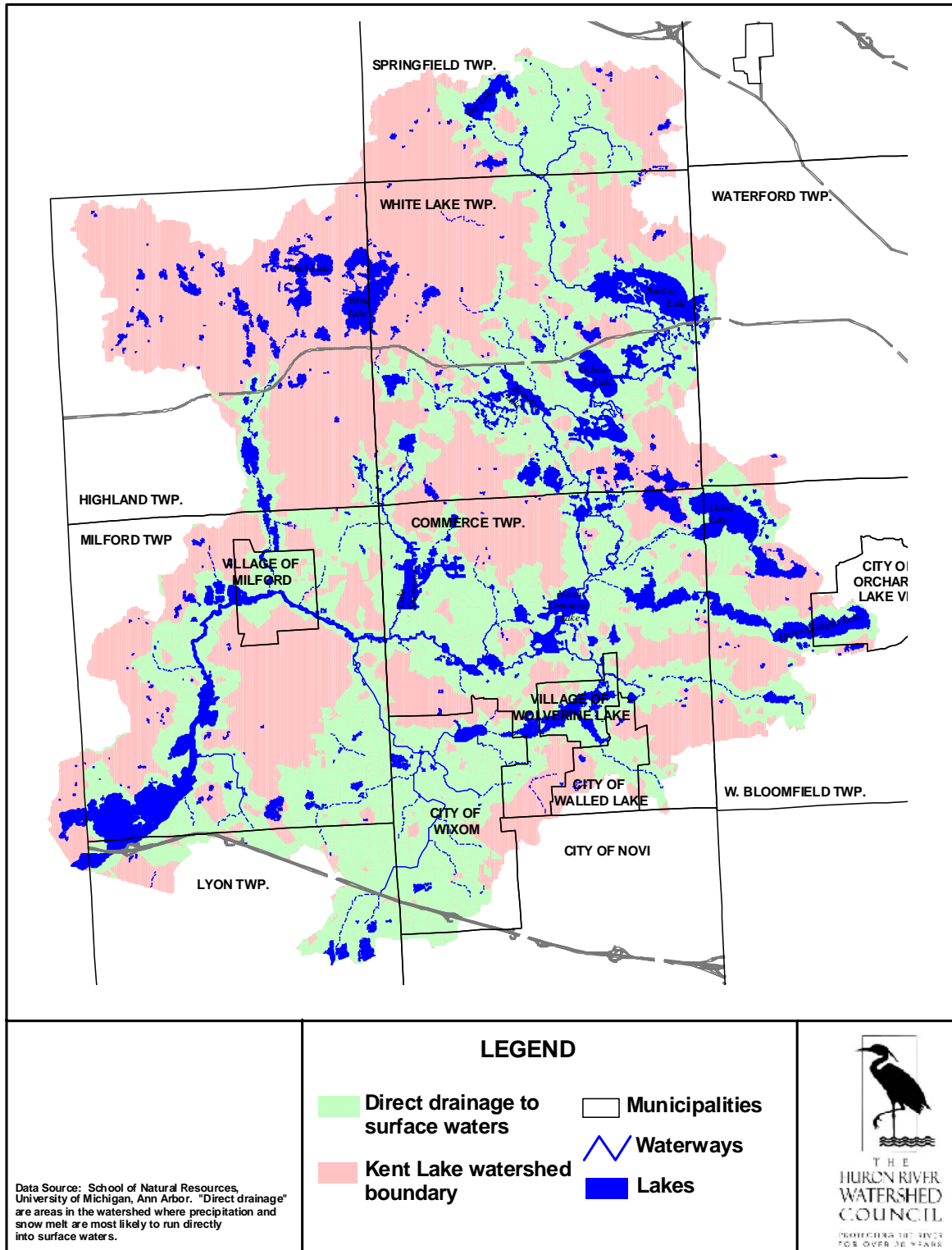




Figure 9. Probability of Groundwater Recharge Areas for the Kent Lake Subwatershed

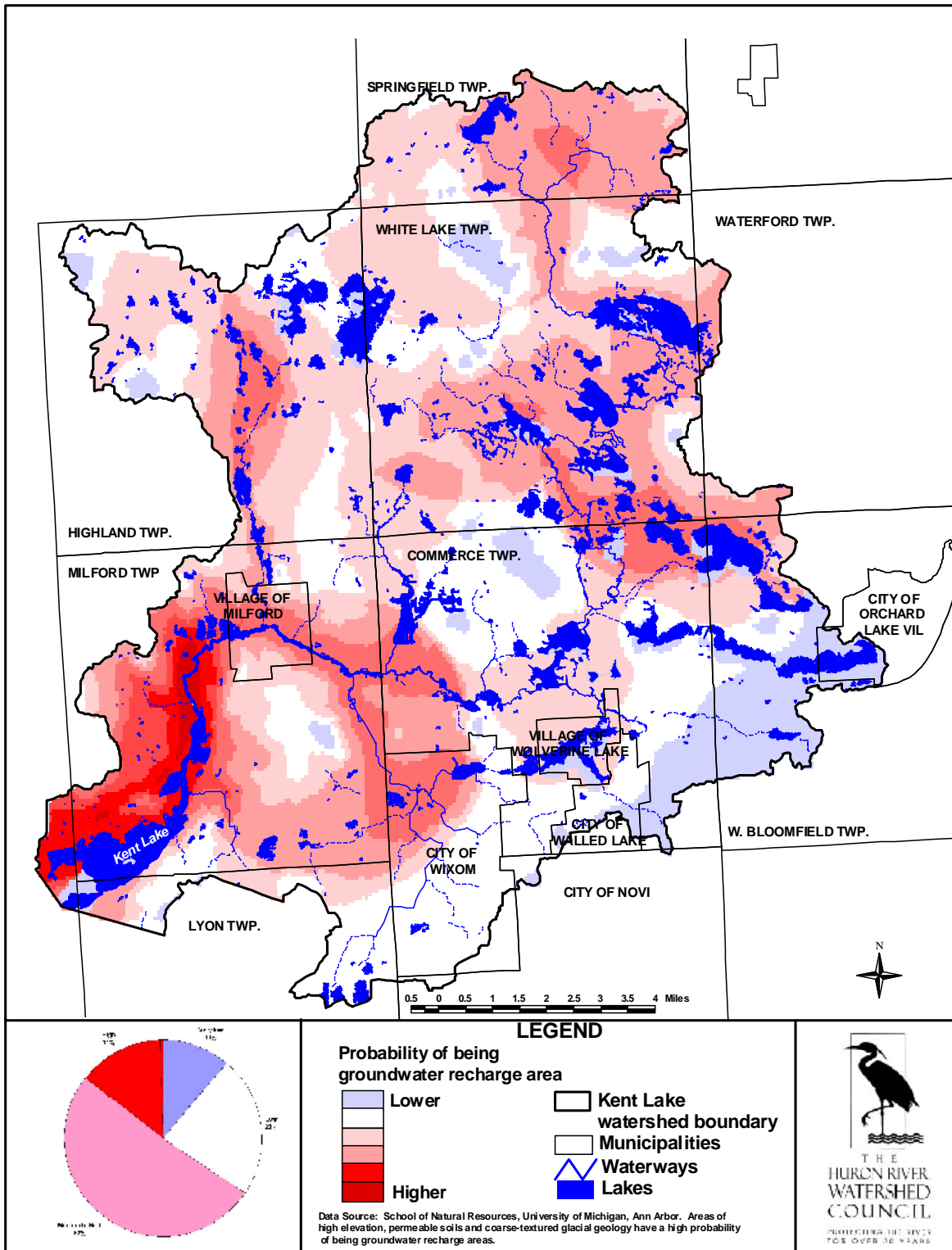


Figure 10. Depth to Water Table for Kent Lake Subwatershed

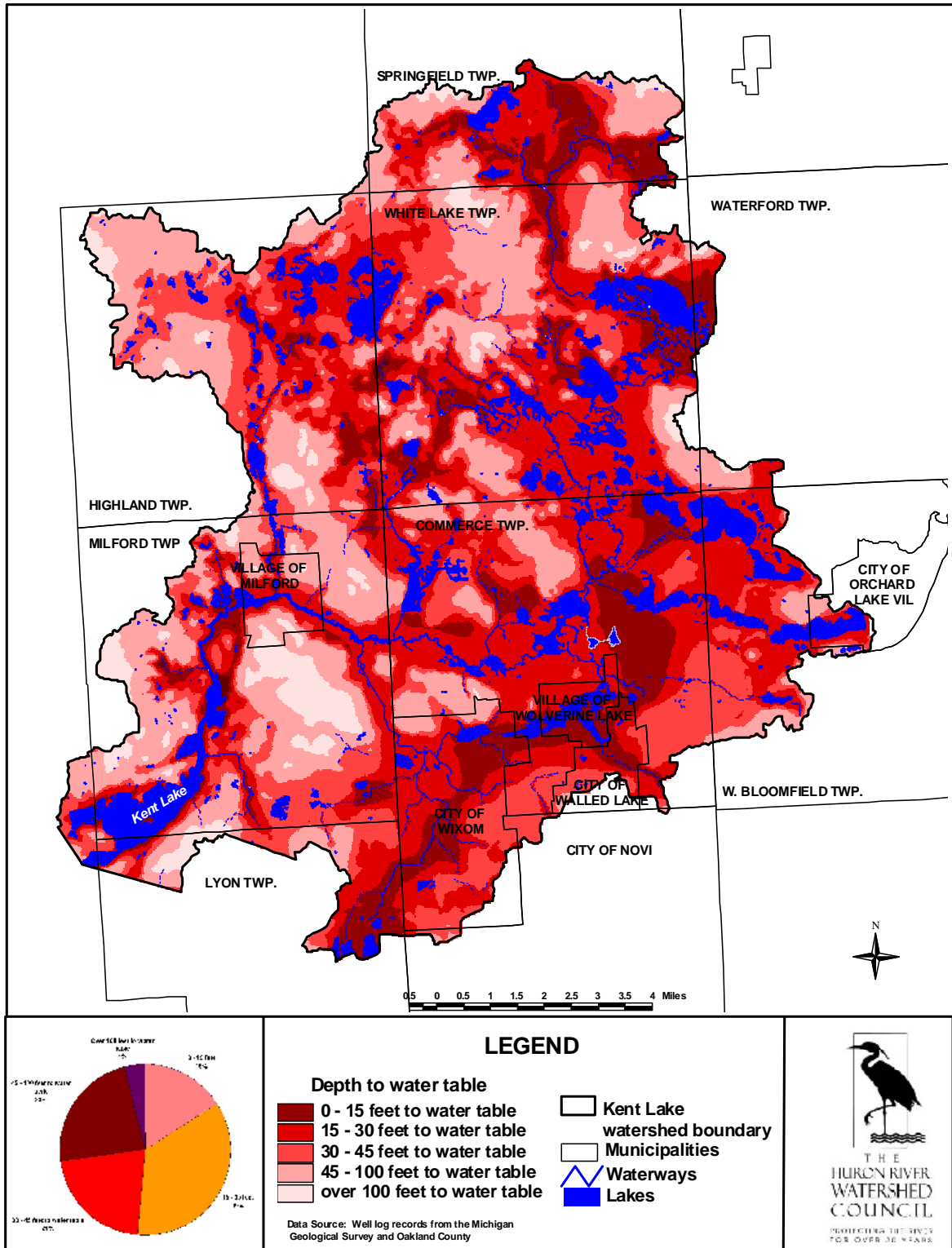
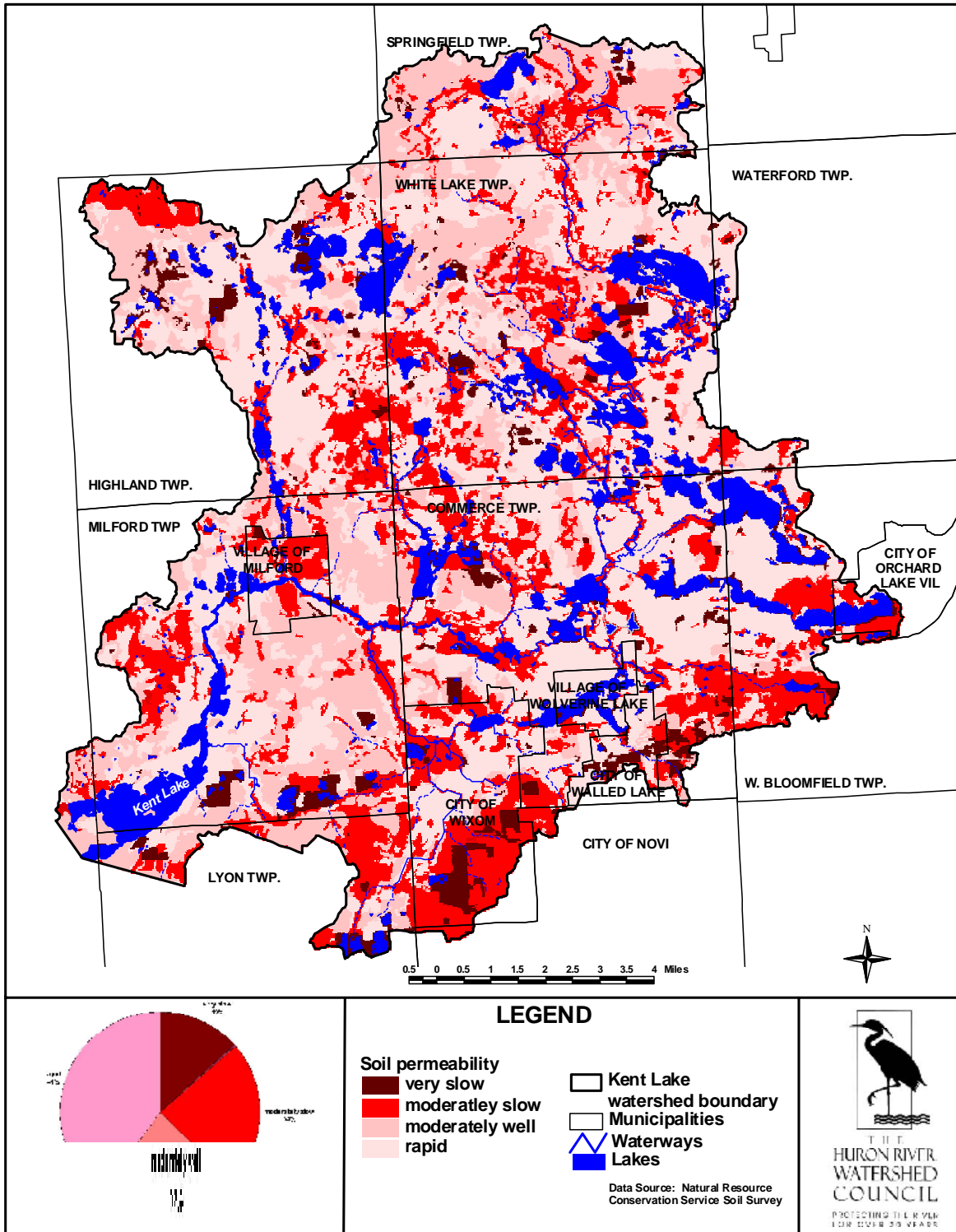


Figure 11. Soil Permeability Properties of the Kent Lake Subwatershed



Two major tributary creeks discharge to the Kent Lake Subwatershed—Pettibone Creek and the Norton Creek/Drain. Pettibone Creek is located in the north-central portion of the subwatershed north of the Village of Milford. Norton Creek is located in the south-central portion with its outfall a few miles east of the Village of Milford.

Another attribute contributing to the overall hydrological condition of the Kent Lake Subwatershed is the presence of dams or impoundments. According to the U.S. Environmental Protection Agency (EPA) BASINS program, 22 of the 96 identifiable dams or impoundments in the Huron River Watershed are located in the Kent Lake Subwatershed (Figure 12 and Table 2).

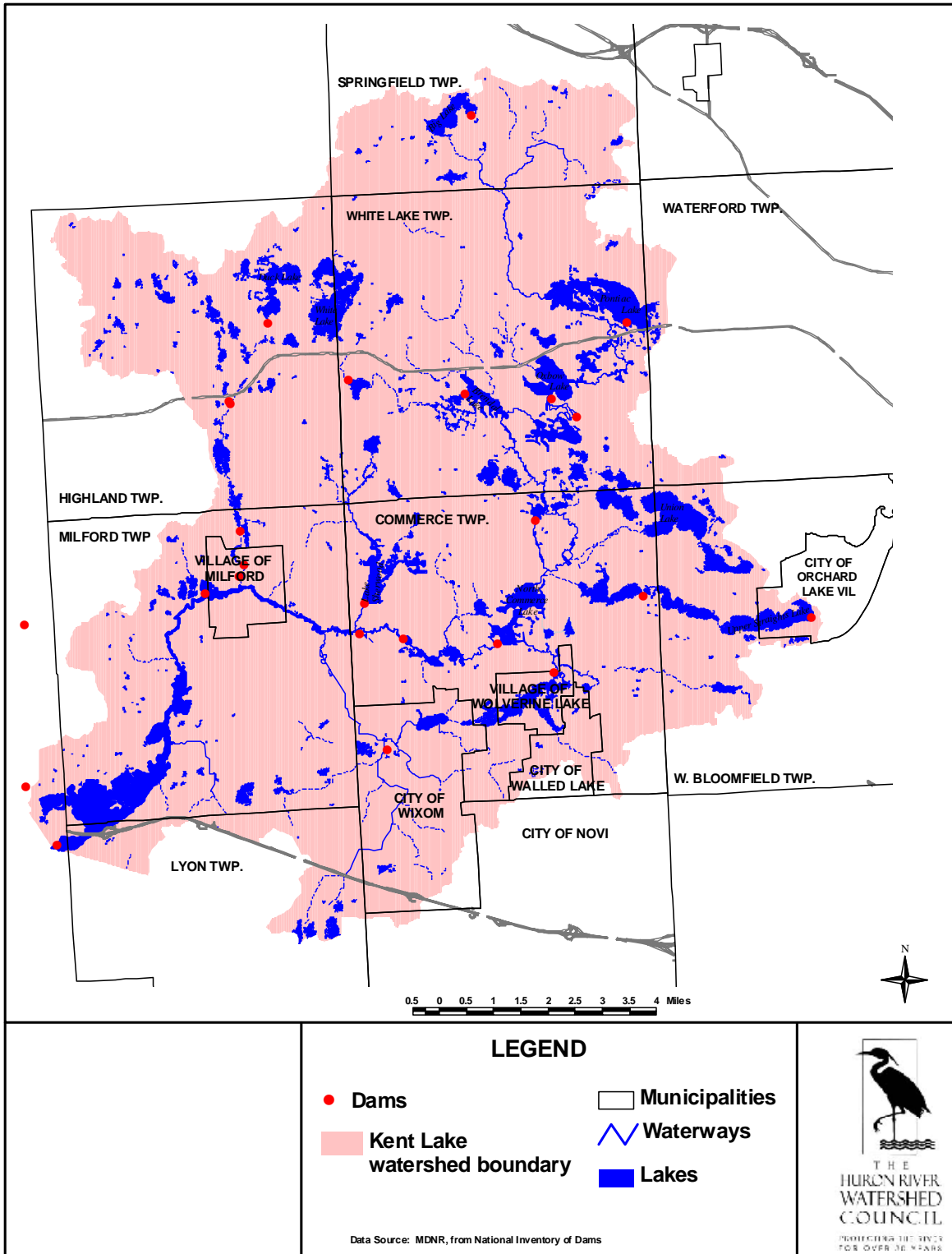
County established drains are common in the subwatershed. Oakland County Drain Commissioner's Office has established over 25 Chapter 4 agricultural drains, all open ditch, covering 50 miles of watercourse. There are also some Chapter 20 enclosed drains that cover about 3 miles of the drainage area. In addition, within West Bloomfield Township, there are over 20 additional subdivisions that have their drainage systems managed by OCDC through Chapter 18.

Table 2. Name, Location and Waterway of the Dams of the Kent Lake Subwatershed

<b>Dam Name</b>	<b>Human Hazard</b>	<b>Community</b>	<b>Waterway</b>
Kent Lake	Significant	Milford	Huron River
Ford No. 3	Significant	Lakeland	Huron River
Oxbow Lake	High	White Lake	Huron River
Pontiac Lake	High	White Lake	Huron River
Lake Neva	High	Union Lake	Unnamed tributary to the Huron River
Pettibone Pond No. 1	--	V. of Milford	Pettibone Creek
Pettibone Pond No. 2	Low	V. of Milford	Pettibone Creek
Moore Lake	Low	Milford	Pettibone Creek
Haven Hill Lake	Low	Union Lake	Unnamed tributary to the Huron River
Fox Lake Level Control Structure	Low	Commerce	Huron River
Lake Sherwood	Significant	Milford	Unnamed tributary to the Huron River
Cedar Island Lake	--	White Lake	Huron River
Middle Lower Straits Lake	--	Commerce	Unnamed tributary to the Huron River
Upper Straits Lake	--	West Bloomfield	Unnamed tributary to the Huron River
Wolverine Lake	--	Wolverine Lake	Unnamed tributary to the Huron River
Commerce Lake	--	Commerce	Huron River
Proud Lake	--	Commerce	Huron River
Wexford Mews Detention Pond	--	Wixom	Norton Creek
Winegar Lake	--	Highland	Pettibone Creek
Hubble Pond	--	Milford	Huron River
Big Lake	--	Springfield	Huron River
Duck Lake	--	Highland	Unnamed tributary to the Huron River

(-- signifies designation unavailable)

Figure 12. Dams in the Kent Lake Subwatershed



## Geomorphology and Soils

From its headwaters to Commerce Lake, the river is narrow and the channel exhibits evidence of past dredging activities. Substrate consists mostly of gravel and detritus with small amounts of rubble. Fish cover is sparse and the stream is dominated by run habitat with very few pools or riffles. Downstream from Commerce Lake to Kent Lake, the river channel varies in configuration. Portions of the river in this locale exhibit the narrowing effects of dredging while other areas show widening effects due to fluctuating water flow or sedimentation. The substrate in the river between Commerce Lake and Kent Lake varies among silt, gravel, and sand. Marl is also found in some locations (Hay-Chmielewski, et al., 1993).

The majority of the soils in the subwatershed are sandy loams or friable sand-clay mixtures. Near the river and its tributaries, Fox-Oshtemo-Plainfield associations are predominant. Areas farther away from the river and its tributaries mostly consist of soils in the Bellefontain-Hillsdale-Conover association. The properties of these soils are favorable for consistent groundwater input to surface waters, leading to overall stabilized flows in the river (Hay-Chmielewski, et al., 1993). This is evidenced in soil permeability rates for the subwatershed (Figure 11).

## 2.2 Kent Lake and Kensington Metropark

Numerous dams, or impoundments, in the subwatershed serve as recreational and waterfront housing enhancement structures. The Kent Lake impoundment, which forms Kent Lake, is an example of such a recreational enhancement structure.



Built in 1946 and owned by the Huron Clinton Metropark Authority (HCMA), the Kent Lake impoundment has a head of 14 feet that forms the 1,200-acre Kent Lake. Surrounding the lake is the 4,357-acre Kensington Metropark that opened in 1948. Currently, 2.5 to 2.7 million people visit the Metropark annually to enjoy the abundant opportunities for biking, picnicking, hiking, observing nature, swimming, and horseback riding, as well as numerous winter activities. Fishing is also a popular activity, with nearly 200,000 anglers per year visit Kent Lake and the Kensington Metropark (Hay-Chmielewski, et al., 1993). Another popular activity on the lake is boating, as the HCMA has sold nearly 3,000 daily and 730 annual boating passes for the past several years. In addition, 80 rowboats, 15 paddleboats, and a large tour boat are available for rental on the lake (Schafer, personal communication). The park is also home to a 6,378-yard 18-hole golf course that is open to the public.

## 2.3 Key Natural Areas Protection Opportunities

The extent of stewardship of sensitive open spaces and native habitats can directly impact the quality of life and quality of water in a subwatershed. To this end, the Shiawassee & Huron Headwaters Resource Preservation Project (S&H) with the assistance of the Michigan Natural Features Inventory (MNFI) conducted a natural resources inventory of portions of the Kent Lake Subwatershed project. Within the subwatershed, the townships of Springfield, White Lake, Highland, and Milford and the Village of Milford participated in the process. The MNFI located 114 key habitats and evaluated them for intactness, upland and wetland complexes, riparian corridors, significant forested tracts, and potential for restoration.

Based on MNFI analysis eighteen (18) habitats considered vital (scoring a 7 or better out of 10) within the subwatershed were identified for targeted protection practices (Table 3 and Figure 13).

Table 3. Key Habitats for Protection and Recreation within the Kent Lake Subwatershed

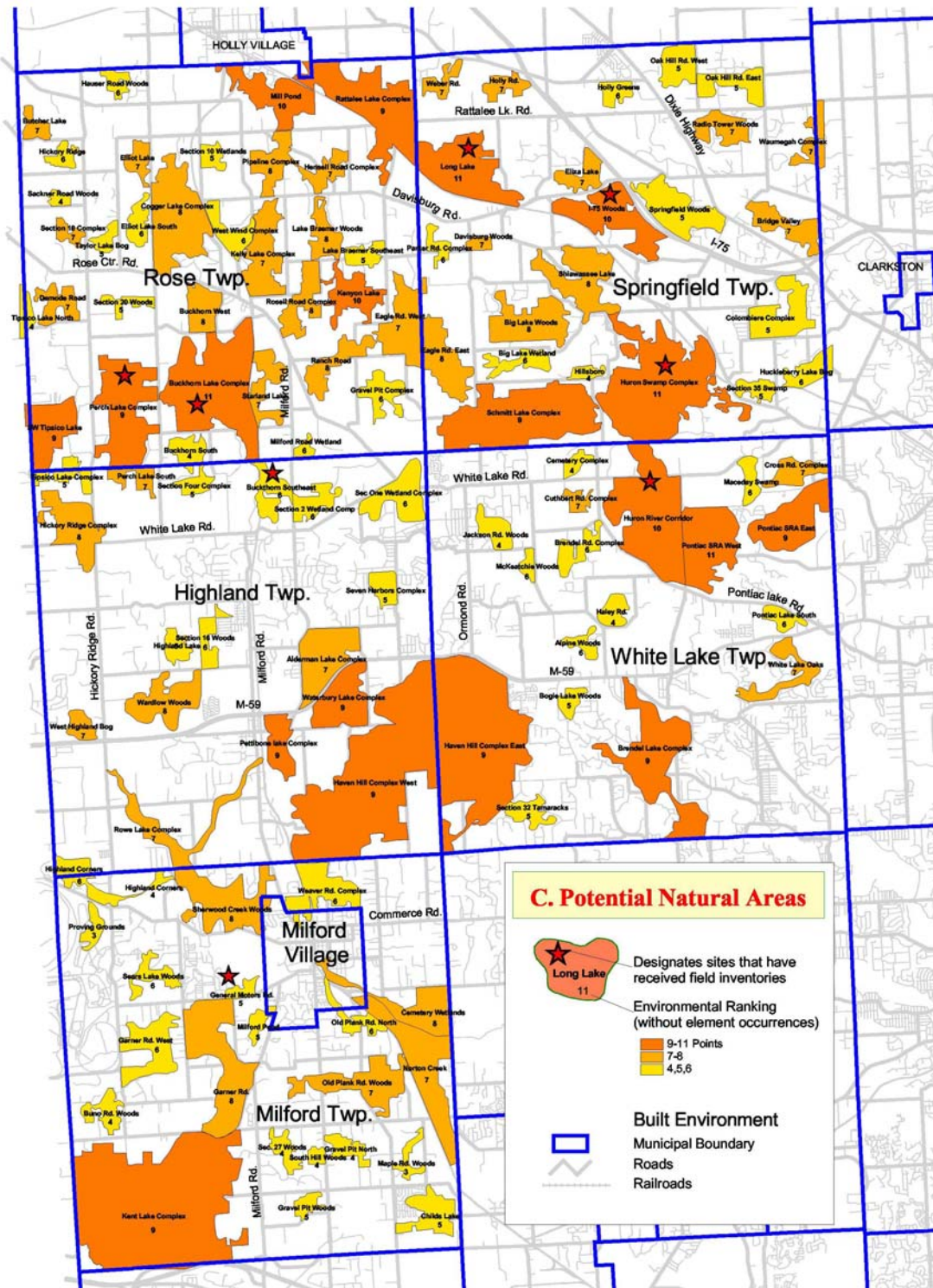
Site Name	Community
Huron Swamp Complex	Springfield
Schmitt Lake Complex	Springfield
Pontiac SRA East & West	White Lake
Huron River Corridor	White Lake
Cuthbert Road Complex	White Lake
Haven Hill Complex East & West	White Lake & Highland
Brendel Lake Complex	White Lake
Pettibone Lake Complex	Highland
Alderman Lake Complex	Highland
Waterbury Lake Complex	Highland
Old Plank Road Woods	Milford
Norton Creek Complex	Milford
Cemetery Wetlands	Milford
Sherwood Creek Woods	Milford & Village of Milford
Garner Road Complex	Milford
Kent Lake Complex	Milford

(Source S&H Project, 2000).





Figure 13. Key Habitats for Protection and Restoration



(Source S&H Project, 2000).

## 2.4 State and Federal Programs of Water Quality Significance

### Total Maximum Daily Load Program and Kent Lake

The Kent Lake Subwatershed Management Plan was originally developed to address TMDL as stipulated in Section 303(d) of the federal Clean Water Act. The Act provides that states, territories, and authorized tribes are to list waters for which technology-based limits alone do not ensure attainment of water quality standards.

#### Michigan TMDL Program

The Michigan Natural Resources and Environmental Protection Act (NREPA), Public Act 451 of 1994, authorizes the Michigan Department of Environmental Quality (MDEQ), Great Lakes and Environmental Assessment Section (GLEAS), to develop Water Quality Standards (WQS) to protect the quality of state waters. The purposes of the Water Quality Standards are to: (1) establish water quality requirements for the Great Lakes, their connecting waterways, and all other surface waters of the state, (2) protect public health and welfare, (3) enhance and maintain the quality of water, (4) protect the state's natural resources, and (5) carry out the aims of the federal Clean Water Act (CWA) and the Great Lakes Water Quality Agreement between the U.S. and Canada. These standards are used to set the minimum water quality requirements for state waters.

The draft 2002 state report of Impaired Waters, called the Michigan 303(d) Report, identifies 21 waters in the Huron River Watershed which do not meet water quality standards, 10 of which are in the Upper Huron drainage area. This list is available to the public from MDEQ.

Table 4. Impaired Waters of the upper Huron River Watershed, Livingston and Oakland Counties

Waterbody	Pollutant	TMDL Developed and Approved	ID
Bishop Lake	Mercury	No	MI061206N-1998
Brighton Lake	Phosphorus	Yes	MI061205O-1998
Horseshoe Lake Drain	Biological Impairment	No	MI061205R-1998
Kent Lake	Phosphorus;	Yes	MI061206D-1998
	Polychlorinated biphenyl	No	
Limekiln Lake	Phosphorus	No	MI061205T-1998
Norton Creek	Biological Impairment	No	MI061206M-1998
Ore Lake	Phosphorus	Yes	MI061205S-1998
Pontiac Lake	Polychlorinated biphenyl	No	MI061206G-2000
Strawberry Lake	Phosphorus	Yes	MI061205U-1998
Whitmore Lake	Polychlorinated biphenyl	No	MI061205H-2000

(Source: Draft 2002 Michigan Section 303(d) Report. MI/DEQ/SWQ-02/013)

### **Phosphorus Total Maximum Daily Load for Kent Lake**

In April of 1998, a 12-month phosphorus loading analysis was initiated by the MDEQ to investigate the water quality of Kent Lake and its upstream sources. The analysis showed that Kent Lake was threatened to fail to meet water quality standards due to phosphorus enrichment. Based on water quality sampling and modeling, a phosphorus TMDL of 30 µg/L for Kent Lake was established. Based on three years of scheduled monitoring and the employment of the Walker methodology of lake trophic assessment, the TMDL estimates that the current annual phosphorus load is 7,000 pounds/year. The phosphorus TMDL for Kent Lake was approved by the USEPA on March 10, 2000.

### **National Pollutant Discharge Elimination System Phase II**

This updated subwatershed management plan has now been revised to specifically address USEPA's federal Phase II Storm Water Regulations that required approximately 170 Southeast Michigan municipalities to obtain a NPDES permit by March 2003 to cover their storm water discharges. In the Kent Lake Subwatershed, the Townships of Commerce, Highland, Lyon, Milford, Springfield, Waterford, West Bloomfield, and White Lake, the Cities of Novi, Orchard Lake Village, Walled Lake and Wixom, and the Villages of Milford and Wolverine Lake have obtained a permit. Some of these communities already have coverage for the adjoining Rouge River drainage area under the watershed-based permit and have simply increased their efforts in a similar fashion as the Phase II requirements fell into place in March of 2003. However, MDEQ received consent from the USEPA under the Regulatory Innovation Program to offer a Michigan General Storm Water Permit as equivalent to the Federal Phase II Storm Water Regulations.

The Kent Lake Subwatershed's Watershed-based General Permit covers the six minimum management measures through cooperative watershed planning and action planning that is customized to the characteristics and programs applicable to the Kent Lake Subwatershed, as well as strong components of public education and illicit discharge elimination. As noted earlier, the specific plan components include: A Public Education Plan (PEP), an Illicit Discharge Elimination Plan (IDEP), a Watershed Management Plan, a Public Participation Plan (PPP), and a Stormwater Pollution prevention Initiative (SWPPI). This plan was developed to meet the Watershed Management Plan requirement of the NPDES Phase II requirement.

## CHAPTER 3. SUMMARY OF WATER QUALITY CONDITIONS

As part of the preparation of the voluntary plan to address the Total Maximum Daily Load (TMDL) for phosphorus, the Huron River Watershed Council compiled a summary of readily available water quality data. Their efforts established a baseline of water quality conditions of the subwatershed. HRWC solicited input from Subwatershed Advisory Group (SWAG) members, lake associations, and researchers in the area. They obtained numerous studies and datasets of relevance; however, the information gathered cannot be considered comprehensive.

Working from this initial baseline, SWAG members completed further research to better document conditions not directly related to the phosphorus TMDL. This effort included surveys of the general public to identify specific water quality concerns, as well as review of additional studies from the STORET database. No direct collection or analysis of water quality data has been attempted.

### 3.1 Variables of Concern

The SWAG identified variables of concern that have been loosely grouped into seven categories including nutrient enrichment (phosphorus and nitrogen), fish and macroinvertebrate populations, persistent toxins (PCB's and mercury), reduced water quality (suspended solids, temperature, conductivity, dissolved oxygen and chlorophyll a), bacteria loadings, groundwater impacts (nitrates and chlorides), and other contamination from known sources.

The selection of these variables was based, in part, on relevancy to water quality, lake trophic status, and availability of the data. Total phosphorus and total nitrogen loads were calculated by HRWC where sufficient data existed. While the results may be incomplete, due to limited data sets, the results are informative.

In the discussion that follows, several sub-drainage areas are referenced as distinct units that have garnered the attention of researchers over time (see figure 14). The Kent Lake Subwatershed is approximately 100,000 acres in size. The immediate drainage area of the lake is estimated at 16.9 square miles (10,900 acres). The lake has an average depth of 2 meters and a hydraulic residence time of 33 days (0.09 year).

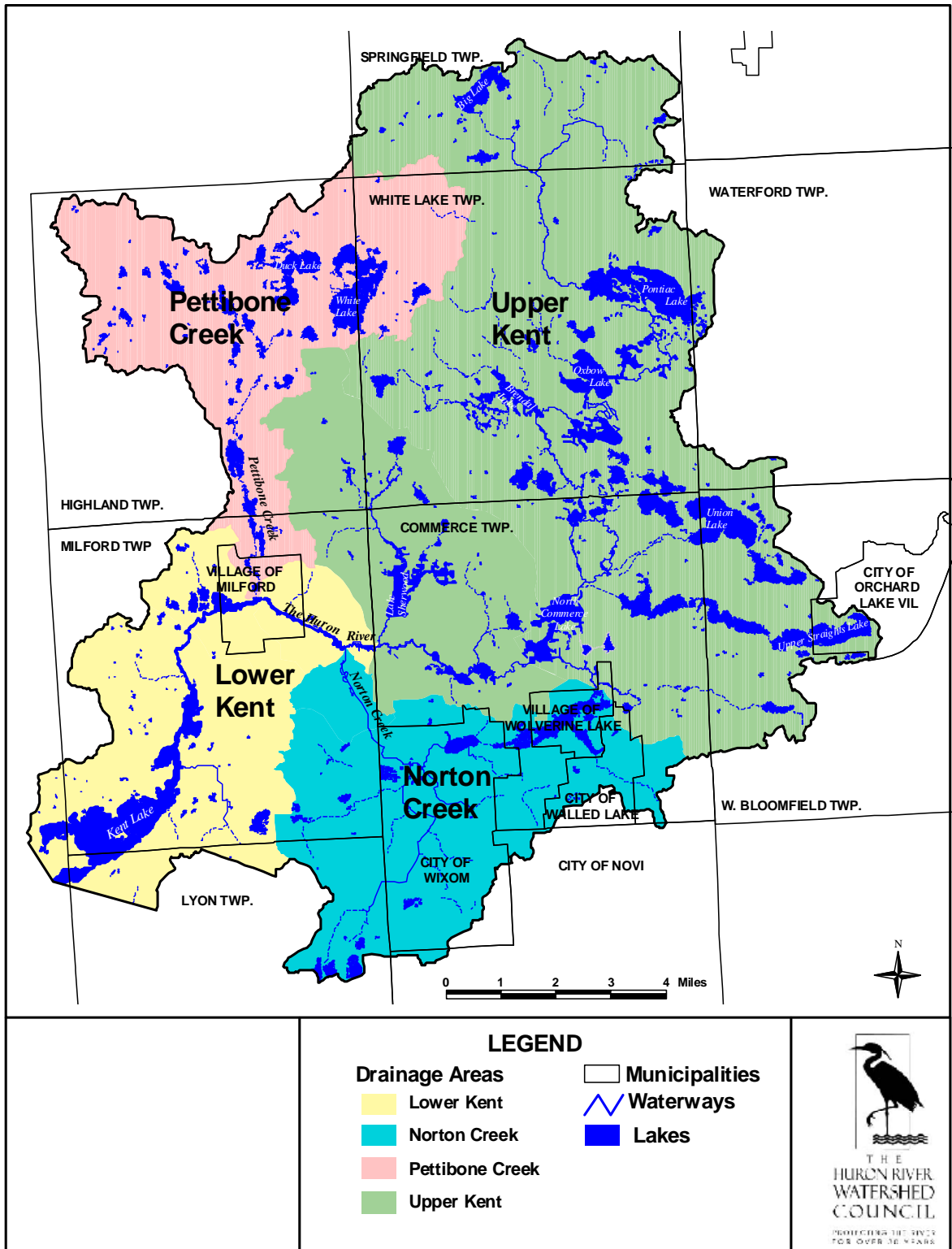
Kent Lake is fed by streams and creeks flowing from other sub-drainage areas. The Upper Kent drainage area begins at the headwaters of the Huron River and extends in a southeasterly direction to approximately the eastern boundary of the Village of Milford. The drainage area of the Upper Kent is roughly 5,023 acres.

The Pettibone Creek drainage area begins north of the village of Milford and extends south to its outfall at Milford. The drainage area of Pettibone Creek is roughly 15,710 acres.

The Norton Creek Drainage Area is located in the south-central portion of the Subwatershed and discharges into the river a few miles east of the Village of Milford. The drainage area is located in the southern portion of the Sub-watershed and encompasses approximately 1,548 acres.

The Lower Kent Drainage Area begins east of the Village of Milford boundary and extends southeast until reaching Kent Lake. This drainage area is approximately 9,488 acres (14.8 square miles).

Figure 14. Sub-drainage areas within Kent Lake Subwatershed





### 3.1.1 Nutrient Enrichment

Phosphorus and nitrogen are nutrients essential for the growth of all plants in waterbodies such as lakes. Phosphorus is often considered the limiting nutrient (regulating growth) in the production of in-lake algae and is the main parameter of concern regarding to lake and impoundment eutrophication. By quantifying phosphorus concentration, a trophic status for a lake can be determined. Trophic status is a useful means of assessing the water quality of a lake since it affects the productivity or growth of the system.

Oligotrophic (phosphorus concentrations less than 10 micrograms/liter ( $\mu\text{g/L}$ )) and mesotrophic status (phosphorus concentrations between 10 to 20  $\mu\text{g/L}$ ) are generally associated with healthy lake conditions which support uses such as cold water fisheries (e.g., trout, various species of bass) and recreational activities (USEPA, 2000). Lakes vary from eutrophic to hypereutrophic when phosphorus concentrations are greater than 20 to 30  $\mu\text{g/L}$ . Eutrophic lakes often support warm water fisheries (e.g., carp) but have limited recreational value because of periodic nuisance algal blooms. Hypereutrophic lakes, which experience frequent and intense nuisance algal blooms, do not ordinarily support cold or warm water fisheries and offer little or no recreational value. In addition, these lakes often exhibit decrease in open water surface areas because of layers of algal and aquatic plant masses.

Stormwater runoff is frequently considered the major source of phosphorus contribution to waterbodies, particularly in places where rapid conversion to urban land uses and over-fertilization of lawns occur. Phosphorus is carried into the water bodies through soils and sediments, since it is typically bound to soil particles. Sewer system failures, illicit connections, and permitted point sources are also cited as major routes of phosphorus and nitrogen introduction.

Nutrient enrichment has been identified as a variable of concern in the Kent Lake, Norton Creek, Wolverine Lake and Lake Sherwood subareas. As noted earlier, the Kent Lake Subwatershed is subject to a Total Maximum Daily Load limit for phosphorus.

#### 3.1.1.2 Phosphorus

Phosphorus concentrations are documented for a few specific areas within the Kent Lake/Upper Huron River subwatershed. Available water quality data from published studies and the USEPA STORET database were summarized in the previous watershed management plan prepared for the Phosphorus TMDL, as well as loading calculations based on a land use model prepared by HRWC.

A 1979 report by the MDNR concluded that, at the time of the investigation, Kent Lake had a phosphorus concentration ranging from 27 to 90  $\mu\text{g/L}$  with a mean of 44  $\mu\text{g/L}$ . The report states that these concentrations indicate eutrophic to hypereutrophic conditions. Total phosphorus loading to the lake was estimated at 12,355 lbs/yr, of which 60% was from point sources. The remaining 40% represented nonpoint source loads.

Alexander conducted another water quality study of the watershed in 1999. The author completed an analysis of point and non-point source loading. Comparison of the Alexander analysis and previous studies clearly showed a measurable increase in non-point source phosphorus loading. Point source loading decreased due to modifications at the City of Wixom Wastewater Treatment Plant, which included service to the Ford Motor Company facilities.

Other pertinent studies include studies of the Greenaway Drain and a Lake Management Plan prepared for the Village of Wolverine Lake (conducted annually 2000-2004), and Water Quality studies completed for Lake Sherwood from 1994-2003. In 2004, the total phosphorus concentrations recorded for Wolverine Lake ranged from 11 to 25  $\mu\text{g/L}$ , indicating moderate enrichment of the lake. Wolverine Lake was

characterized as moderately eutrophic in the annual Lake Management Plan Update for 2004, as prepared by Professional Lake Management.

Refer to the HRWC Watershed Management Plan for the phosphorus TMDL for a more rigorous discussion of the findings of available reports. It appears that phosphorus is the limiting nutrient for this portion of the Sub-watershed.

### **3.1.1.2 Nitrogen**

Nitrogen is also considered essential in determining algae growth in lakes, and it is often found in waterbodies at higher concentrations than phosphorus. Consequently, nitrogen is often not considered the limiting nutrient to detrimental growth. Additionally, unlike phosphorus loading, nitrogen loading is often difficult to reduce due to the high water solubility of nitrogen. Therefore, concerns regarding nitrogen and its role in eutrophication are often considered secondary to phosphorus. Typical sources of nitrogen in surface waters include human and animal wastes, decomposing organic matter, and runoff from fertilizers. Poorly-operated wastewater treatment plants and septic systems, as well as sewer pipeline leaks can also act as additional sources of nitrogen to waterbodies.

In the Kent Lake Watershed, there are few available records of total nitrogen measurements. For the period of record between 1977-78, the USGS reported a total nitrogen average of 847  $\mu\text{g/L}$  ( $n = 83$ ) in the Upper Kent Drainage area. Using 11 cfs as the average flow identified in the study, an annual nitrogen load of 1.8 lbs/day can be determined.

STORET included record of one 1980 USEPA study for Norton Creek which reported nitrate-nitrogen values. Based on an assumed flow rate of 1.9 cfs, an average nitrate-nitrogen concentration of 163  $\mu\text{g/L}$  corresponds to a load of 602 lbs/day.

For Pettibone Creek, nitrate-nitrogen values as reported in a 1972-73 USEPA study indicate a concentration of 45  $\mu\text{g/L}$ . Since flow data was not reported, a nitrogen load could not be calculated.

For the Lower Kent Drainage Area, the only records of samples tested for nitrogen values are for the period of record from 1985-86, when total nitrogen averaged 967  $\mu\text{g/L}$  ( $n = 3$ ). Using 120 cfs as the average flow, an annual nitrogen load of 618 lbs/yr can be calculated.

The Village of Wolverine Lake collects data regarding nitrate concentrations in their annual report. For 2004, the nitrate concentrations ranged from 512 to 550  $\mu\text{g/L}$ , which indicates low to moderate nutrient enrichment of the lake.

Based on the limited available data, it appears that phosphorus is the limiting nutrient for the Subwatershed.

### 3.1.2. Fish and Macroinvertebrates

The vitality of fish and macroinvertebrate populations is an important indicator into the overall health of a watershed. Declining populations are early signs of stress in a stream or watercourse.

The HRWC coordinates volunteers through the Adopt-A-Stream Program to monitor seven study sites within the Kent Lake Subwatershed. Insect diversity is measured in the spring and fall, and the winter stonefly population is monitored in January. Habitat conditions are recorded approximately every 3-7

years. The volunteers also measure simple water quality parameters such as conductivity in key locations.

The first site, for which monitoring began in 1994, is located at the outlet of Big Lake, headwater to the Huron River. The second site, for which monitoring began in 1997, is slightly upstream of the impoundment at Commerce Lake.

Bioassessment results for the headwaters site were better than expected for the Huron River. The number of sensitive macroinvertebrate families, indicators of those families vulnerable to human-influenced or created (anthropogenic) pollution, ranged from 1 to 7. The number of Ephemeroptera, Plecoptera, and Trichoptera (EPT) families, which are particularly sensitive to reduced dissolved oxygen, flow, and/or increased temperature, ranged from 7 to 13. On three occasions, collecting teams found Odontoceridae caddisflies, which are rare in Michigan's Lower Peninsula. Macroinvertebrate monitoring of the second site in the Upper Huron River drainage area upstream of Commerce Lake indicated good overall ecological health, although not as impressive as the upstream site of the Huron River at White Lake Road. Overall, EPT families have ranged between 4 and 6 and between 0 and 1 for sensitive families at both sites.

In addition to HRWC Adopt-a-Stream summer sampling, HRWC volunteers have monitored the two sites for winter stoneflies. Winter stoneflies are of interest because they have unique life cycles which enable them to be relatively immune to perturbations that often occur during summer months, such as increased water temperature fluctuations common in stormwater runoff. However, when little or no winter stoneflies are present, it indicates the site may be or may be receiving toxic contamination. At the Huron River at White Lake Road site, sampling events in 1995, 1996, and 2000 found at least one winter stonefly family for each sampling event. However, 1998 and 2000 sampling at the Commerce Township site found 0 and 1 winter stonefly family, respectively, indicating possible impairment.

As a supplement to macroinvertebrate sampling, habitat assessments were performed in 1998 at the Big Lake site and the Commerce site. The Big Lake site was rated as having good habitat with stable bank conditions. Conversely, the Commerce site was deemed poor in both habitat conditions and bank stability as erosion and bare banks were prevalent.

J.L. Hulbert (1966) performed a biological survey of Kent Lake and the Huron River inlet to the lake. Of the six stations selected for the study, one was located at the inlet and three were located directly in the lake. The author utilized the Beck Biotic Index methodology of assessment in order to determine the biological health of the sampling stations. The Beck Biotic Index is defined as the index value based on biological findings and is indicative of the cleanliness of a stream or lake with regard to organic pollution. An index value of 0 indicates severe pollution, 1 to 6 moderate pollution, and 7 to 10 and greater a clean system. Results from the investigation indicated excellent biological communities at the inlet sampling station with a Beck Biotic Index score of 20. The three sampling stations in Kent Lake did not rate as well, yet were still quite good. Going progressively downstream towards the outlet, biological indexes range from 8 to 11, with the lowest index score of 8 at the deepest lake sampling point.



Based on review of MDNR Fish Studies of streams in the watershed, plus the HRWC Adopt-A-Stream reports, the SWAG has identified poor fish and macroinvertebrate populations as a variable of concern in the Norton Creek.



### 3.1.3. Persistent Toxins

Pollutants that do not naturally degrade, but rather accumulate in sediments and in the bodies of fish, reptiles, birds and animals are classified as persistent toxins. These include heavy metals, such as mercury and chemical compounds such as polychlorinated biphenyl's (PCB's). Persistent toxins accumulate in fatty tissues, can be passed from mother to infant through breastmilk, and may be linked with neurological dysfunction and some cancers. The full risk to human health is not known, but sufficient information is available to convince health officials to issue consumption advisories for all inland fish due to mercury levels.

A TMDL for polychlorinated biphenyls (PCBs) is scheduled for Kent Lake in 2010 (MDEQ, 2000). PCBs have been banned since the 1970s but are persistent in the environment. Sources of PCBs include industrial activity use in degreasing and cleansing products and insulation for electrical conductors. MDEQ determined Kent Lake to be contaminated with PCBs via the State's Fish Contaminant Monitoring Program.

The Michigan Fish Contaminant Monitoring Program (FCMP) was established in 1980. Fish contaminant data is used to determine whether fish from the state's waters are safe for human and wildlife consumption, and as a surrogate of bioaccumulative contaminants in surface water.

STORET also includes records of 12 detections of 2,4-Dichlorophenoxyacetic acid [94-75-7], commonly referred to as 2,4-D. These records are from a 1984-86 study by the USGS in the Lower Kent Drainage Area. Most often used in commercial lawn applications, 2,4-D is a pesticide that can have negative impacts to aquatic organisms and other non-target species if misapplied or misused. Based on the reported data, the mean 2,4-D concentration from 1984-86 was 0.25 mg/L. The Michigan final acute value for 2,4-D is 2.9 mg/L, the final chronic value is 0.22 mg/L, and the aquatic maximum value is 1.4 mg/L.

Based on a review of fish monitoring studies and records of 2,4-D contamination, persistent toxins are identified as variables of concern for the Kent Lake (PCB and mercury advisories), and Pontiac Lake (PCB advisories in channel catfish), Lower Kent Drainage Area (2, 4\_D) as well as all other lakes in the subwatershed due to mercury levels.

### 3.1.4. Reduced Water Quality

In temperate zones, lakes, such as Kent Lake, experiences changes in water chemistry and biology throughout the year. During the winter months, lake water temperature, dissolved oxygen, and other variables are essentially equal at all depths. As ice thaws when spring approaches, winds and temperature changes in surface waters cause a mixing within the water column. This event is often referred to as a spring turnover. Into the summer months, warm air temperatures interacting with surface waters cause stratification or layering of lake water due to water temperature and density relationships. During this time of thermal stratification, little mixing of lake water occurs. Lakes that receive increased pollutant loading can exhibit quantifiable reductions in water quality at this time because of the lack of water mixing. As the season enters fall, cooler air temperatures increase surface water density and mixing establishes uniformity within the water column in what is termed as fall turnover.

Suspended sediment concentrations are often analyzed as a measure of water column clarity. As a broad measurement, suspended sediments include organic matter and inorganic matter such as sand, silt, and clay particles. Suspended sediments are often of water quality concern because they tend to carry

adsorbed phosphorus and to increase biological oxygen demand, and hence reduce dissolved oxygen levels, in waterbodies. Sources of suspended solids include, but are not limited to, runoff from disturbed land (e.g., construction activities and impervious surfaces), certain illicit discharges, poorly operating wastewater treatment plants, and erosion of stream banks.

There are few direct measures of suspended sediment concentrations recorded for the Upper Huron/Kent Lake Subwatershed. A 1984-86 record indicates widely varying suspended sediment readings for the lower Kent Drainage Area. The mean suspended sediment concentration for this period was 9.7 milligrams/liter (mg/L) with a range of 1 to 47 mg/l. The variability of the data cannot be explained due to the limited dataset and reporting. However, it is possible that soil disturbance events upstream or adjacent to sampling stations or a period of unusually high flow could have caused the reported variability.

Conductivity is often analyzed as a simple indicator of dissolved solids in the water. High conductivity levels (>800 microSiemens per centimeter,  $\mu\text{S}$ ) may indicate the presence of toxins, whereas abnormally low conductivity levels may indicate other water quality concerns. Fish and organisms can thrive only in environments within a relatively narrow band of conductivity levels. The HRWC annual adopt-a-stream reports indicate that Norton Creek at West Maple Road has experienced chronically high conductivity levels (1685  $\mu\text{S}$ ). Other locations tested by Adopt-A-Stream volunteers indicated average conductivity levels less than 800  $\mu\text{S}$ .

The Village of Wolverine Lake includes total dissolved solids concentrations in their annual updates. Values for Wolverine Lake indicate a high concentration of dissolved solids.

Water temperature has a direct effect on the health of living organisms. Fish and reptiles have limited ability to control their body temperatures. High temperatures lead to increased metabolic rates and stresses on the heart and lungs. Water temperatures also affects water chemistry; oxygen and other gases are more soluble at lower water temperatures. Finally, water temperatures can affect the physiology of the lake, since it effects turnover and mixing of water columns. These actions are important for distributing nutrients in the lake and returning oxygen to deeper lake levels.

Adopt-a-Stream records from the summer of 2000 and 2001 indicated average summer temperatures ranging from 64 degrees to 77 degrees, Fahrenheit at the seven locations tested. Huron River at White Lake Road and Norton Creek at West Maple are cold study sites (<66.2 °F), with temperatures sufficient to sustain cold water fish such as sculpin and trout. Warm study sites include the Huron River at Commerce, and Norton Creek at Pettibone Lake and the Loon Lake outlet (>71.6 °F). Fish such as smallmouth bass, rockbass, sunfish, carp and catfish can survive such temperatures. Wide temperature variability coupled with warm temperatures can decrease fish diversity. Norton Creek at the Loon Lake outlet experiences the widest temperature fluctuations and is a warm water site (Wehrly, K.E. et al, 2003).

Reduced levels of dissolved oxygen (DO) are often detected in waters where eutrophication is present. This observation is due to the fact that nuisance algae blooms and excessive plant growth utilize large amounts of DO for respiration. Because DO in surface waters is important to support all aquatic life, sufficient DO levels are vital to sustaining desirable fish, plant, and macroinvertebrate species. In addition, suppressed levels of DO in bottom layers of lakes tend to act as a catalyst for the release of sediment bound phosphorus, hydrogen sulfide, metals, and ammonia into the aqueous phase (USEPA, 2000). Typically, DO levels greater than 8 mg/L indicate adequate conditions to support aquatic life (Sawyer, et al., 1994).

STORET data for the Upper Kent Drainage Area indicate DO levels of 8.8 for the 1977-78 sampling stations. The conditions the in Norton Creek Drainage Area are less desirable, but still adequate, with an



average concentration of 7.8 mg/L recorded during a 1980 USEPA study. A 1977-78 study reported in STORET determined a mean dissolved oxygen level at the Pettibone Creek sampling location of 10.6 mg/L, indicating ample levels of dissolved oxygen. DO Levels in the Lower Kent Drainage Area averaged 10 mg/L for the 1985-86 record.

Researchers have documented poor dissolved oxygen levels for Kent Lake. In 1975, the USEPA, as part of the National Eutrophication Survey in cooperation with the Michigan DNR and the Michigan National Guard, performed a water quality assessment of Kent Lake. The study determined that the trophic status of Kent Lake was eutrophic. The authors noted that algae blooms were reported to have been frequent and intense for the lake and that dissolved oxygen levels appeared to be depleted.

Chlorophyll *a* is the green pigment in plants that is used for photosynthesis. Chlorophyll *a* is a good indicator of the total quantity of algae in a lake. Large amounts of algae in a lake can decrease the clarity of the water, alter the colour of the water (making it greener), form surface scums, reduce dissolved oxygen, alter the pH of the water and produce unpleasant tastes and smells.

Reduced water quality is documented, and of particular concern, in Kent Lake, Norton Creek, Pettibone Creek, Wolverine Lake and Lake Sherwood.

### 3.1.5. Bacteria Loadings

Bacteria and pathogens in the surface water can cause infections and other ill health affects in humans that come in direct contact through recreational activities such as swimming and fishing. High E-coli levels can signify pollution from animal wastes and sewage disposal failures.

The Oakland County Health Department has collected bacteriological data on over 150 inland lakes and one location on the Huron River at 345 public and semi-public beaches for over 30 years. The Health Division uses E-coli results to issue beach closing notices under the Public Health Code.

E-coli levels greater than 300 Colony Forming Units (CFU) in a 100 ml daily average or 130 CFU/100 ml weekly average result in beach closures. Not all lakes or beaches are sampled annually. Some beaches are sampled on a 3-year cycle. Others are sampled on a daily basis throughout the summer months.

There are 86 beach locations on 45 lakes and one site on the Huron River within the Kent Lake subwatershed. Sixteen lakes (33%) of lakes in Kent Lake subwatershed were closed due to E-coli levels (1995-2003). Fifty-six percent of lakes with closings have had chronic conditions (closed on multiple locations and sampling locations). See Figure 15.

In addition, the Village of Wolverine Lake has routinely sampled water from the Greenaway Drain at two locations. Periodically, the tests return E-coli levels in excess of the State Water Quality Standard for full body contact (300 CFU/100 ml)

The Oakland County Health Division also completed an onsite sewage disposal system survey of the Wolverine Lake area in 1996. Results showed an average system failure rate of forty-six percent (46%). Sixteen percent (16%) of those systems were rated as critical, with severe leakage of dye within one hour of application.

### 3.1.6. Known Sources of Contamination

The Oakland County Office of Solid Waste Planning reports that there are twelve closed facilities within the Kent Lake subwatershed. These include six licensed landfills, five unlicensed landfills and dumps (predating P.A. 641 of 1987), and one other fill site. Two sites are listed on the Federal National Priorities List (NPL) as sites of contamination, and under CERCLA (better known as Superfund). These include a landfill in Springfield Township and Hi-Mill Manufacturing (located on M-59 in Highland Township.)

The landfill in Springfield Township was placed on the NPL in 1983. Contaminants of concern include groundwater and soils contamination with PCB's, heavy metals (lead and arsenic) and volatile organic compounds (toluene, xylene). The site is under a remediation plan for soils and groundwater contamination. The plan calls for soils extraction and a groundwater treatment which was installed in 2000. The site is in operation maintenance and monitoring mode with a 5-year reporting and evaluation period.

Hi-Mill Manufacturing Company was placed on the NPL in 1990. Contaminants of concern include shallow groundwater, subsurface and surface soils onsite, and surface water contamination from onsite process wastewater lagoons, including TCE, DCE and vinyl chlorides. Test results indicate elevated levels of heavy metals in a nearby pond and in Waterbury Lake. No significant adverse impact or health threats are indicated. Hi-Mill is performing remediation of the site. Lagoons have been cleaned, soils removed and backfilled. The site is under a 30-year groundwater monitoring schedule with the MDEQ.

The Old Plank Road landfill in Milford Township operated as a landfill/dump from the early 1940's until 1976. Contaminants of concern include groundwater and soils contamination with Beryllium, Lead Iron, Manganese, Aluminum, cis-1,2-Dichloroethylene, Trichloroethylene, cis-1,2-Dichloroethylene, and Vinyl chloride. A remedial action plan is under development for the site.

The Village of Milford, White Lake Township and Highland Township each have wellhead protection programs. As a part of this program, the communities have identified sites of potential contamination. Among sites of interest are the former Kelsey Hayes site in the Village of Milford, which was under investigation by the MDEQ as a source of groundwater contamination and Numatics Industries in Highland Township, which is undergoing remediation for volatile organic compounds (VOC's). In White Lake Township, there are several open leaking underground storage tanks.

### 3.1.7. Nitrates and Chlorides in Groundwater

Nitrates and chlorides are parameters of interest in evaluating drinking water quality. Nitrates are associated with "blue baby syndrome", a condition where levels of nitrate in the bloodstream impair the oxygen carrying capacity of a child's blood stream. Nitrates are often linked to failing septic systems and excess fertilizers. Chlorides are not specifically linked to health risks, but impact taste and other aesthetic considerations of drinking water. Chlorides are usually associated with road salts. Both nitrates and chlorides in groundwater serve as possible indicators of other pollutants.

Low concentrations of nitrates and chlorides have been detected in drinking water wells throughout the subwatershed. (USGS Groundwater Atlas of Oakland County).

# CHAPTER 4. WATERSHED USES, CONCERNS, GOALS, & CRITICAL AREAS

This chapter describes the results of the watershed management planning process. The process included the following steps:

1. Identifying the designated and desired uses of water resources within the Kent Lake subwatershed.
2. Identifying stakeholders' subwatershed concerns and identifying critical areas related to subwatershed concerns.
3. Determining the causes and sources of impairments and concerns.
4. Identifying goals and objectives to address the sources of impairments and concerns

## 4.1 Water Resource Designated and Desired Uses and Impairments

### 4.1.1. Designated Uses

The State of Michigan has developed water quality standards under Part 4 of the Administrative Rules issued pursuant to Part 31 of the Natural Resources and Environmental Protection Act (1994 PA451, as amended). Rule 100 (R323.1100) of the Water Quality Standards states that all surface waters of the State of Michigan are designated for, and shall be protected for eight uses. The Kent Lake Steering Committee evaluated these designated uses and determined whether they are applicable to the Kent Lake subwatershed and whether they are impaired, threatened, or unimpaired (See Table 5). An unimpaired use is one for which there is no evidence or data that an impairment exists. An impaired use is one for which clear evidence of impairment exists. A threatened use is one for which current evidence does not reflect an impairment, however current trends in land use and management or water resources management is expected to contribute to deteriorating conditions in the future. Clear analytical evidence supported that all applicable designated uses except for agriculture and navigation be listed as impaired in the Kent Lake Subwatershed.

### 4.1.2. Desired Uses

Desired uses are those uses above and beyond those designated by the state which local communities and watershed stakeholders desire to protect and sustain into the future. The Kent Lake Steering Committee evaluated various desired uses for their applicability to the Kent Lake subwatershed and determined whether they are impaired, threatened, or unimpaired, as described above for designated uses (Table 5). All desired uses were perceived as being threatened by the stakeholders. This reflects the local knowledge of future land development and use patterns that will require the use of best practices to avoid impacts to these desired uses.

Table 5. Impairment Status of Waters in Kent Lake for Desired and Designated Uses

	<b>Applicable</b>	<b>Impairment Status</b>
<i>Designated Uses</i>		
Agriculture	A	U
Industrial Water Supply	NA	NA
Public water supply at the point of intake	NA	NA
Navigation	A	U
Warm water fishery	A	I
Indigenous aquatic life and wildlife	A	I
Partial body contact recreation	A	I
Total body contact recreation between May 31 <sup>st</sup> and October 31st	A	I
<i>Desired Uses</i>		
Water-based recreation (boating, swimming, floating, fishing)	A	T
Land-based recreation (parks, trails, corridors)	A	T
Preservation of open spaces, greenways, natural features, and river corridors	A	T
Flood control	A	T

A= Applicable

NA= Not Applicable

I= Impaired

U = Unimpaired

T = Threatened

Five of the seven uses designated by the State of Michigan were deemed applicable to the Kent Lake subwatershed by Kent Lake stakeholders. There is no water-dependent industry and no public water supply within the subwatershed, so these were identified as non-applicable designated uses. Agricultural and navigational uses were not identified as impaired. There is adequate water quantity and quality for the limited agricultural needs in the subwatershed. Navigation is not impacted; paddling and other recreational boat use is common in the subwatershed. The Norton Creek has been identified as having non-attainment status under part 303(d) of the Clean Water Act for fisheries and macroinvertebrates; this information was used as a basis for identifying the “warm water fishery” and “Indigenous aquatic life and wildlife” uses as impaired. Several of the beach monitoring points studies by the Oakland County Health Division have been in violation of total and partial body contact standards, so these uses were identified as impaired. All identified desired uses within the Kent Lake subwatershed were deemed as being threatened by current and future land development practices.

## 4.2. Subwatershed Concerns & Critical Areas

In addition to the designated and desired uses, the Kent Lake Steering Committee and watershed stakeholders identified various concerns regarding the subwatershed. These concerns were collected using a variety of methods, including public workshops, worksheets, and stakeholder group discussion. Once a list of concerns was developed, a map of the subwatershed was prepared to identify critical areas that are important to these concerns by presenting an opportunity to address that concern (Table 6), (Map 15).

The concerns identified for the Kent lake subwatershed are as follows:

*Nutrient Loading:* Kent Lake has been identified as not attaining water quality standards for Phosphorus loading under the EPA Total Maximum Daily Load program, under part 303(d) of the Clean Water Act. A plan for addressing the TMDL was developed and approved by the Michigan Department of Environmental Quality in August of 2002. Loading of excessive nutrients to a watershed system results in algal blooms, depleted oxygen conditions, and fish kills. Over the years, Kent Lake has suffered these consequences.

*Bacterial Loading:* Water quality testing conducted by the Oakland County Health Division has resulted in beach closings on lakes within the Kent Lake subwatershed. These beach closings result in the subwatershed failing to meet the state designated uses for full and partial body contact recreation.

*Decreased Water Quality:* Decreased water quality is a concern that encompasses not only nutrient and bacterial loading issues, but also issues of water clarity and toxicity. Additional water quality items of concern include turbidity, conductivity, pesticides, and persistent pollutants such as polychlorinated biphenyls (PCB's) and mercury. Two lakes within the subwatershed have been identified under the TMDL program for PCB problems. Fish advisories have been promulgated for mercury on every lake within the State of Michigan.

*Erosion and Sedimentation:* Flashy flows, inadequate stream-road crossings, and unsound streambank management practices all contribute to erosion and sedimentation problems. These issues threaten property as well as degrade the fisheries within the system. Excess sediment can accumulate behind dams and lake level control structures, requiring costly dredging and maintenance.

*Flooding:* Flooding results from the limited capacity of the river system to carry excess flow volume resulting from storm events and snowmelt. Increases in impervious surfaces within the system result in increased delivery of runoff to the stream, which can exacerbate flooding.

*Trash and Litter:* Public stakeholders in particular were concerned with the improper disposal of trash and litter in the subwatershed on roadways and in stream corridors. Trash and litter degrades the aesthetic qualities of the natural resources within the subwatershed and may contribute to declining property values.

*Economic Development & Vitality:* The proper balance between economic development and vitality and environmental protection is of concern to various subwatershed stakeholders. A desire to protect the natural resources within the subwatershed while allowing for beneficial economic development is of primary concern. Leveraging opportunities relating to the natural beauty of the subwatershed to promote economic development was a concern. Such leveraging may occur through the development and promotion of recreational opportunities and connection of commercial enterprises and areas to the natural heritage of the landscape.

*Loss of Open Space and Impacts on Natural Features:* Many stakeholders are concerned about the loss of open space and natural features as development paves its way through the communities within the subwatershed. The Michigan Natural Features Inventory has identified substantial natural areas within the subwatershed, much of which is protected by state, regional, and local park systems. However, a great deal of sensitive land is not protected and will eventually be developed in accordance with local master land use plans. Methods to protect these sensitive lands while accommodating this development will be a major challenge in the next 25 years within the subwatershed.

*Lack of Public Knowledge and Concern:* Many stakeholders are concerned that the public is not educated about the value of the natural and water resources within the Kent Lake subwatershed and what their individual role is in protection of these resources. Since the majority of land within the subwatershed is owned by private individuals, public education is critical to the future status of water resources.



Table 6. Kent Lake Issues of Concerns and Related Critical Areas

<b>Concerns</b>	<b>Critical Areas</b>
<p><b>Nutrient Loading</b></p> <p><b>Bacterial Loading</b></p> <p><b>Decreased Water Quality</b></p>	<p>Sherwood lake, Wolverine Lake, Kent Lake, Norton Creek are listed under part 303d of the Clean Water Act as not attaining water quality standards for nutrients.</p> <p>Beaches on Kent, Commerce, Lower Straits, Duck, Harvey, White, Childs, Philips, Sun, Wolverine, Middle Straits, Teeple Lakes and Huron River have all failed partial and full body contact standards in past years.</p> <p>Pontiac Lake and Kent Lake are listed under part 303d of the Clean Water Act as not attaining water quality standards for persistent polychlorinated biphenyls (PCB's).</p> <p>Norton Creek is listed under part 303d of the Clean Water Act as not attaining water quality standards for fish and macroinvertebrate communities.</p>
<p><b>Erosion/Sedimentation</b></p> <p><b>Flooding</b></p>	<p>Roadways, Riparian Corridors</p>
<p><b>Trash and Litter</b></p>	<p>Roadways, Riparian Corridors</p>
<p><b>Economic Development &amp; Vitality</b></p>	<p>Downtown areas and commercial land uses</p>
<p><b>Loss of Open Space and Impacts on Natural Features</b></p>	<p>Michigan Natural Features Inventory Potential Natural Areas &amp; Wetlands</p>
<p><b>Lack of Public Knowledge and Concern</b></p>	<p>Public Recreation Lands</p> <p>Schools</p>

Figure 15. Concerns and Critical Areas

### 4.3. Causes & Sources

Once concerns for the subwatershed were identified, the sources and causes of these concerns were examined (Table 7). In order to develop meaningful goals and objectives, a careful analysis of the causes of each identified concern and the sources of the causes must be undertaken. The sources and causes of subwatershed concerns were identified through a combination of researching similar issues in other subwatersheds and through the filling out of a stakeholder worksheet followed by stakeholder discussions. Several discussions were held to refine the list of sources and concerns.

For example, a subwatershed concern was nutrient loading. One source of this concern is failing on-site septic systems. In order to develop a meaningful set of goals and objectives to address this problem, the causes of this source must be clearly identified. The group carefully examined this source and found several causes contributing to it, including lack of education or incentives on proper maintenance of on-site sewage disposal systems, as well as inadequate permitting, design, construction and inspection standards. Goals and objectives to address these issues were then developed, and subsequent action plans as developed in each communities Stormwater Pollution Prevention Initiative (SWPPPI) document will include items to address these root causes of the nutrient problem.

Table 7. Concerns, Sources, and Causes in the Kent Lake Subwatershed

Concerns	Sources	Causes
<b>Nutrient Loading</b>  <b>Bacterial Loading</b>  <b>Decreased Water Quality</b>	1. Improper lawn maintenance & fertilizer use  2. Failing on-site sewage disposal systems  3. Illicit discharges  4. Inadequately functioning stormwater retention infrastructure  5. Geese  6. Pet Waste  7. Reduction in wetlands.  8. Improper disposal of hazardous materials  9. Inadequate financial resources to address issues.	1. Lack of access, education and available expertise on low-impact lawn practices and products, inadequate local regulation.  2. Lack of education or incentives on proper maintenance of on-site sewage disposal systems, inadequate permitting, design, construction and inspection standards.  3. Unknown sources of contamination  4. Inadequate funding to address aging, poorly designed or out-capacitated stormwater infrastructure  5. Riparian landscaping practices that favor geese habitat  6. Lack of education about proper pet waste management  7. Lack of education about wetland values, inadequate and inadequately enforced state and local wetland protection measures, lack of economic incentives to protect.

Table 7 (cont.) Concerns, Sources, and Causes in the Kent Lake Subwatershed

		<p>8. Lack of knowledge about or access to appropriate disposal alternatives.</p> <p>9. Lack of funding to address concerns.</p>
<p><b>Erosion/Sedimentation</b></p> <p><b>Flooding</b></p>	<p>1. Inadequate construction erosion controls</p> <p>2. Inadequately functioning stormwater retention infrastructure</p> <p>3. Excessive impervious surfaces</p> <p>4. Reduction in wetlands.</p> <p>5. Hydrologic alterations do not consider system-wide needs.</p> <p>6. Inadequate financial resources to address issues.</p>	<p>1. Inadequate enforcement of erosion control statutes.</p> <p>2. Inadequate funding to address aging, poorly designed or out-capacitated SW infrastructure</p> <p>3. Inadequate and inflexible local development regulations for impervious surfaces minimization, inadequate training of designers and engineers on impervious surface reduction and innovative stormwater management techniques.</p> <p>4. Lack of education about wetland values, inadequate and inadequately enforced state and local wetland protection measures, lack of economic incentives to protect.</p> <p>5. Lack of holistic approach to hydrologic alteration and stormwater management.</p> <p>6. Lack of funding to address concerns.</p> <p>7. Lack of funding to address concerns.</p>
<b>Trash and Litter</b>	<p>1. People disposing of trash and litter inappropriately.</p> <p>2. Inadequate financial resources to address issues.</p>	<p>1. Lack of respect for and education on the values of the natural environment</p> <p>2. Lack of funding to address concerns.</p>
<b>Economic Development &amp; Vitality</b>	<p>1. Opportunities for water resources in economic development not capitalized on.</p> <p>2. Threat of property values loss.</p> <p>3. Impairment of public/private beach recreation.</p> <p>4. Inadequate financial resources to address issues.</p>	<p>1. Lack of effort to target water-resources related economic development opportunities.</p> <p>2. Potential for degraded water resource quality.</p> <p>3. See causes for bacterial loading</p> <p>4. Lack of funding to address concerns.</p>

Table 7 (cont.) Concerns, Sources, and Causes in the Kent Lake Subwatershed

<p><b>Loss of Open Space and Impacts on Natural Features</b></p>	<ol style="list-style-type: none"> <li>1. Loss or degradation of natural features in new development</li> <li>2. Hydrologic disruption resulting from impacts on the hydrologic system</li> <li>3. Inadequate financial resources to address issues.</li> </ol>	<ol style="list-style-type: none"> <li>1. Inadequate and inflexible local development regulations for natural features preservation, inadequate education about potential financial incentives.</li> <li>2. Lack of holistic watershed approach to stormwater and hydrologic management, lack of professional education &amp; expertise.</li> <li>3. Lack of funding to address concerns.</li> </ol>
<p><b>Lack of Public Knowledge and Concern</b></p>	<ol style="list-style-type: none"> <li>1. Lack of public interest and education.</li> <li>2. Inadequate financial resources to address issues.</li> </ol>	<ol style="list-style-type: none"> <li>1. Lack of educational opportunities and outreach regarding individual stewardship, responsibility, and cumulative impact of behaviors.</li> <li>2. Lack of funding to address concerns.</li> </ol>

#### 4.4. Goals & Objectives

Goals and objectives were developed to address each of the concerns identified within the subwatershed. These goals and objectives were developed during a stakeholder workshop, in which stakeholders broke up into small groups, developed a set of goals and objectives, and then came back together to compare results. The output from this initial workshop was combined and refined through additional discussion.

These goals and objectives are guidelines for each community to follow as they develop their Stormwater Pollution Prevention Initiative (SWPPI) document, which is the enforcing document of the Phase 2 stormwater permit. Each community will identify their own unique solutions for addressing the goals and objectives presented here, based upon their own unique situations, opportunities, and resources.

These goals are all identified as long-term goals, with potential for continued progress throughout the foreseeable future, well beyond the life of the permit. To assist the partners in establishing priorities in development of their SWPPI's, the Subwatershed Advisory Group further identified objectives as "short-term" (ST) or "long-term" (LT) objectives.

In general, public education goals are immediately implementable and can result in measureable changes in attitude and behavior over the initial permit period (see Chapter 7 for discussion of Methods of Evaluating Progress). These are considered "Short Term" objectives.

Other objectives often require programming and design efforts before implementation, with progress measured well after implementation. These also might require collection of baseline data in order to measure future progress. Such objectives are generally considered "Long Term" objectives.

**Goal # 1: Promote and maximize community assets and recreational opportunities related to water resources.**

Objective # 1-1: Provide information to the public on access to the water resources and riparian lands in the watershed, and available uses and recreational opportunities.(ST)

Objective # 1-2: Improve and maintain fisheries and wildlife habitat. (LT)

Objective # 1-3: Pursue harmonious economic development approaches through intentional connection with the natural environment. (LT)

**Goal # 2: Enhance and improve protection of open space, greenways, and natural features.**

Objective # 2-1: Coordinate planning approaches with neighboring communities using a systems approach to protection of natural features. (ST)

Objective # 2-2: Identify planning opportunities for protection of open space, greenways, and natural features and investigate the implementation of tools appropriate to each community. (ST)

Objective # 2-3: Develop and maintain a working relationship with a local land conservancy, if applicable. (ST)

**Goal # 3: Reduce water quality degradation and address the Kent Lake TMDL (Total Maximum Daily Load).**

Objective # 3-1: Investigate sources of water quality degradation, including bacterial and nutrient loading, erosion, and sedimentation. (LT)

Objective # 3-2: Develop and evaluate methods for source reduction. (LT)

Objective # 3-3: Promote public awareness of the effects of pollutants such as trash, litter, and fertilizer on the water quality and aesthetic conditions. (ST)

**Goal # 4: Educate, engage, and empower the public to protect water resources.**

Objective # 4-1: Faithfully implement Public Education Plans (PEP). (ST)

Objective # 4-2: Identify, promote, and encourage participation in educational opportunities targeting land-use decision-makers in their role in protecting water resources. (ST)

Objective # 4-3: Promote participatory experiences to foster a personal connection and sense of responsibility between the public and local lakes, rivers, streams, and wetlands. (ST)

**Goal # 5: Improve management of stormwater and watershed hydrology.**

Objective # 5-1: Consider the function of natural hydrologic systems through coordinating stormwater management with neighboring communities when appropriate. (LT)

Objective # 5-2: Identify watershed-wide and community-scale planning, design, and engineering alternatives to manage stormwater, protect wetlands, floodplains, and other natural features that protect water quality and quantity, and incorporate those alternatives where appropriate. (LT)

Objective # 5-3: Develop and maintain a working relationship with the Huron River Watershed Council. (ST)

**Goal # 6: Develop resources to address the concerns, goals, and objectives outlined in the subwatershed management plan.**

Objective # 6-1: Continue regular operation of the Kent Lake Subwatershed advisory Group and incorporate additional stakeholder interests as appropriate to share resources. (ST)

Objective # 6-2: Form a subcommittee to investigate potential funding options/sources and opportunities to leverage resources for addressing watershed concerns, goals, and objectives. (ST)

## CHAPTER 5: BEST MANAGEMENT PRACTICES

The elements contributing to the degradation of water quality in the Kent Lake/Upper Huron Subwatershed are primarily the by-products of human activities and land use practices. In order to preserve the watershed for its desired uses, and restore any impaired ecological functions, it is essential that we begin to encourage changes in human behavior, and to implement structural improvements to filter sediments, toxins and other pollutants from stormwater.

The Goals and Objectives identified previously in this plan can be addressed by a number of Best Management Practices (BMP's). BMP's may include public education programs, policies and regulations to encourage more environmentally sensitive site design, municipal "housekeeping" practices and even structural improvements to improve water quality.

We have identified a range of BMP's, some of which are most appropriate for our cities and more urban partners, who face the challenges of maintaining existing infrastructure and retrofitting systems to address water quality concerns. Others are more appropriate for the outlying townships, who are grappling with issues of encouraging better design in new development. All communities within the watershed can equally participate in programs to educate the public and encourage stewardship activities in the watershed.

The following is a brief summary of each of the BMP's included in this management plan. There are also many references that detail the BMP's. This summary is intended to provide a basic explanation of each practice that corresponds with the objectives of the watershed goals. Further information on BMP's can be found in the EPA's *Preliminary Data Summary of Urban Storm Water Best Management Practices* report and in various sources on the internet. The BMP's are grouped with similar practices, but are not listed in any particular order of priority.

### 5.1. Ordinances, Regulations and Standards

Our cultural landscape and built environment are directly affected by the ordinances, regulations and design standards that govern development. Communities can impact water quality by encouraging environmentally sensitive design and enforcing appropriate stormwater management techniques.

The Huron River Watershed Council (HRWC) has offered assistance to communities in evaluating their ordinances through the Code and Ordinance Worksheet program (COW) which is based on a "watershed friendliness" evaluation system promoted by the Center for Watershed Protection (CWP). The COW program will provide participating communities with specific advice about what types of provisions might be incorporated into ordinances and regulations. HRWC may offer technical assistance to communities seeking to implement those recommendations. HRWC's effort is funded by a Section 319 Grant to implement the Kent Lake TMDL Watershed Management Plan to reduce phosphorus. We anticipate that the benefits of participating in that program will have additional value in meeting the goals of this Watershed Management Plan.

In addition, the Shiawassee & Huron Headwaters Resource Preservation Project (SHHRPP) included a variety of recommendations and model ordinances to guide communities in developing more watershed friendly ordinances and regulations.



Oakland County has also recently completed an evaluation of, and revision to, their Soil Erosion and Sedimentation Control permitting process. Oakland County is the enforcement agent for provisions of the Natural Resources and Environmental Protection Act (Act 347 EA) for many of the townships.

In evaluating and modifying ordinances, the partners are evaluating the areas as noted below. The group will discuss issues at ongoing sub-watershed advisory group meetings (SWAG), will share examples of ordinances with each other, and will work to incorporate those ordinances, regulations and design standards into their communities practices as are feasible and appropriate.

#### 5.1.1. Water Resources Protection Ordinance

In undeveloped areas, or in areas where redevelopment may occur, it is important to place regulations that guide development with regard to protecting water quality, water quantity and biological integrity of receiving surface water. Site design should consider controlling runoff so as to avoid negative impacts to local streams and water resources by development as much as practical. Regulations can limit or prohibit direct connections of runoff to provide for sediment removal, reduction of thermal impacts, and protection from erosive forces.

#### 5.1.2. Storm Water Standards for Redevelopment

In developed areas, the footprint of development is sometimes such that there is little space to integrate common structural BMP's to improve water quality. Standards should include special consideration of engineering and management solutions appropriate for retrofitting existing systems. The standards should direct property owners to improve stormwater management systems when any significant site investment is completed.

#### 5.1.3. Local Fertilizer Ordinance

Fertilizer ordinances, standards or guidelines that regulate application of nutrients by both private landowners and/or commercial applicators can minimize nutrient loading (specifically phosphorus) to the waterways. These guidelines can supplement public education and involvement programs. Commerce Township and West Bloomfield Township have already adopted fertilizer ordinances that require licensing and/or permits for commercial applicators.

#### 5.1.4. On-Site Sewage Disposal System (OSDS) Ordinance

Poorly maintained and failing septic systems contribute to the decline of our surface water bodies as well as endanger groundwater aquifers. Traditionally, once the County Health Division has issued a permit for construction of an onsite sewage disposal system, there is no mechanism to allow for future inspections of such systems. Ordinances can require periodic inspections during property transactions (time of sale), during routine maintenance such as septic tank pump-outs, or on a specific periodic interval. The ordinances can then address mechanisms to correct system deficiencies or failures. Commerce Township has recently adopted an on-site sewage disposal system ordinance requiring periodic inspections. The County is also investigating a county-wide ordinance requiring time of sale inspections.

#### 5.1.5. Native Landscaping Ordinances

The use of native vegetation in landscaping and in conjunction with other stormwater BMP's can improve stormwater absorption and filtration. Native landscaping ordinances can include guidelines to preserve and restore native plant communities in open space, buffer zones and parklands, to encourage the use of native landscaping for new development, and to utilize native plants in constructed wetlands and stormwater management systems such as detention and retention ponds. It may also be necessary to revise weed ordinances to accommodate native plants. Establishing native plants, including prairie and wildflower meadows, within new developments as opposed to grass seed or sod can also enhance stormwater infiltration and nutrient uptake.

Springfield Township has been a leader in Southeast Michigan in promoting Native Landscaping.

#### 5.1.6. Natural Features Setback and Protection Ordinances

In order to protect key local natural resources while allowing for appropriate development, it is often prudent to implement local ordinances that clarify why protection of certain features is important and how they will be protected under the law. These local ordinances can provide better protection than state or federal law, and can better reflect priorities of the local community based on local knowledge of the interrelationship and function of natural systems.

#### 5.1.7. Soil Erosion and Sedimentation Control (SESC) Techniques/Ordinances

Construction activities can contribute to the destabilization of slopes and introduction of sediments into our surface waters. Ordinances can establish requirements for minimum acceptable practices and performance standards for effective SESC plans to supplement state law and provide for local oversight and control.

#### 5.1.8. Soil Erosion and Sedimentation Control (SESC) Inspection and Enforcement Practices

A well-considered plan does not protect surface water quality if not properly implemented and maintained. The County, and those communities that enforce SESC programs will review and incorporate improvements into their practices to provide staff with training, adequate time to process permits, inspect sites and respond to complaints. County and local programs will include efforts to educate developers and contractors working within their jurisdiction of best practices, as well as explaining their control mechanisms associated with the program and the environmental benefits of complying with the program.

#### 5.1.9. Wetlands, Woodlands, Tree Replacement Ordinances

The Goemere-Anderson Wetlands Protection Act regulates activities in wetlands that meet minimum requirements of size, location, and connections to lakes, streams and rivers. The Act does not necessarily

protect smaller, yet significant, wetlands that may have a key function in local ecological systems. Communities may choose to regulate certain wetlands that do not fall under state control, provided certain legal conditions are satisfied. In addition, communities may choose to regulate development in wooded areas, and/or require that developers plant young trees to replace those disturbed by their construction activities. Sensitive management of development in and around key natural habitat areas such as wetlands and woodlands protect water quality in surface waters and otherwise further the goals and objectives of this watershed management plan.

## 5.2. Coordinated Planning Activities

Although land use is traditionally controlled by local governments, there are many opportunities to protect and enhance the watershed by working cooperatively to plan for regional needs based on watershed boundaries. By coordinating planning activities, each community might also benefit from efficiencies in dealing with issues such as wastewater management and water supply. Communities can coordinate trails programs for facilities that cross jurisdictional boundaries, and provide cross-access for its residents to natural areas they might not otherwise enjoy. There is nearly always a benefit in sharing information and ideas that might be implemented.

The watershed partners are evaluating the areas as noted below. The group will discuss issues at ongoing sub-watershed advisory group meetings (SWAG), and may form limited partnerships to plan and implement projects.

### 5.2.1. Continue Involvement in the General Storm Water Permit Program

The Subwatershed Advisory Group will continue to meet regularly to share information, and identify opportunities to coordinate planning and resources.

### 5.2.2. Identify and Prioritize Key Potential Recreational Areas and Activities

The Oakland County Planning and Economic Development Services provides assistance to communities throughout Oakland County in identifying natural areas and stewardship opportunities. Communities in the subwatershed are utilizing their planning services to assist in developing a “greenprint” or natural resource opportunity plan. The Oakland County Parks and Recreation Services Department also works cooperatively with communities to identify, obtain and develop key parklands.

As subwatershed communities revise and implement their existing recreation plans, they will consider opportunities that further the goals and objectives of this watershed management plan. For instance, the Village of Wolverine Lake is planning a boardwalk project that will improve pedestrian access to the lakefront. Voters in Milford Township have adopted a dedicated millage for trail development, which will likely provide new opportunities for access to natural areas. Waterford Township, White Lake Township, Highland Township and the MDNR are cooperating in planning for a trail system to connect Highland Recreation Area with Pontiac Lake Recreation Area, also providing access to water features along the route.

### 5.2.3. Identify Areas for Recreation Enhancement

Many subwatershed partners already have properties associated with water bodies or other significant natural features in the watershed. These may offer little or no access or opportunity for interaction between the users and the environment. The partners will evaluate their recreational plans in light of the goals and objectives of this watershed management plan to look for new opportunities for programs or physical improvements to extend meaningful outdoor experiences to more users.

### 5.2.4. Conserve Riparian Land for Future Parks & Public Access

Waterside property is typically in high demand and can be costly. It is often in the interest of local agencies and land conservancies to compete in the open market for riparian lands. Once available land has been identified, funding must be secured through local general funds, state and federal programs, foundations or donations. Communities should prepare for future acquisition of such properties by identifying them in natural area and recreation plans, and by including their acquisition in long-term land use plans and local policy decisions.

Commerce Township voters have approved a millage for acquisition of parklands and operation of existing recreation areas.

### 5.2.5. Encourage Conservation Easements to Protect Natural Resources

Even when outright acquisition of property is not feasible, it is often possible to secure the protection of the environmental resource through conservation easements. Opportunities for easement acquisition are present in the site plan and subdivision review process, and through the educational and outreach programs of local conservancies. Highland Township Ordinances require developers to include a long term monitoring and maintenance plan with open space proposals. One option includes conveying a conservation easement to a recognized land conservancy. Commerce Township includes similar provisions in their zoning ordinance.

### 5.2.6. Integrate Natural Resource Protection into the Planning Process

As noted above, the Oakland County Natural Resources Stewardship Staff has encouraged watershed partner communities to utilize their process for identifying key natural areas. Each watershed community should validate the County efforts with local knowledge and inventories as they update their comprehensive land use plans. The Comprehensive Plans should include specific goals and objectives related to protection of natural resources, and identify policies and tools to provide resource protection. Tools could include engineering design standards, purchase of development rights, conservation easements, or other tools as were identified in the Shiawassee & Huron Headwaters Resource Preservation Project.

### 5.2.7. Utilize Comprehensive Planning for Wastewater Treatment Systems

Each of the community partners in the subwatershed are at varying points in the process of developing, extending and/or maintaining wastewater treatment systems. For instance, Highland Township is currently in the process of seeking a wastewater discharge permit for a facility located just outside this subwatershed, but with the potential of servicing properties in the watershed. Milford Township is contracting with adjacent communities to provide service for limited areas of the Township. Other communities, such as Wixom, have a fully developed wastewater treatment system.

The Oakland County Drain Commissioner is currently conducting a County-wide study of wastewater systems, and hopes to identify opportunities for cooperative projects.

Communities should review the utility components of their Comprehensive Plans periodically in conjunction with the state mandated review of their land use elements. In particular, communities should consider whether changes in service boundaries are necessary to better protect water resources in the subwatershed, and whether the land use for key properties are provided an appropriate means for dealing with the wastewater disposal.

## 5.3. Public Education and Stewardship Opportunities

Ultimately, protection of our water resources relies on changes to human behavior. Changing behavior requires changing attitudes, and starts with an effective message about the importance of stewardship of our watershed, and how each individual's choices can and do make a difference in our world. The more an individual interacts with, and develops a personal connection to the watershed, the more likely they are to follow through with behavioral changes.

The Subwatershed partners have collaborated in developing and disseminating educational materials and programs designed to increase awareness of desired changes. Each partner has submitted a Public Education Plan and is currently working towards implementation of same.

The following identifies some of the best management practices identified and selected by the subwatershed partners:

### 5.3.1. Increase Public Awareness through Print and Other Media Campaigns

Public participation and education programs are activities in which people learn about and/or work together to control storm water pollution. Programs should be designed to reach the key audiences whose behavior impacts our water quality, and clearly provide options to make a positive difference that the audience can "buy in" to. By encouraging the public to accept responsibility for individual and collective actions, we can begin to facilitate meaningful change in the watershed. Without effective public education programs, relatively small sources of pollutant will continue to wield collective damage on our water resources.

The subwatershed communities are partners with SEMCOG in the Southeast Michigan Partners for Clean Water. This program attempts to provide a consistent and coordinated message and identity to be used throughout Southeast Michigan to promote watershed awareness. The program includes a media

campaign, collateral materials for adults and children (such as water bottles, toys, tip cards, etc.) and a website presence.

Many of the partners are also members of the Huron River Watershed Council (HRWC). HRWC also provides materials for the media, tipcards, a newsletter, and recognition through its hands-on stewardship activities.

### 5.3.2. Lawn Care Behavior Change Programs

Michigan State University Extension Service (MSUE) has developed effective programs to educate homeowners about appropriate practices for caring for lawns, including information on soil testing, fertilization, watering, and cutting the lawn in manners that promote soil absorption of runoff and plant uptake of nutrients. Watershed partners have agreed to facilitate seminars locally, and distribute their materials.

The Southeast Michigan Partners for Clean Water are also targeting homeowners with a specific message regarding lawn care practices. Tip cards, news releases, articles and radio spots are available for distribution by partners.

### 5.3.3. Septic Systems Maintenance Programs

Michigan State University Extension Service (MSUE) has developed effective programs to educate homeowners about appropriate practices for maintaining their septic systems. The program includes information about septic tank health (such as what not to introduce to your tank) and maintenance (such as when to pump the solids). Watershed partners have agreed to facilitate seminars locally, and distribute their materials.

The Southeast Michigan Partners for Clean Water are also targeting homeowners with a specific message regarding septic tank maintenance. Tip cards, news releases, articles and radio spots are available for distribution by partners.

### 5.3.4. Animal/Pet Waste Maintenance Programs

In order to protect water resources, pet waste should be collected and properly disposed of in the trash, down the toilet, or other appropriate disposal facility. When a pet owner fails to clean up after his pet, it is not only inconsiderate of others, but poses a threat to the watershed as it washes to storm drains and ditches.

In order to facilitate proper pet waste disposal on public lands, some communities, such as Highland Township, have installed and maintain dispensers for waste baggies, a convenient trash can, and signs with an educational message at local parks. Lyon Oaks in Lyon Township provides a “bark park” where such educational messages are promoted. Commerce Township has adopted an animal waste ordinance to encourage cleaning up after one’s pet.

The Southeast Michigan Partners for Clean Water are also targeting residents with a specific message regarding proper disposal of animal wastes. Tip cards, news releases, articles and radio spots are available for distribution by partners.

#### 5.3.5. Household Hazardous Materials Collection Programs

The average American household contains three to ten gallons of hazardous chemicals, including such items as automotive wastes, cleaners and paints. In general, the public is unaware of the problems associated with overuse and improper disposal of these materials. In addition, the public generally does not recognize the toxicity of materials used in and around homes. The goal of Household Hazardous Waste Programs is to:

- Minimize the purchase and usage of household hazardous materials that exhibit characteristics such as corrosivity, ignitability, reactivity, and/or toxicity, or are listed as hazardous materials by the EPA, and
- Ensure proper storage and disposal of such materials if they must be purchased and used.

The proper disposal of hazardous materials will minimize the amount of hazardous materials that will enter surface waters and groundwater supplies.

Many communities, such as Highland Township, Milford Township/Village of Milford sponsor their own household hazardous waste collection days. Other communities collaborate in the “No-HAZ” program that is organized on a regional basis.

#### 5.3.6. Litter and Debris Clean-up and Recycling Programs

Curbside recycling pick-up is available in many of the communities in the subwatershed including Highland, Milford and Commerce Townships, and the Village of Wolverine Lake.

MDOT promotes the “Adopt-a-Road” program for the state trunklines that run through the subwatershed including M-59 and I-96. The Road Commission for Oakland County also sponsors a similar program on county roads. Residents of the watershed volunteer twice a year to clean-up litter and debris along their sponsored segment of roadway.

Some communities also employ prison work crews on a periodic basis to clean up debris in and around their parks and municipal facilities.

#### 5.3.7. Ongoing Events, Stewardship and Involvement Activities

Subwatershed partners have long been involved with groups such as the Huron River Watershed Council (HRWC), lake homeowner’s associations, and similar groups. The North Oakland Headwaters Conservancy, Oakland Conservancy, White Lake Citizens Care and similar groups undertake stewardship projects such as leading interested citizens through natural areas, habitat rehabilitation projects, and conducting other public education programs.

The subwatershed partners will support their work by displaying their materials, providing links from community websites, and other similar means.

#### 5.3.8. Support of Local River/Lake Protection Groups

The subwatershed partners have worked effectively with the Huron River Watershed Council on many projects that impact water quality in the watershed. HRWC facilitated the planning process for preparation of the TMDL plan for phosphorus reduction and has provided technical assistance to communities implementing structural BMP's addressed in that plan. Other programs include public education, stewardship programs such as River Day and the Adopt-a-Stream program, and other technical assistance to communities.

Most partners are currently members of the HRWC, and will continue to support the organization through dues and participation in their programs (such as subscribing to print runs for watershed calendars, tipcards, etc).

Partners will also support local lake protection groups working in their jurisdictions such as White Lake Citizen Care by displaying their materials, providing links from community websites, and similar means.

#### 5.3.9. Encourage Generally Accepted Agricultural Management Practices (GAAMPS)

Although much of the subwatershed is now considered urbanized, there is still active agriculture within the subwatershed, as well as hobby farms. An equestrian coalition is working to increase awareness of the significant horse and pony population within our area.

Small horse farms and agricultural businesses may contribute to higher bacteria concentrations if manure is not managed properly. State agencies have the authority to manage commercial agricultural practices through voluntary measures called Generally Accepted Agricultural Management Practices (GAAMP's), although they typically do not deal with the hobby farmer or horse enthusiast. GAAMP's do provide landowners with guidelines to follow in regard to nutrient and pesticide application and storage, manure management, groundwater protection and habitat protection. Michigan State University Extension agents and others offer outreach programs to educate landowners about these recommended practices, which should be utilized to control potential pollutants arising from this land use.

Subwatershed partners will work with the local conservation district to identify and promote the use of GAAMP's.

#### 5.3.10. Encourage Golf Course Nutrient Management

The United States Golf Association and other trade organizations conduct research and publish best management practices for environmentally sound turf management practices. In addition, Michigan State University Extension Service produces a number of publications and training programs relevant to pest and nutrient management in turfgrass that is relevant to golf course nutrient management. MDEQ also targets golf courses through the Pollution Prevention (P2) Initiative.



The Huron-Clinton Metropark Authority, as well as other private and public courses within the subwatershed are certified members of the Michigan Turfgrass Environmental Stewardship program. This is a voluntary program, unique in the nation, with a mission to protect groundwater resources, enhance fish and wildlife habitat, and promote greater awareness of and adoption of best management practices for golf courses to achieve environmental goals.

Subwatershed partners will provide golf course managers with periodic reminders to use environmentally safe turf management practices, as well as a list of resources and contacts for appropriate programs.

#### 5.3.11. Programs to Eliminate Sources of Bacteria that Prevent Desired Recreational Activities

Subwatershed partners will participate in programs designed to eliminate sources of bacteria that contribute to beach closings, algal blooms, and other detriments to recreational activities.

One such program is the annual goose round-up, which is conducted under permit from the Michigan Department of Natural Resources each spring, in an effort to control goose populations. This program results in the reduction of Canadian geese populations by replacing or shaking eggs from the nests. In Highland Township, this program is conducted on Duck Lake, Taggett Lake, Kellogg Lake and White Lake. Other lakes in the watershed also participate.

### 5.4. Municipal/Organization Housekeeping Practices

Each of the partner communities and organizations can provide leadership for its residents and the public in environmental stewardship by reviewing and improving its own housekeeping practices. This includes keeping streets and parking areas clean of debris and managing stormwater to improve water quality and control flooding and erosion. This also includes caring for the lawns in our public areas using the principles of appropriate fertilization, soils testing and watering.

The subwatershed partners have identified programs for training decision makers and employees, and for improving our housekeeping practices to further the goals and objectives of the watershed management plan. Each of these items refer to management of facilities under the direct jurisdiction of the community or agency, and not management of private property. Similar practices in the private sector will be encouraged through other BMP's identified in the plan.

#### 5.4.1. Implement Institutional Framework for Watershed-Wide Action

The Subwatershed Advisory Group (SWAG) will continue to meet on a periodic basis to discuss issues related to the implementation of the watershed management plan, to share data and strategies for revising ordinances and policies and to otherwise support and further the goals and objectives of the plan.

The SWAG representatives will report back to the appropriate decision-making bodies on a regular basis. As opportunities arise, some or all of the communities and agencies will enter agreements to cooperate on specific projects.

#### 5.4.2. Education for Land Use Decision Makers/Staff

The SWAG representatives will identify educational opportunities for decision makers and staff to become better acquainted with issues related to watershed management. For instance, the Michigan Municipal League, Michigan Townships Association, Michigan Planning Society, Southeast Michigan Council of Governments, Huron River Watershed Council and Michigan Environmental Council periodically offer seminars, workshops and roundtables to educate decision makers on the environment and on policy and funding alternatives.

Decision makers and staff will be specifically invited to attend training opportunities offered to the public, such as lawn maintenance and septic system maintenance workshops.

#### 5.4.3. Implement Municipal Employee Training Programs

The more urbanized partners employ public works employees who often work with heavy equipment to maintain streets, sewers and similar facilities. These partners often maintain their own fleets of vehicles as well. Many will adapt training materials developed by the City of Troy to conduct onsite training programs on housekeeping issues related to our watershed goals.

Even the more rural partners can avail themselves of training programs developed by Wayne County and others to educate employees about illicit discharge detection and elimination.

Partners may also encourage employees to seek certification in the commercial application of pesticides through the Michigan Department of Agriculture.

#### 5.4.4. Utilize RETAP and other resources to identify improvements to Municipal Housekeeping Practices

Retired professionals are available through the Retired Engineer Technical Assistance Program (RETAP) to assist local governments and institutions with pollution prevention. The program provides a team of retired professional engineers and scientists (many with 30 to 40 years of experience in industry) to review operations for potential waste reduction strategies and opportunities; including source reduction, reuse, recycling, and energy efficiency.

The program is provided without charge, and has been reported to save its participants money, as well as reduce pollution prevention. The program is administered through the Michigan Department of Environmental Quality. Contact information is available on the website at <http://www.mich.gov/deq>

#### 5.4.5. Identify and Eliminate Illicit Discharges

Illicit discharge detection and elimination includes activities that lead to the prevention, detection and removal of any physical connections to the storm water management system that contribute materials other than storm water to the groundwater or waterways. It also includes measures to detect, correct, and enforce against illegal dumping of materials into streets, storm drains and waterways. Finally, it includes

spill prevention, containment, cleanup and disposal techniques designed to prevent or reduce the discharge of spilled materials into stormwater systems.

Wayne County has developed formal training programs for field crews on how to identify illicit discharges and locate the source of illicit discharges. Other agencies have developed similar programs based on this model. Subwatershed partners will provide training opportunities for the appropriate field staff.

Each community has submitted an illicit discharge detection and elimination plan in conjunction with their NPDES Phase II permit coverage, which outlines other specific actions associated with this BMP.

#### 5.4.6. Street Sweeping & Catch Basin Cleaning

When performed regularly, street sweeping removes much of the street pollutants, including excess fertilizer, which can potentially enter surface waters through runoff. Street sweeping can also make road surfaces less slippery during light rains, improve aesthetics by removing litter and control pollutants which can be captured by the equipment. Street sweeping involves the use of specialized equipment to remove litter, loose gravel, soil, pet waste, vehicle debris and pollutants, dust and industrial debris from road surfaces. Street sweeping equipment consists of mechanical brooms, vacuum sweepers or a combination of both.

Each of the partners with street systems (Cities, Villages and Oakland County), own and operate street sweeping equipment, and have routine programs for street sweeping.

#### 5.4.7. Perform Storm Sewer System Maintenance and Drain Cleaning

Often, especially in low flow conditions, sediments enter storm water systems and are deposited in sumps and the bottoms of pipes. Cleaning drainage systems helps remove pollutants that have settled out of the sewers before a storm event flushes them through the system and into the waterways. Cleaning drainage systems also maintains the ability to convey design flows, and limit potential for upstream flooding. The removal of deposited materials can be accomplished with vacuums, jetters, and scrapers. Materials released during the cleaning process must be captured and removed from the system before discharge to the waterways.

In the case of open drains, sediments can accumulate and reduce the hydraulic carrying capacity of the channel. Regular cleaning of open drains retains the design capacity, thus limiting flow velocities, reducing potential for re-suspension of sediments and minimizing the potential for erosive impacts on streambeds and streambanks.

#### 5.4.8. Detention Basin Maintenance Programs

To be continually effective, detention basins must be maintained in a manner to preserve their design volume and outlet control function. This includes removing sediment from sediment forebays and basins on a periodic basis, checking the outlet structures to ensure that orifices are present and clear of obstructions, and cleaning oil accumulations.

Subwatershed partners will include periodic maintenance of their detention facilities in their annual budgets and workplans.

#### 5.4.9. Maintain Sanitary Sewer Infrastructure

Sanitary sewer infrastructure consists of the sewers, force mains, pump stations and manholes that convey household, commercial and industrial wastes to the wastewater treatment facility. Regular maintenance includes inspections of the piping to locate partial blockages before they backup water into basements or onto the surface, to locate pipe failures which could cause illicit discharges, and to locate cross connections between sanitary and storm systems. Maintenance personnel can perform inspections by actually walking the sewer routes or using a video camera to inspect pipe interiors to document conditions.

#### 5.4.10. Identify and Eliminate Failing Onsite Sewage Disposal Systems (OSDS's)

The Oakland County Health Division and MDEQ are responsible for the permitting of onsite sewage disposal systems (OSDS), but do not have a mechanism for to ensure the ongoing maintenance of the system. Currently, most communities with properties served by OSDS rely on citizen complaints and homeowner action to identify defects and failures. Once a failure is identified, the appropriate agency works with the property owner to affect the repair or abandon the system and connect to municipal sewer if available.

The subwatershed partners will take action to ensure that their own systems (those at township and city halls, fire stations, parks, etc.) are periodically inspected and repaired as needed, under permit from the appropriate agency.

Field staff will also be trained to identify signs of failing or distressed systems and report any findings to the Oakland County Health Division for further investigation and action.

Subwatershed partners will also consider ordinances as described elsewhere in this chapter for point-of-sale or periodic inspections and/or certifications of existing systems serving private properties.

#### 5.4.11. Manage Lagoon Systems & Package Wastewater Treatment Systems

Lagoon systems and package wastewater treatment plants have been used to provide wastewater treatment in many areas of the subwatershed. Such systems are used when conventional septic tank/tile field systems have failed, and where there are not viable alternatives for serving multiple homesites or commercial facilities.

When operated correctly, lagoon systems and package wastewater treatment plants can provide adequate protection to the waterways. However, over an extended period of time, these systems are often poorly maintained and operated, resulting in deteriorating discharge quality. Once permitted, there is little operational oversight by local, county or state agencies unless a complaint is received or the operator steps forward to request repair or modification.

Local government can assist in ensuring proper operations and maintenance of such systems by requiring appropriate agreements or establishment of special assessment districts to provide for responsible management oversight (physical and fiscal). For instance, both Highland Township and Milford Township have developed standard agreements requiring the establishment of escrow accounts for maintenance and replacement of systems.

#### 5.4.12. Manage Public Facilities

Responsible management of public facilities such as Township and City Halls, fire stations, DPW garages, parks and cemeteries include consideration of lawn management practices, parking lot and storm system management practices, as well as fleet maintenance, chemical storage and application programs.

Subwatershed partners will work to improve “housekeeping practices” at their facilities such as:

- Eliminating direct discharge of downspouts to the storm sewer or waterways
- Develop a fertilizer, herbicide and pesticide management plan for public grounds and make sure that usage is minimized to the lowest possible, yet effective, amount
- Check public buildings to eliminate illicit discharges and provide for a safe and effective means of sewage disposal
- Establish bioretention basins to minimize storm water volume impacts as appropriate

#### 5.4.13. Reduce Fertilizer, Pesticide and Herbicide Usage

Nitrogen, phosphorus, potassium, and other nutrients are necessary to maintain optimum growth of most vegetation. Fertilizer management addresses the proper selection, use, application, storage and disposal of fertilizers. Nutrients that are applied beyond what plants require are often flushed from the soils and enter lakes, streams, and wetlands with stormwater runoff. Excess nutrients can leach into the groundwater, or can cause algae blooms and excessive aquatic plant growth. Proper fertilizer management will minimize the potential for pollution of surface and ground waters.

Pesticides and herbicides must also be managed to minimize undesired impacts on the local ecology. The applicator should be especially trained to select the products providing the proper balance of effectiveness and environmental and health safety.

Subwatershed partners will implement these practices on public owned land, and encourage landowners to implement these practices on privately owned land.

#### 5.4.14. Manage Riparian Corridors

Sheet or overland runoff can carry large amounts of contaminants into streams and directly into the bay during wet weather events. Proper maintenance of areas adjacent to riparian corridors that are left in their natural state or are established as buffer strips provide a filtering mechanism that removes suspended

materials contained in the runoff. Buffer strips are generally located adjacent to agricultural operations to reduce contamination by manure, sediment, and chemicals used for crop production. Buffer strips are also used in urban settings.

Subwatershed partners will retain natural buffer areas on their properties adjacent to rivers and waterways, and will work to incorporate buffer strip requirements in ordinances and regulations for site development.

## 5.5 Structural Improvements

Each of the partner communities and organizations can provide leadership for its residents and the public by undertaking appropriate and effective structural improvements for existing and planned public facilities. This includes improvements to existing stormwater management and soil erosion/sedimentation measures to improve water quality and control flooding and erosion.

The subwatershed partners will review site operations at existing facilities to identify opportunities for structural improvements. Each of the items described refer to management of facilities under the direct jurisdiction of the community or agency, and not management of private property. Similar practices in the private sector will be encouraged through other BMP's identified in the plan.

### 5.5.1. Construct/Maintain Storm Water Storage Facilities

Stormwater storage facilities are ponds, basins or tanks designed to manage flow sufficiently to prevent downstream flooding and/or reduce erosive velocities in the receiving stream. They are typically required in all new stormwater systems through ordinances and design regulations. It is possible, although often difficult, to retrofit storage facilities for existing stormwater systems.

Detention facilities can be designed to provide treatment, accumulate sediments, and attenuate flow from rainfall events. Systems vary from large, wet, extended ponds and basins which appear much like manmade lakes and handle runoff for large tributary areas, to small, typically dry depressions in lawn areas to handle runoff from a single site. Properly designed, a detention facility can provide an attractive amenity for a site, as well as manage the quantity and quality of the outflow. Another alternative is underground tanks and infiltration systems, which are often installed under parking areas to avoid consuming the land area required for ponds and basins.

Subwatershed partners will review their facilities to determine whether storm water storage systems are needed to provide water quality or quantity management. In addition, storm water storage facilities will be provided for new site construction undertaken by the partners. The partners will also review ordinances and design regulations to determine that adequate systems are required of private developers.

#### 5.5.2. Install/Maintain Sediment Control Devices

Sediment control devices, such as filters, basins, buffer strips and other devices are designed to remove sediment from runoff. Sediment basins are generally used at the downstream end of large drainage areas. Dikes, temporary channels, and pipes should be used to divert runoff from disturbed areas into the basin, and runoff from undisturbed areas around the basin. Simpler devices are used for smaller areas. These include sediment traps, sand bag barriers, silt fences, and straw bales.

Sediment control devices can be used on storm drain inlets and can include filter fabric, excavated drop traps, gravel filters, and sandbags. Maintenance is a key requirement. Sediment traps, barriers, basins and filters should be routinely inspected after every storm event to determine if repairs are needed or sediment should be removed.

#### 5.5.3. Implement Streambank Stabilization Measures

Streambank stabilization measures work by either reducing the force of flowing water and/or by increasing the resistance of the bank to erosion. Three types of streambank stabilization methods exist. They include: engineered methods, bioengineered methods and biotechnical methods. Engineered structures include riprap, gabions, deflectors and revetments. Bioengineering refers to the use of live plants that are embedded and arranged in the ground where they serve as soil reinforcement, hydraulic drains, and barriers to the earth movement and/or hydraulic pumps. Examples of bioengineering techniques include: live stakes, live fascines, brush mattresses, live cribwall and branch packing. Biotechnical measures include the integrated use of plants and inert structural components to stabilize channel slopes, prevent erosion and provide a natural appearance. Examples of biotechnical include: joint plantings, vegetated gabion mattresses, vegetated cellular grids and reinforced grass systems. Whenever possible, bioengineered or biotechnical methods should be implemented in lieu of engineered methods.

#### 5.5.4. Prevent & Remove Flow Obstructions

Flooding and erosion problems can sometimes be attributed to blockages of debris, sediment and tree branches that have fallen into the river. When cleanup is required, it is important to use practices that minimize disruptions to the habitat. Stream cleanup should always be considered before any drastic measures such as clearing and snagging, channelization or other severe modifications are taken. Discussion with the MDEQ/MDNR is necessary prior to any action. Both communities and individuals should be encouraged to get involved with the process of monitoring and maintaining stream flow conditions, checking for obstructions that are hindering the flow of the river and causing upstream ponding problems and removing smaller obstructions before they become a major problem.

## Community Action Plans

Table 8 summarizes each partner's commitment to implementing the various best management practices within its jurisdiction. The table includes a discussion of anticipated costs and a qualitative discussion of anticipated benefits to the watershed.

The key for the table may be interpreted as follows:

C = current practice, which the partner intends to continue

ST = short term commitment, which the partner intends to implement during the initial permit cycle (by May 1, 2008)

LT = long term commitment, which the partner intends to implement, but not necessarily during the initial permit cycle

W = Wish List item. These items meet one or more of the following criteria:

- Go beyond the scope of stormwater controls
- Are not yet technologically feasible
- Cannot be implemented given existing resources (financial or politically infeasible)

N/A = Not applicable, because it is either outside the partner's jurisdiction/authority to implement, or it doesn't apply to the jurisdiction. As an example, if no golf courses exist in a community, then the BMP to promote Golf Course Nutrient Management is not appropriate.

\*\* = Special notations apply to a few classes of BMP's for specific partners. For instance, the Oakland County Drain Commissioner's Office is the enforcement agent for SESC in many communities. Rather than marking these BMP's as N/A, this special notation was used for just those communities/partners that are *not* Local Enforcement Agents (LEA's)



Table 8. Community Action Matrix (11 x 17)

Table 8. Community Action Matrix (cont). (11 x 17)

Table 8. Community Action Matrix (cont). (11 x 17)

Table 8. Community Action Matrix (cont). (11 x 17)

Table 8 Community Action Matrix (cont.) (11 x 17)

Table 8 Community Action Matrix (cont.) (11 x 17)

Table 8 Community Action Matrix (cont.) (11 x 17)

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## CHAPTER 6. —EDUCATE AND INFORM THE PUBLIC

Whereas each subwatershed partner has identified a variety of best management practices to implement that best meets their constituents needs and their agencies capabilities, the Subwatershed Advisory Group (SWAG) recognizes that the action items related to public education and stewardship opportunities afford the partners a significant opportunity for effective collaboration. Therefore, it seems relevant to better document the planning for public education in the watershed management plan.

Through a series of meetings and discussions held in 2004, each community developed coordinated public education plans to inform the public about their role in protecting water quality and preventing stormwater pollution in their community. The Public Education Plan (PEP) is a requirement of the NPDES Phase II stormwater permit and outlines public education goals and messages that must be communicated under the Phase II regulations. The PEP also describes the existing and future efforts the communities will undertake to achieve these goals and how the efforts will be evaluated.

The purpose of this chapter is to summarize the coordinated effort of educating the public in the Kent Lake Watershed. This chapter identifies the key partners in the education plan process including all responsible stakeholders, individuals, and organizations. The rest of the chapter outlines the required plan elements, an evaluation plan, and implementation schedule.

### 6.1 Stakeholders

Development of a Public Education Plan is one of the requirements of the National Pollutant Discharge Elimination System (NPDES) Phase II program. The key stakeholders responsible for public education efforts for the Kent Lake Watershed include:

Oakland County	Commerce Township
Highland Township	Lyon Township
Milford Township	Springfield Township
Waterford Township	West Bloomfield Township
White Lake Township	Village of Milford
Village of Wolverine Lake	City of Novi
City of Orchard Lake Village	City of Walled Lake
City of Wixom	Huron Valley School District

#### *Other Involved Organizations*

In implementing their Public Education Plans, the involved Phase II permit holders will pursue cooperative partnerships and information and resource sharing with various organizations including but not limited to:

- SEMCOG
  - Ours to Protect campaign materials, mass media, public service announcements, displays, survey
- Oakland County Planning and Economic Development Services

- Riparian brochure, presentations
- Oakland County Drain Commission
  - Signage, hotline, display
- Huron River Watershed Council
  - Calendar, ads, Adopt-A-Waterway, River Day
- Michigan State University Extension-Oakland County
  - Workshops
- Michigan Department of Environmental Quality
  - Pollution prevention programs
- Huron Clinton Metropolitan Authority
  - Kensington MetroPark activities and events

## 6.2 Messages and Target Audience

The Public Education Plans required by the Phase II Permit list the key educational messages and target audiences as outlined in the Phase II Permit language. The following is a summary of the key education elements that are addressed in each of the public education plans. Each of the required plan topics includes a description of the overall target audiences, key messages, and a listing of both existing and future education efforts.

### 1) Watershed Stewardship

Education of the public about their responsibility and stewardship in their watershed.

### 2) Storm Drainage Systems and Waterways

Education of the public on the location of residential separate stormwater collection system catch basins, the waters of the state where the system discharges, and potential impacts from pollutants from the separate stormwater drainage system.

### 3) Reporting of Illicit Discharges

Encouragement of public reporting of the presence of illicit discharges or improper disposal of materials into the applicant's separate stormwater drainage system.

### 4) Common Home and Yard Stormwater Pollutants

Education of the public on the need to minimize the amount of residential, or non-commercial wastes washed into nearby catch basins.

5) Waste Disposal

Education of the public on the availability, location, and requirements of facilities for disposal or drop-off of household hazardous wastes, travel trailer sanitary wastes, chemicals, yard wastes, and motor vehicle fluids.

6) Riparian Land Management

Education of the public concerning management of riparian lands to protect water quality.

Target audiences for these key messages may include but are not limited to:

Residents, businesses, industries, municipal employees, construction contractors, developers, and visitors (e.g. to municipal offices).

### 6.3 Overall Evaluation Plan

In addition to evaluating individual activities, each permit holder's overall public outreach program will be evaluated. The Southeast Michigan Partners for Clean Water performed a regional water resource survey of the residents of Southeast Michigan in the summer and fall of 2004. Additionally, Oakland County Drain Commission paid to have the survey statistically significant for the Kent Lake Watershed. This survey information provides a baseline to gauge the overall effectiveness of the Phase II education efforts. Effectiveness will also be gauged through follow-up activities such as subsequent surveys, web site and phone tracking, and discussions with the various target audiences.

Table 9. Findings and Implications for Southeast Michigan Partners for Clean Water Survey

Findings	Implications
Overall, results similar across the region (same issues, similar level of education).	Shows need for consistent, coordinated messages.
Residents are using the resource	
Making some of the connection, but not all (don't know where storm drains lead to)	Focus needs to be to close the gap on making the connection on storm drain awareness.
Composting yard waste has been successful, few people are maintaining cars at home, and very few are using low-phosphorus fertilizer	Possibly focus energy on where get most bang for buck (few people are doing car maintenance...focus on fertilizer).
People are willing to make adjustments to daily habits	Education can work because people are willing to make adjustments for both "easy" and "hard" actions.
Top communication methods: community newspaper, major newspaper, TV, municipal newsletter	Ensure these distribution channels are used with consistent, coordinated messages

### 6.3.1. Major Survey Findings for the Kent Lake Watershed

The Regional Public Education survey was undertaken the summer of 2004. Following are results specific to the Kent Lake Watershed.

#### **Perceptions and Value of Water Resources**

Residents were asked to rate the quality of water in lakes, rivers, and streams in the community where they live. Twenty percent (20%) of those surveyed thought water quality was improving ("somewhat better" or "much better"). Thirty-seven percent (37%) reported that they thought water quality was getting worse ("somewhat worse" or "much worse").

Seventy-three percent of those surveyed thought the way they cared for their lawn and home affects the quality of water in lakes and streams in the community where they live; 19% did not, and 8% indicated that they "didn't know."

Forty-five percent of those surveyed indicated that their household had taken some type of action to protect water resources in the past two years; 46% had not, and 9% indicated that they "didn't know" if they had done anything that would have helped protect water resources.

### **Connection of Stormwater Runoff and Water Resources**

Forty-five percent of those surveyed thought stormwater runoff was the greatest contributor of pollution to lakes, rivers and streams. Sewage overflows were second (26%). Industrial discharges (24%) were next, followed by wastewater treatment plant discharges (5%).

Forty-eight percent thought stormwater goes directly to lakes/streams without treatment; Thirty-six percent of those surveyed indicated that they “didn’t know” where stormwater goes after it enters a storm drain or roadside ditch. 9% thought it goes to a treatment plant, and 6% thought it goes to lakes/streams with treatment.

### **Current Activities**

Twenty percent (20%) of those surveyed indicated that they typically wash their vehicles at home in the driveway. Most (84%) of those surveyed indicated that they use a car wash.

Nineteen percent (19%) of those surveyed indicated that members of their household usually change motor oil, transmission fluid or radiator fluid for a vehicle at their home.

Seventy-one percent (71%) of those surveyed indicated that their household uses a community collection site to dispose of household hazardous waste, such as old oil, fluids from vehicles, batteries, and pesticides; 15% of those surveyed indicated that their household typically disposes of household hazardous wastes with their regular trash.

Over half (65%) of those surveyed who were not using a community collection site for household hazardous waste indicated that the reason they did not use a community collection site was because they did not know where one was located.

Thirty-one percent (31%) indicated they use fertilizer on their lawn at least once a year. Thirty-five percent (35%) of those surveyed indicated that their household uses fertilizers on their lawn seldom or never.

## **6.4 Action Strategy**

The implementation strategies for Phase II public education activities for each community in the Kent Lake Watershed will be noted in the individual Public Education Plans. As appropriate, the communities in the Kent Lake Watershed will coordinate their education efforts through shared resources. Listed below are examples of materials and activities that many communities may include in their Public Education Plans:

- Southeast Michigan Partners for Clean Water Informational Materials
- Southeast Michigan Partners for Clean Water Mass Media Efforts
- Articles in Municipal Newsletters
- Web Site Information

- Cable Access/Community billboard
- Kensington MetroPark Activities
- Water Quality Displays
- Water Resource Protection Workshops
- Water Resource Protection Presentations
- River Day Activities
- Adopt-A-Stream Program
- Watershed/Stream Crossing Signage
- Watershed Calendar
- MDEQ Pollution Prevention Programs
- Storm Drain Labeling
- Oakland County Drain Commission Water Pollution Hotline
- Household Hazardous Waste Collection Day/Site
- Yard Waste Collection Program
- Recycling Program
- Riparian Land Management Brochure
- Managing Shoreline Property Booklet

Table 10. Public Education Plan Requirements Met by Activity

	Watershed Stewardship	Storm Drainage	Reporting of Illicit Discharge	Common Home & Yard Stormwater Pollutants	Waste Disposal	Riparian Land Management	
Activity	PEP Requirement						Contact
Southeast Michigan Partners for Clean Water Informational Materials	X	X	X	X	X	X	Amy Mangus, SEMCOG
Southeast Michigan Partners for Clean Water Mass Media Efforts	X	X	X	X	X	X	Amy Mangus, SEMCOG
Articles in Municipal Newsletter	X	X	X	X	X	X	Amy Mangus, SEMCOG
Web Site Information	X	X	X	X	X	X	Amy Mangus, SEMCOG
Cable Access/Community Billboard	X	X	X	X	X	X	Amy Mangus, SEMCOG
Kensington MetroPark Activities	X	X		X		X	
Water Quality Display	X	X	X	X	X	X	Amy Mangus, SEMCOG
Water Resource Protection Workshops	X	X	X	X	X	X	Matt Dykstra, MSU Extension
Water Resource Protection Presentations	X	X	X	X	X	X	Nina Ignaczak, OCPEDS
River Day Activities	X	X				X	
Adopt-A-Stream Program	X	X				X	Joan Martin, HRWC

Table 10 (cont.) Public Education Plan Requirements Met by Activity

	Watershed Stewardship	Storm Drainage	Reporting of Illicit Discharge	Common Home & Yard Stormwater Pollutants	Waste Disposal	Riparian Land Management	
Activity	PEP Requirement						Contact
Signage at Road/Stream Crossings or Entering the Watershed	X						Lynne Yustick, Macomb County
Community Watershed Calendar	X	X	X	X	X	X	Jennifer Wolf, HRWC
Promote MDEQ's Pollution Prevention Programs	X	X	X	X	X	X	Tricia Huddas, MDEQ
Chamber of Commerce	X	X	X	X	X	X	
Storm drain labeling		X	X				
Promote Oakland County Drain Commission's (OCDC) Water Pollution Hotline			X				Karen Tauriainen, OCDC
Household Hazardous Waste Collection Day/Site					X		
Riparian Land Management Brochure						X	Nina Ignaczak, OCPEDS
Yard Waste Collection and Recycling Program					X		

### 6.5 Implementation Strategy

The implementation strategies for the public education activities for each community in the Kent Lake Watershed will be noted in the individual communities' Public Education Plans.



## CHAPTER 7. METHODS OF EVALUATING PROGRESS

Any effective plan is a living document, subject to change in response to new information or changing conditions in the watershed. Especially given the limited financial, staff and volunteer resources available to the subwatershed partners, it is essential to develop a means to evaluate whether our investments of time and energy are yielding results.

Much of our hope for a sustainable, healthy watershed lies in changing public perceptions and modifying human behavior. Except in light of a perceived crisis, these changes occur gradually over time, and may not be immediately manifested in terms of measurable improvements in water quality. The evaluation program will therefore include some measurement of effort, not only measurement of results.

To provide a means of gauging public awareness of and sensitivity to watershed issues, as well as the “willingness to change”, SEMCOG conducted a Regional Water Quality Survey in the summer of 2004. The survey was designed to provide a benchmark to determine the effectiveness of public outreach campaigns. It consisted of a four-page survey and cover letter mailed to 10,800 households in the SEMCOG planning area and an additional 1200 households located outside the planning area. All households that received the survey were later contacted by phone. 3720 surveys were completed. Results have been compiled on a watershed basis. The study will presumably be updated in the future.

Each community will monitor its own progress in meeting the obligations of its Stormwater Pollution Prevention Initiatives (SWPPI). This will likely be “task-based” evaluation.

The Subwatershed Advisory Group (SWAG) will periodically take up the question of whether we are making satisfactory progress as a group, based in part on the individual partner’s annual reports. The SWAG is responsible for updating the watershed management plan every two years. Additional evaluation methods will be needed to determine if we are meeting our goals and objectives. This will include a review of which best management practices have been adopted, and how well they have been received by the decision makers and public. It will also include an assessment of which best management practices were not implemented, and what obstacles or barriers must be eliminated for future progress.

The following describes the evaluation methods the SWAG will utilize for each of the goals and objectives identified in the Watershed Management Plan. Please note that the SWAG did not identify measurable goals for any of the short-term objectives at this time, since each of these objectives is related to public awareness and individual behavior changes. The “measureables” are intended to document progress and effort.

***Goal # 1: Promote and maximize community assets and recreational opportunities related to water resources.***

*Objective # 1-1: Provide information to the public on access to the water resources and riparian lands in the watershed, and available uses and recreational opportunities.*

*Objective # 1-2: Improve and maintain fisheries and wildlife habitat.*

*Objective # 1-3: Pursue harmonious economic development approaches through intentional connection with the natural environment.*

For this goal and these objectives, each partner will track the number of pamphlets, newsletters, tip cards or other materials with messages highlighting water resources and recreational opportunities.

The Subwatershed Advisory Group will monitor annual reports from the Adopt-a-Stream program, and observations from the annual Lake Management Plan for Wolverine Lake or other lakes relative to fish and wildlife populations.

The City of Wixom and Milford Township have indicated a willingness to collect and analyze water samples in the watershed for water quality parameters such as phosphorus, nitrogen, dissolved oxygen, temperature, turbidity, etc.

Partners will document economic development activities associated with the natural environment through photographic evidence of projects along waterways, as well as statistics similar to the Main Street Oakland County parameters.

**Goal # 2: Enhance and improve protection of open space, greenways, and natural features.**

*Objective # 2-1: Coordinate planning approaches with neighboring communities using a systems approach to protection of natural features.*

*Objective # 2-2: Identify planning opportunities for protection of open space, greenways, and natural features and investigate the implementation of tools appropriate to each community.*

*Objective # 2-3: Develop and maintain a working relationship with a local land conservancy, if applicable.*

Each of the watershed partners will review their comprehensive master plans and recreation plans on a bi-annual basis to determine whether the land use policies incorporated therein are consistent with the goals and objectives of providing and protecting open space, greenways and other natural features.

As plans are revised and updated, neighboring communities will be provided opportunities for comment, consistent with state law. In addition, Oakland County Planning and Economic Development Services provides services in facilitating review and coordination of plans.

Oakland County Planning and Economic Development Services will provide assistance in mapping and monitoring changes in greenway and open space preservation through their Environmental Stewardship initiatives. The Environmental Stewardship staff provides assistance to communities in developing a conservation vision and identifying opportunities for preservation or rehabilitation. Their staff provides natural resources mapping through a Geographic Information Services system for all of Oakland County.

The partner communities and agencies will also obtain annual reports from the local land conservancies documenting their activities within the watershed.

**Goal # 3: Reduce water quality degradation and address the Kent Lake TMDL (Total Maximum Daily Load).**

*Objective # 3-1: Investigate sources of water quality degradation, including bacterial and nutrient loading, erosion, and sedimentation.*

*Objective # 3-2: Develop and evaluate methods for source reduction.*

Objective # 3-3: Promote public awareness of the effects of pollutants such as trash, litter, and fertilizer on the water quality and aesthetic conditions.

Partners will monitor the number and nature of complaints and enforcement actions related to onsite sewage disposal systems and related to soil erosion and sedimentation control permits and construction activities.

Partners will also complete the record keeping and reporting requirements associated with the illicit discharge detection and elimination plans.

The Subwatershed Advisory Group will monitor development of improved storm water management standards by partner communities, which will be shared at periodic meetings. Meeting minutes will be used to document those meetings.

Partners will track the number of news releases, newsletters, cable television airings and other distributions of messages related to trash, litter, animal waste management, lawn care and other issues related to preserving and protecting water quality.

#### **Goal # 4: Educate, engage, and empower the public to protect water resources.**

Objective # 4-1: Faithfully implement Public Education Plans (PEP).

Objective # 4-2: Identify, promote, and encourage participation in educational opportunities targeting land-use decision-makers in their role in protecting water resources.

Objective # 4-3: Promote participatory experiences to foster a personal connection and sense of responsibility between the public and local lakes, rivers, streams, and wetlands.

The public education plans each include methods for measuring progress towards completion of various tasks. The Subwatershed Advisory Group will review partner reports bi-annually to assess whether communities comply with their plans.

Each partner will collect documentation of participation in formal training programs, watershed meetings, and similar events by their decision makers and key staff.

Each partner will provide documentation of meetings that include discussions of watershed issues and the Citizen Planner program. This would include Board of Trustees, Village or City Council, Planning Commissions, Environmental Review Boards, etc.

Partners will provide documentation of purchase of watershed educational materials.

Partners will track attendance at stewardship and awareness events associated with lakes, rivers, streams and wetlands.

**Goal # 5: Improve management of stormwater and watershed hydrology.**

Objective # 5-1: Consider the function of natural hydrologic systems through coordinating stormwater management with neighboring communities when appropriate.

Objective # 5-2: Identify watershed-wide and community-scale planning, design, and engineering alternatives to manage stormwater, protect wetlands, floodplains, and other natural features that protect water quality and quantity, and incorporate those alternatives where appropriate.

Objective # 5-3: Develop and maintain a working relationship with the Huron River Watershed Council.

The Subwatershed Advisory Group will monitor development of improved storm water management standards by partner communities, which will be shared at periodic meetings. Meeting minutes will be used to document those meetings.

Partners will document projects that include collaborative efforts to address watershed or local stormwater management issues through meeting minutes, photographic records, and written project summaries.

**Goal # 6: Develop resources to address the concerns, goals, and objectives outlined in the subwatershed management plan.**

Objective # 6-1: Continue regular operation of the Kent Lake Subwatershed Advisory Group and incorporate additional stakeholder interests as appropriate to share resources.

Objective # 6-2: Form a subcommittee to investigate potential funding options/sources and opportunities to leverage resources for addressing watershed concerns, goals, and objectives.

Meeting minutes will document attendance at Subwatershed Advisory Group meetings and the topics of discussion.

The Subwatershed Advisory Group will utilize the findings of the evaluation progress, as well as feedback from the Michigan Department of Environmental Quality staff, to either revise the Watershed Management Plan or to prepare a finding that no such revision is needed.

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