7. Watershed Protection

Introduction

Achieving the goals and objectives presented in Chapter 6 requires many different tools. Primary tools focus on the protection and restoration of aquatic resources and include:

- Watershed Planning, Institutionalization, and Implementation;
- Public Education and Participation;
- Ordinances, Zoning, and Development Standards;
- Good Housekeeping and Pollution Prevention; and
- Stormwater Best Management Practices.

Additional tools necessary to meet the goals and objectives include:

- Natural Features and Resources Management; and
- Recreation Promotion and Enhancement.

Also, watershed protection requires monitoring of implementation and results to determine program effectiveness and guide changes to the plan. All of these aforementioned tools are discussed in the following sections.

Quotable Quotation

"Water is the most critical resource issue of our lifetime and our children's lifetime. The health of our waters is the principal measure of how we live on the land."

--Luna Leopold

SEMCOG Three-tiered Planning Approach

Tier I – those activities which can best be accomplished by local governments or other organizations.

Tier II – those activities which require groups of communities and agencies working together.

Tier III – those activities which require various subwatershed groups working together, including:

- Making subwatershed plans consistent;
- Coordinating and sharing information;
- Advising on funds distribution;
- Dispute resolution; and
- New mechanisms to address unresolved issues.

Source: SEMCOG, 1999.

Some of the action items in Chapter 8 can be classified as Tier I, but the development of this plan and most action items can be classified as Tier II.

Watershed Planning, Institutionalization, and Implementation

Watershed planning is a comprehensive tool that examines the characteristics of a watershed including its geology, hydrology, land use, development, demographics and water quality. This data is typically broken down into smaller subwatershed units for effective and efficient planning and actions. A watershed plan may include:

- Identification of problems, including a prediction of how water resources will react to future land use changes;
- Public input on desired uses within the watershed, including such topics as natural feature preservation and recreational opportunities enhancement;
- Goals and objectives, including meeting the designated and desired uses in the watershed;
- A plan to reduce or abate current and future problems;
- An action plan to select combinations of watershed protection tools for subwatersheds;
- Identification of the implementation and funding agents; and
- The framework for sustainable watershed management, including plan revision procedures (which rely on water quality monitoring)

Effectively implementing a plan requires a mechanism by which its actions are institutionalized and considered by all of the involved entities. This first tool, watershed planning, defines the actions which need to be institutionalized, including: public education and participation; ordinances, zoning, and development standards; good housekeeping and pollution prevention, and stormwater best management practices. Other actions to be defined during the planning process include those related to natural features and those targeting recreation.

The actions defined in a watershed management plan (WMP) need to be closely coordinated with other community programs. This ensures that changes to regulations and rules that impact watershed plan elements are supportive of the goals and objectives of the plan (SEMCOG, 2002).

Because watersheds are generally diverse in nature, and because the communities comprising the watershed have independent regulatory authority, these communities will determine which tools are appropriate

for them (based on current water quality and land development levels) and apply them in ways consistent with their current regulatory structure.

Clinton River Watershed Initiative

The Clinton River Basin Watershed Initiative (CRBWI) is a two-year effort intended to integrate existing Clinton River watershed information and generate easy-to-use tools that will promote coordinated decision-making and action. The goal of the CRWI is to give watershed stakeholders access to the information they need to identify and implement solutions that will improve, restore, and protect the Clinton River watershed. The CRWI will also produce an updated Remedial and Preventative Action Plan (RAP) for the Clinton River Public Advisory Council. The CRB-WI website is http://www.crwc.org/programs/watershedmgmt/crbwi/crbwi.html.

Public Education and Participation

Watershed protection will be most effective when the public understands the environmental challenges and is invested in rectifying them. This understanding and investment ultimately comes through education and participation in meaningful activities. Many programs are available to consider when selecting a method to promote watershed stewardship. The main targets for education and participation include: businesses, municipal employees, and the general public. Some agencies and programs that can provide assistance in this area are discussed below.

Agencies and Programs

Clinton River Watershed Council

The Clinton River Watershed Council (CRWC) is a non-profit organization dedicated to protecting, enhancing and celebrating the Clinton River, its watershed and Lake St. Clair. The council was formed in 1972 as an association of local governments under the authority of the Michigan Local Rivers Management Act of 1964. For more than 30 years, CRWC has served to coordinate the efforts of local governments, businesses, community groups and individuals in improving water quality, promoting innovative watershed management techniques, and celebrating the river as a natural and recreational resource. The CRWC wrote and is implementing the Public Education Plans (PEPs) for most of the communities in the subwatershed The council's website can be found at http://www.crwc.org/.

Southeast Michigan Council of Governments

The Southeast Michigan Council of Governments (SEMCOG) is a regional planning agency in Southeast Michigan. SEMCOG plans in areas that cross jurisdictional boundaries in the Southeast Michigan region that encompasses Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, and Wayne counties. SEMCOG supports local government planning in the areas of transportation, environment, community and economic development, and education. The council's website can be found at http://www.semcog.org/.

SEMCOG, partnering with other organizations through the 'Southeast Michigan Partners for Clean Water' program, conducts municipal training and heads up the 'Our Water. Our Future. Ours to Protect' campaign which includes: the 'Seven Simple Steps to Clean Water' materials, community involvement activities, and informational materials.

Clinton River Basin Watershed Initiative

Important products that will be developed through the CRBWI include:

- A Watershed Information Management System;
- A Clinton River Watershed Model; and
- A Site Evaluation Tool.

Public Education Vehicles

The numerous potential public education messages can be disseminated in myriad ways. Some possibilities include: brochures, door hangers, maps, Websites, newsletters, kiosks, signs, posters, and point-of-sale education.

Important CRWC Programs

Adopt-A-Stream

A volunteer-based program that empowers community members to protect local streams and rivers by monitoring their health. Volunteers are teamed up, assigned sites, given equipment, data sheets and protocols, and sent out to gather information on streamside habitat and macroinvertebrate populations.

River Day / Clinton Clean Up

Days intended for river cleanup, celebration, recreation, and education throughout the entire Clinton River watershed.

Additional Public Education Considerations

Additional considerations include: disseminating materials with municipal services (e.g. recycling bins, building permits), utilizing the Retired Engineer Technical Assistance Program (RETAP), and providing multi-lingual materials to capture the broadest possible audience.

Michigan Turfgrass Environmental Stewardship Program

The mission of the Michigan Turfgrass Environmental Stewardship Program is to advance the environmental stewardship of Michigan's golf industry by increasing the awareness and understanding of environmental issues, ensure regulatory compliance, and recognize stewardship achievements. The program's website is at http://www.mtesp.org/.

Michigan Audubon Society

The mission of Michigan Audubon Society and local chapters is to instill in people an interest, knowledge, and appreciation of birds and other wildlife. The Audubon Society promotes sound conservation methods by helping restore wildlife habitat, helping prevent pollution, preserving outstanding wildlife areas, and educating the public. The society's website is http://www.michiganaudubon.org/.

Michigan Nature Centers

Nature Centers are either privately or locally funded entities that focus on research, recreation, and, education. The State of Michigan has approximately 72 nature centers. The MDEQ lists the nature centers in the state, which can be found at http://www.michigan.gov/deq/ under "Key Topics" → "Environmental Education".

The Groundwater Foundation

The Groundwater Foundation focuses on educating people and communities about the importance of groundwater and how to protect it. The foundation's Groundwater Guardian program assists communities in organizing a team and developing result-oriented activities that focus on education, pollution prevention, public policy, conservation, and best management practices. More information about the Groundwater Foundation can be found at http://www.groundwater.org/.

Southeast Michigan Sustainable Business Forum

The Southeast Michigan Sustainable Business Forum (SMSBF) is a resource for the development and implementation of sustainable business practices. It will promote practices through awareness of global trends, identification of best environmental practices, education and mentoring. The forum's website is available at http://www.smsbf.org/.

The Michigan Department of Environmental Quality

Information on the following programs can be obtained through the MDEQ's website at http://www.michigan.gov/deq/:

- Environmental Education - This section hosts and links to a variety of simple and dynamic information about the environment.
- Surface Water: Nonpoint Source Program (NSP)- The NSP offers grants and technical assistance and develops information and educational materials to help protect and improve Michigan's water.

Michigan Environmental Council

The Michigan Environmental Council (MEC) provides a collective voice for the environment at the local, state and federal levels. Working with member groups and their collective membership of nearly 200,000 residents, MEC is addressing the primary assaults on Michigan's environment; promoting alternatives to urban blight and suburban sprawl; advocating for a sustainable environment and economy; protecting Michigan's water legacy; promoting cleaner energy; and working to diminish environmental impacts on children's health. The MEC website is located at http://www.mecprotects.org/.

Specialized Programs: Youth Education

It is especially important to start educational activities when people are young so as to pave the way for watershed protection to become a societal value. Some sources of environmental curriculum schools are listed below Additional programs are presented in the sidebar.

Clinton River Watershed Council – 'Stream Leaders' Program

The Stream Leaders program is intended to provide students with an educational experience in water quality monitoring, data interpretation, and citizen action, as well as provide general information to local officials concerning water quality. First, students and teachers get in the river and examine the chemical constituents of the river, inventory physical stream-side conditions and land uses that may affect water quality, and sample the aquatic biological communities to evaluate the health of the river. Second, students and teachers analyze their data to locate any possible sources of pollution problems within the river. In the final part of the Stream Leaders, students and teachers identify and complete a civic action project such as collecting and cataloging river, lake and beach debris, restoring degraded habitats, or making community presentations.

Adopt-A-Watershed

Adopt-A-Watershed (AAW) is a non-profit organization that promotes educational enhancement, environmental stewardship, and community development through Place-Based Learning. AAW works with schools, youth education programs, community groups, and environmental organizations, guiding them through 'The 5-Steps to Leadership in Place-Based Learning'. The 5-Step process develops leadership skills and strengthens organizational capacity to envision, create and successfully implement high quality Place-Based Learning. The 5-Step process is a proven model for educational, environmental and community transformation. The website is http://www.adopt-a-watershed.org/.

Center for Global Environmental Education

For over a decade, teachers, students, community leaders, and concerned citizens have come to Center for Global Environmental Education (CGEE) for inspired instruction and outstanding educational resources. CGEE's pioneering work in environmental education is grounded in the tradition of progressive learning that has been a hallmark of Hamline University's Graduate School of Education. The Center's strategic use of technology creates and supports global communities of learners committed to the stewardship of local environments. The center's website can be accessed at: http://cgee.hamline.edu/about_cgee/index.html.

Environmental Protection Agency – Office of Wetlands, Oceans, and Watersheds

This Environmental Protection Agency (EPA) office provides activities, projects, information magazines, and curricula on wetlands, water resources, ecosystems, watersheds, wildlife, and more. Links to educational resources produced by other organizations are also provided. The office's website can be found at http://www.epa.gov/owow/.

Other Youth Education Programs

- Macomb County – offers three programs for teachers
- The Center for Improved Engineering and Science Education
- Freshwater Wetlands Teaching Guide
- Enviroscapes®
- Izaak Walton League – American Wetlands Campaign and Save Our Stream Curriculum
- North American Association for Environmental Education
- USGS Water Resources Outreach Program
- Yahara Watershed Education Network

Earthforce Global Rivers Environmental Education Network

The Global Rivers Environmental Education Network (GREEN) is a national network of schools and communities working together to meet critical water resource challenges through a combination of environmental education and civic action. GREEN builds on national academic standards and teaches elementary, middle and high school-aged youth essential skills including critical thinking, teamwork, problem solving and the application of science to real world problems. Additional information can be found at http://www.earthforce.org/section/ programs/green/.

Michigan Department of Environmental Quality

The Michigan Department of Environmental Quality (MDEQ) has spent $1 million of the Clean Michigan Initiative funds working with the Department of Education to develop and disseminate sound science-based supplementary environmental curriculum materials for use by Michigan educators. The five unit topics include: Air Quality, Ecosystems, Energy and Resources, Individuals' Impact on the Land, and Water Quality.

Additional information (classroom resources, grant opportunities, and speaker request forms) can be found at http://www.michigan.gov/deq/ under "Key Topics" → "Environmental Education".

United States Department of Agriculture

This website features links to wetlands information for middle and high school students. Links to education programs used in different states and programs produced by the EPA are also available. The website can be accessed by visiting http://www.usda.gov/ and selecting "Education and Outreach" from the 'Browse by Subject' menu.

Environmental Protection Options for Local Governments

The MDEQ maintains a web site that hosts the document "Filling the Gaps: Environmental Protection Options for Local Governments". This document helps local governments sift through the maze of protecting the environment from a top down approach: applicable federal laws, applicable state laws, how these apply to various environmental features, and options for local governments authorized by federal and state law to protect the various environmental features.

The site can be accessed by going to http://www.michigan.gov/deq/ then selecting "Water", then "Great Lakes", then "Coastal Management". The document is listed in the "Information" section.

Source: MDEQ, 2006.

Ordinances, Zoning, and Development Standards

Watershed protection requires employing a broad range of environmental protection planning and regulatory options at the local government level. The techniques, designed to minimize negative impacts of land use decision, can be used separately or in most cases together, to establish the amount of protection and effort a community is comfortable with. This effort can range from simply targeting peak flow reduction of stormwater runoff into waterbodies to attempting total watershed protection. The techniques that are selected need to be crafted with professional planning and legal assistance to fit each community and its natural resources.

The remainder of this section presents three levels of planning that need to be considered in watershed protection: 'Coordinated Planning', 'Zoning', and 'Advanced Regulation'. Coordinated Planning and Zoning are the most familiar options, but Advanced Regulation tends to provide the most powerful protection authority. These three levels are discussed in the following subsections, along with some additional considerations.

Coordinated Planning

The first step for a local government to protect its watershed is to prepare a future land use plan in cooperation with neighboring jurisdictions. Future land use plans (also known as Comprehensive Plans or Master Plans) should be based on a comprehensive inventory of natural resources and environmental features. Because the environment knows no jurisdictional boundaries, the most effective plans are developed when communities work together, as this prevents competing or incompatible actions. If one community along a river approves development in a floodplain, downstream communities are likely to be flooded. If one community on a lake adopts keyhole development regulations, but other communities abutting the same lake do not, then achieving the objective of preventing overuse of the surface of the lake is not likely to be achieved. If one community establishes a buffer zone around sensitive environmental areas, but abutting jurisdictions do not, then the benefits of the buffer zone will be limited. These examples demonstrate the importance of communities working cooperatively in the development of plans and the implementation of programs to protect our natural resources.

A future land use plan sets forth the desired pattern of land uses in the community for the next 20 to 30 years. It shows where agricultural and forest land should be retained and where new residences, commercial and industrial areas should be constructed. It creates the basis for planning for new roads, sewers and water infrastructure to meet the needs of the land uses displayed on the map. Future land use can work with nature, or against it. Communities can plan to keep development out of floodplains and population density low along waterbodies. Communities can plan to preserve greenbelts for wildlife and vegetation along waterbodies to help filter stormwater runoff and provide space for trees to shade streams, keeping them cold enough for sportfish like trout. By planning with nature, they can preserve the characteristics of nature that immeasurably add to our quality of life. Following is a list of key strategies that communities can follow in the development of local future land use plans to help protect the environment and natural resources for use and enjoyment by both present and future generations:

- Prepare local future land use plans based on a comprehensive inventory of natural resources;
- Keep density and intensity of land use low near and along watercourses;
- Avoid developing in sensitive areas like floodplains, wetlands, environmental areas, sand dunes and high risk erosion areas;
- Plan for greenbelts and buffers along watercourses;
- Provide for links between natural areas so wildlife have safe corridors to move within;
- Protect renewable natural resources like farm and forest land in large blocks; and
- Set forth the specific zoning and other land use regulations that should be adopted to promote wise natural resource management and environmental protection.

The Development Cycle

The actions under 'Ordinances, Zoning, and Development Standards' cover stormwater issues in the first two phases of the development cycle: land use planning and site design. Some stormwater management BMPs deal with the construction phase, where soil erosion is of primary concern. Many of the actions from the other categories focus on the final phase: home ownership and building occupation.

Wildlife Corridor

Source: RCRCD, 2005.

The future land use plan provides the legal foundation for local land use regulations. If the community wishes to protect natural resources and the environment through local land use regulations, then it must have a basis for these regulations in the future land use plan and then adopt zoning and related regulations consistent with the plan. However, to realize the maximum benefit, communities must coordinate the future land use plan with the planning efforts of adjoining communities.

Zoning

Zoning is the principal local tool for guiding land use change in a community. Zoning classifies land uses into zones or districts generally on the basis of land use intensity ranging from "high" (e.g. industrial) to "low" (e.g. nature preserve) intensity. The range of intensity is based largely on environmental impacts and infrastructure needs of the land use. A zoning map illustrates the location of various zones or districts within a given jurisdiction. Within each zone, a range of land uses are permitted by right, or after some special review and approval process. The zoning ordinance establishes development standards for each mapped district. This includes the uses permitted, building height, bulk, lot size, setback, minimum yard and related standards. If the zoning ordinance has appropriate standards to protect our waterways and minimize harm to them as new development occurs, then not only the present generation, but also future generations will benefit.

More on Zoning

An enforceable zoning ordinance requires that it be based on some type of plan for a given community, such as a land use master plan.

ZONING OPTIONS

Watershed-based Zoning – this is a zoning methodology designed to consider information presented in a watershed management plan (refer to www.stormwatercenter.net for additional information).

Prescriptive Zoning – characterized by segregation of land uses into districts; includes very explicit standards and use exclusions.

Mixed-Use Zoning – exemplified by the juxtaposition of different uses to reduce automobile dependence, preserve green space, and promote a sense of community.

Incentive Zoning – a reward-based system to encourage development that meets established development goals.

Performance Zoning – uses goal-oriented criteria to establish review parameters for proposed development projects in any area of a municipality.

Advanced Regulation

There are many regulatory options communities may consider in protecting the watershed. This section describes three regulatory options that are available to communities to better protect their local lakes and streams. These options are not mutually exclusive nor are they interdependent; communities could adopt some or all of the measures in the first option as well as some or all of the second or third options, or vice versa. Because of this flexibility and the potential complexity, it is important that properly trained planners and attorneys be involved in adapting sample ordinance language to a community's planning and regulatory structure. The options are discussed below:

- The first option is model ordinance language that specifically addresses stormwater management. These models could be adopted as overlay zones in the zoning ordinance, or as a separate ordinance that applies to development in particular locations, in addition to zoning.
- The second option is a series of brief ordinance provisions that address common natural resource and environmental protection concerns associated with stormwater management. These provisions are commonly found in zoning ordinances across the state.
- The third option focuses on coordinating land use permit review and approval procedures between the MDEQ and local zoning authorities. This approach is based on refining the local site plan review procedure (as are some of the techniques in the second option).

Additional measures to consider are presented at the end of this subsection.

Option 1 – Adopt Model Ordinance Language Targeted at Stormwater

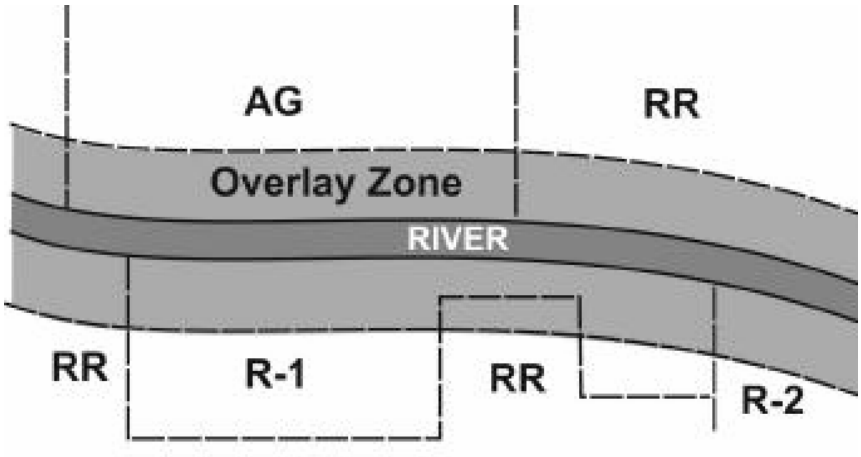
Separate statutory authority exists for local units of government to adopt regulations to protect the following natural resources:

- Wetlands
- Environmental areas (e.g. sand dunes, submerged lands, forests)
- Soil erosion and sedimentation control
- Inland lakes and streams
- Natural rivers
- Floodplains
- High risk erosion areas
- Landmark trees

The Michigan Department of Natural Resources (MDNR) in 1996, prepared model ordinance language to guide local governments in the preparation of ordinance language applicable to each of these natural resources – except for environmental areas. There are many variations of some of these models. All but the soil erosion and sedimentation model ordinance language is structured as an overlay zone.

An example of an overlay zone is illustrated in Figure 7-1. The letter designations in the figure refer to existing zoning types (e.g. AG = agriculture; RR = rural residential).

Figure 7-1. Example of an Overlay Zone.



Source: John Warbach, Planning and Zoning Center, Inc.

In an overlay zone, the special environmental provisions only apply in a limited area which is usually depicted on a map. For example, the floodplain regulations only apply to the area defined as a floodplain. This is usually an area that may be inundated by a flood with an average frequency of being equaled or exceeded once each 100 years.

Macomb County Model Ordinances

The Macomb County Department of Planning and Economic Development (MCPED) has developed a number of model ordinances for use by local communities. The currently available model ordinances are:

- Storm Water Management
- Floodplain Management
- Wetlands Ordinance
- Overlay District
- Natural Feature Setback
- Native Vegetation
- Woodlands and Trees

Due to the initial success of this program, the MCPED is working with Southeast Michigan Council of Governments to further explore the implementation and application of the more pertinent ordinances.

The ordinances are available on-line at:

http://macombcountymi.gov/planning/index.html

Source: MCPED, 2005.

Macomb County Stormwater Standards

The Macomb County Public Works Office (MCPWO) is in the process of updating its design standards manual for the control of post-construction runoff from new development and significant redevelopment. The design standards are expected to be adopted in 2007.

Storm Water Center Model Ordinances

The Storm Water Center (www.stormwatercenter.net) has numerous model and example ordinances and other zoning and regulatory devices on the following subjects:

- Post-Construction Stormwater Management;
- Stream Buffers;
- Illicit Discharge and Elimination Program;
- Erosion and Sediment Control;
- Open Space Design;
- Operations and Maintenance for Stormwater Practices; and
- Groundwater Protection.

Source: SWC, 2006.

Model ordinance language can be incorporated into a separate section or article of the local zoning ordinance or adopted as an independent police power ordinance. Cities, villages, townships, and, to a lesser extent, counties in Michigan have authority to adopt police power regulations. The public purpose of the regulation must be stated in the ordinance and must advance one or more aspects of the public health, safety and general welfare. Some communities adopt environmental regulations as separate ordinances outside of the local zoning ordinance in order to "shelter" the zoning ordinance from any legal attacks that may be directed at the ordinance. Should a court find that the community had adopted or was administering the ordinance improperly, the judge could invalidate all or part of the ordinance without in any way affecting or undermining the integrity of the local zoning ordinance. Another reason why some communities choose to adopt separate police power ordinances is because they do not have to protect nonconforming uses (unless the statute they are operating under specifically requires protecting them). A nonconforming use is one that pre-existed the zoning ordinance or an amendment to the zoning ordinance. Such a use is considered "grandparented" and is allowed to continue in the future in the same manner and to the same extent as it did when it became nonconforming. When nonconforming uses are not protected, then even without a proposed change to the property, it could be required to be brought into conformance with the new regulations.

Option 2 – Zoning Ordinance Provisions that Cover a Wide Range of Environmental Issues

Many local units of government are unwilling to take on the significant administrative responsibilities and potential liability associated with implementation of some or all of the model ordinance language described in the first option above. Nevertheless, they cherish protection of Michigan's environment and natural resources as much as the next community and want to do their part in ensuring it is protected. Short, simple approaches to environmental and/or natural resource protection are presented below and in the dialog boxes on this and the following page.

Environmental Assessment Requirements

When projects are proposed in or adjacent to sensitive natural resources, some communities require applicants to submit an environmental assessment which details the impact of the proposed development on natural resources. Communities that have plans and zoning regulations based on a solid environmental inventory are able to set the threshold for future environmental assessments at a defensible level. Without such a basis, an environmental assessment may be considered arbitrary as there is little context for the requirement. An environmental assessment can be a valuable source of information, and in some cases an important tool for ensuring that new development is designed in such a way that unavoidable environmental impacts are properly mitigated. Environmental assessments can also be viewed as an affirmative tool for helping a local government meet its responsibility for preventing pollution, impairment or destruction of the environment.

The Gibson Drain and its Riparian Corridor: With Environmental Assessment, a Nearby Proposed Development Would Consider its Impacts on this Resource

Photo courtesy of MCPWO.

Shoreline Protection Provisions

More refined shoreline provisions may address a host of other environmental protection issues such as the application of fertilizers or weed killers in near shore and stream bank areas, the trimming of shoreline vegetation for views, prohibitions on removal or replacement of natural shoreline vegetation with grass or ornamental landscaping, or requiring restoration of damaged natural vegetation on stream banks. These regulations tend to vary dramatically across the state, but for the most part, provide some measure of protection from overuse or removal of natural vegetation near the shore. These may also be called buffer strip or greenbelt provisions.

Groundwater Protection Standards

The Michigan Department of Public Health and MDNR, and more recently the MDEQ, have widely collaborated with hundreds of Michigan communities to develop and implement groundwater protection standards as a part of the local site plan review process. In most cases, communities adopting sample ordinance language also included standards to ensure protection of surface waters from land uses that had the potential to pollute, impair or destroy soil and water resources. These standards have many parallels to stormwater protection and the cooperative effort between the state and local governments on this issue has piloted the way for continuing this approach on a wider scale. Groundwater protection standards are fundamental public health and safety measures that should be adopted by local governments throughout the state.

Sensitive Area Protections

Instead of targeting specific natural resources for protection by means of a single regulatory approach, many communities have folded basic separation distances (setback provisions) into sensitive area or natural features provisions. These regulations list a set of sensitive areas or natural features in the community and require that all new structures or intensive use areas of the proposed development be set back at least a certain distance from the identified natural feature. Such provisions have been applied to shoreline, waterfront, floodplain, wetland, woodland, sand dune, and high risk erosion areas. Because of a Michigan Attorney General opinion (No. 6892, March 5, 1996) that says setbacks from wetlands may not be required under a wetland ordinance, but may be required if properly crafted as part of a zoning ordinance regulating natural features, it is important for communities to be very careful about how natural features are defined and how such regulations are crafted. In some ordinances these provisions are called buffer strip or greenbelt provisions.

Planned Unit Developments and Cluster Developments

Planned unit developments (PUDs) and cluster developments are forms of land design that usually focus on integration of the natural features of a site with the new development to be constructed on the site. Most PUDs are largely residential, although increasingly they are mixed use–usually commercial and residential. The combination of a golf course with a residential subdivision or site condominium is the most common form of PUD in Michigan. Commercial, office and industrial PUDs are also becoming common, especially in urban and suburban locations along freeways. In suburban and rural Michigan, PUDs are increasingly designed around a sensitive natural feature like a small pond or wetland.

Riparian Buffer

Source: Sygenta, 2005.

Macomb County Natural Features Inventory

The Macomb County Maps page at

http://macombcountymi.gov/GIS/Maps.asp

has many resources that may be useful for local planning efforts. The page has links for a wetland indicator map, watershed boundaries, and the Macomb County Natural Features Inventory Report and Map.

The Macomb County Natural Features Inventory is a resource that documents and prioritizes local potential conservation areas and natural areas.

Good design with a large natural vegetation buffer area around the sensitive resource can result in its protection as an asset to the PUD.

A cluster development is a form of PUD that is usually exclusively residential and surrounded by large amounts of open space. An example of a conventional subdivision compared with a cluster development is shown in Figure 7-2.

Figure 7-2. Conventional subdivision compared to cluster development.

(a) Conventional Subdivision **(b) Cluster Development**

Recent amendments to Michigan's zoning enabling acts require many communities to adopt cluster development provisions that permit projects with at least 50% open space in townships and counties and 20% open space in cities and villages by "right" (i.e., without any special review and approval process). Communities can define what constitutes permissible open space, but it cannot include land in a golf course. See for example MCL 125.286h in the Township Zoning Act, MCL 125.584f in the County Zoning Act, and MCL 125.584f in the City-Village Zoning Act.

The combination of a PUD and cluster development can be a very effective way for communities to permit some development in areas with sensitive natural resources without seriously undermining the integrity of the natural features. This takes careful design, attention to mitigation, good site plan review standards and experienced professionals reviewing the proposed site plans to get the best result. There are many different sample PUD and cluster development ordinances in use throughout Michigan.

Site Plan Requirements / Better Site Design

Next to placing land into various zoning districts, site plan review is the most powerful planning and watershed protection tool. Easily enforced, site plan review is a way for communities to ensure what is approved on a site plan is what will be built. A site plan is a plan, drawn to scale, showing the layout of proposed uses and structures. Site plans include lot lines, streets, building sites, existing structures, reserved open space, utilities, and any other required information. The Center for Watershed Protection (www.cwp.org) and the Low Impact Development Center (www.lowimpactdevelopment.org) can provide additional information.

Communities can require a number of sustainable development best management practices such as landscaping standards, use of native plant species, on-site stormwater best management practices, percentage of allowable impervious coverage, and a host of other environmental design considerations through the use of site plan requirements and reviews.

Most ordinances automatically call for site plan review of industrial, office, commercial, and multi-family uses. But communities can require that other uses, even uses allowed by legal right, go through a site plan review.

For example, proposed single family home construction in areas where wetlands, critical habitat, or other unique natural features exist can be regulated to protect these features through the site plan review process. Communities can also adopt provisions addressing preservation of mature trees, preventing light pollution, and other design mechanisms which in turn protect community character.

For environmental, as well as aesthetic concerns in a community, site plan review (of both drawings and written requirements) is one of the best overall zoning tools that can be implemented by local governments. Site plan requirements are a good way of eliminating any development "surprises" and also serve as a mechanism for working with a community's natural features.

Option 3 – Coordinated Permit Review and Approval Procedures

An effective way to combine the strength of local zoning with the weight of state environmental permitting and enforcement is for local governments to coordinate zoning decisions with the MDEQ and MDNR when sensitive natural features are involved. When local governments have appropriate, but limited environmental protection standards in the zoning ordinance, they can condition final development approval on receipt of necessary permits from the state government. This type of coordinated review and approval process helps ensure key environmental and natural resources are protected as new development occurs. Many communities have informally been working with the MDEQ/MDNR this way for years. In some cases, more formal coordinated review procedures are desirable and can be beneficial to all involved parties. One form for such an agreement is a memorandum of understanding that spells out state and local responsibilities.

This approach is possible because all three zoning enabling acts permit local governments to condition approval of zoning permits generally and site plan review specifically, on approvals under statutes administered by other governmental agencies (see for example MCL 125.286e(4) and (5), the Township Zoning Act; MCL 125.216.e (4) and (5) of the County Zoning Act and MCL 125.584d (4) and (5) of the City-Village Zoning Act).

Better Site Design Options

Some options for better site design include:

- Decreased number of parking lots;
- Providing compact car parking spaces and minimizing stall dimensions;
- Encouraging shared parking;
- Minimizing required street pavement width based on need to support travel lanes, street parking, and emergency, maintenance, service vehicle access;
- Optimizing street layout to minimize total roadway length;
- Minimizing required street right-of-way widths to accommodate travel-way, sidewalk, and vegetated open channels;
- Minimizing the number of street cul-de-sacs and reducing cul-de-sac radius to accommodate emergency and maintenance vehicles;
- Considering alternative turnarounds, including the use of mountable curbing and grass shoulders for occasional access by fire trucks and other large commercial trucks;
- Promoting flexible design standards for residential subdivision sidewalks such as locating sidewalks on only one side of the street and providing common walkways linking pedestrian areas; and
- Relaxing side yard setbacks and allowing narrower frontages to reduce total road and driveway lengths within the community.

This approach is especially desirable because local governments can be additional "eyes and ears" for natural resource protection, while leaving the environmental permit and enforcement decisions to the state agencies that have the technical wherewithal, the statutory responsibility and the ability to absorb any liability for the decisions made. For small and rural communities especially, these are huge considerations. In the end, development proposals that do not meet both state environmental standards, and local zoning standards are not approved. Projects whose site plans do meet the standards of both local zoning ordinance and state regulations must be approved.

Additional Measures to Consider

Four other common zoning techniques that have significance as regards to certain decisions affecting natural resource and environmental protection are presented below.

Nonconforming Uses

Uses of land that pre-date the zoning ordinance or an ordinance amendment that no longer comply with zoning regulations are called nonconforming uses. Essentially, these uses are protected from changes created by new zoning regulations. Local governments are permitted to restrict or prohibit expansion or structure additions of nonconforming land uses or structures, with the long-term goal of eventually phasing them out. In riparian areas, local planning officials have an opportunity to address the rapidly changing dynamic of their shoreline through the manner in which nonconforming uses are regulated. For example, if a nonconforming structure exists on a property and is demolished, a new structure cannot replace it without conforming to the current zoning or other applicable regulations. This situation has become increasingly common in recent years as small coastal cottages are torn down and replaced by much larger single family or multifamily dwellings. This presents an opportunity to gain conformance with ordinance requirements, which should be sensitive to watershed protection considerations.

Rezoning

The process of changing from one zoning district classification to another is called rezoning. The most fundamental question which must be asked regarding a rezoning request is whether the area proposed to be rezoned is an appropriate area for the permitted uses in the proposed zone. Typically, rezoning requests are made for the purpose of increasing the intensity of the use of a parcel. In riparian areas, where there are significant, fragile natural features such as critical habitats and wetlands, rezoning from a low-intensity use classification to a high-intensity use classification could have significant ecological impacts.

Special Land Uses

Special land uses, also called conditional uses or special exception uses, are uses of land that are allowable within a particular zone only when the proposed activity meets a defined set of standards that are particular to that use and are included in the zoning ordinance. Site-specific issues can be addressed using these designations as opposed to the more general considerations typical of a zoning district.

The dominant land use in a district is usually a use "by right", such as farmland in an agricultural district. Special use provisions can provide

Professional Reviews

Some governments may lack the kind of professional staff available to perform a thorough technical review of all the complex elements of many contemporary development proposals. Everything from issues associated with stormwater retention, sewage disposal or water supply, or the impacts on wetland species from partially filling a wetland for an access road, may be beyond the scope of available staff. In these cases, a community needs to hire outside professionals to perform reviews of development applications to ensure conformance with ordinance requirements. Communities are often unwilling to hire outside experts because they don't want the cost to be borne by existing taxpayers. A recent appellate court decision has demonstrated that a community can collect fees in escrow to pay for the cost of professional reviews, provided the community has a provision enabling such fees in its zoning ordinance, and it returns to the applicant any unused fees (see Cornerstone Investments v. Cannon Township, 459 Mich 908 (1998); after remand, 239 Mich App98, 1999). This ruling means no community need go without the professional expertise necessary to ensure a project meets ordinance requirements.

communities with the opportunity to control certain activities not allowed "by right", but commonly associated with "by right" uses. Typical special land uses include communication towers, churches, junkyards, private airfields, etc.

Variances

A variance is a legally granted action to waive a requirement in a zoning ordinance. If a community grants a variance, it permits one property owner to do something that is otherwise not permitted in the zoning ordinance. As a result of the zoning enabling acts, most zoning ordinances and court cases have a very narrow set of circumstances that must exist before a variance can be lawfully granted. In most cases, if a property owner can use the land for the desired use, or place a structure or addition elsewhere on the land without a variance, then the variance is not appropriate. As is apparent, the improper granting of a variance can quickly undermine the integrity of the zoning ordinance. This is even more consequential when the variance has the effect of undermining the integrity of natural resources. In general, if communities adopt zoning measures to protect natural resources and prevent pollution, impairment or destruction of the watershed, they should consider variance requests very carefully and only grant them when not doing so would preclude the land owner from otherwise exercising a lawful property right. Even then, the community should consult with environmental professionals and attorneys familiar with zoning and environmental law.

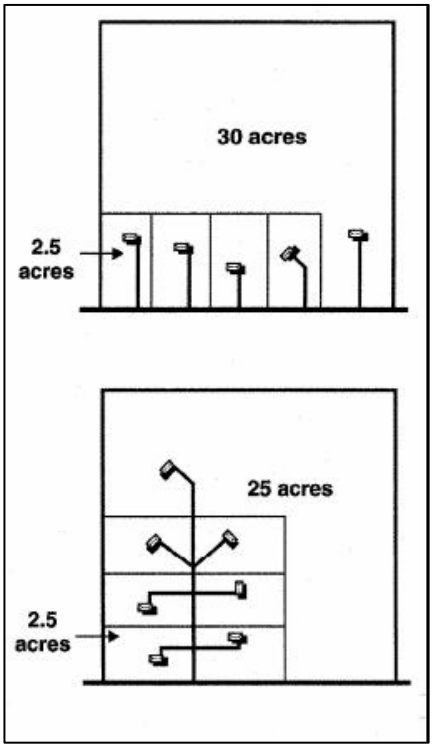
Land Division and Subdivision Ordinances

Two of the local regulatory tools with the greatest potential to minimize harm in sensitive environmental areas are regulations that apply to land divisions and subdivisions. These are usually two separate ordinances that are linked to the zoning ordinance, but because the authority for them derives from a statute different from the zoning enabling acts, they are adopted as separate ordinances. The first is usually known as a land division ordinance. The second is usually called a subdivision or plat ordinance.

Land Division Ordinance

A land division ordinance may be adopted by a local unit of government pursuant to Section 109 of the Land Division Act, Public Act 288 of 1967, as amended (MCL 560.109). A land division ordinance regulates the creation of lots and bounds splits of a parcel of land. Refer to the figure on the left for an example of land division. A statutory formula in Section 108 specifies the maximum number of splits that are permitted from a "parent parcel" without platting. Bonus lots are permitted for shared access and preservation of open space. Minimum standards for lot size, width-to-depth ratio and relationship to access are provided by statute. All parcels splits smaller than 40 acres in size are required to be reviewed and approved locally before they can be recorded with the county register of deeds. Land divisions being created must also conform to local zoning regulations, provided those regulations are not in conflict with the land division provisions of the Land Division Act.

Example of Land Division



Source: John Warbach, Planning and Zoning Center, Inc.

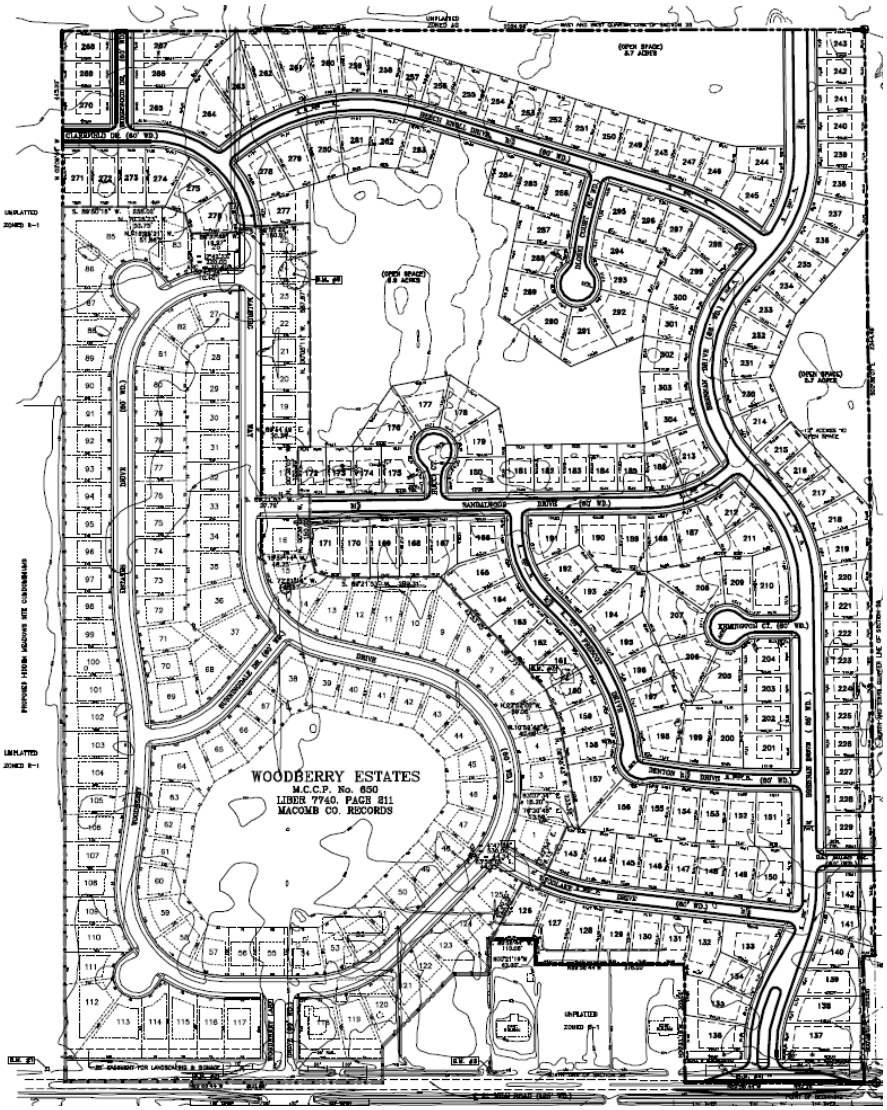
An Example of a Subdivision being Constructed: Woodberry Estates (not in subwatershed)

Photo courtesy of Anderson, Eckstein and Westrick.

Subdivision Ordinance

A subdivision ordinance is adopted by a local unit of government to regulate the creation of more splits than are permitted under the land division provisions of the Land Division Act. Refer to the figure on the left for an example of a subdivision. Section 105 of P.A. 288 of 1967, as amended, provides authority for the adoption of local subdivision ordinances. Developers of platted subdivisions are required to put in public infrastructure such as paved streets, curb, gutter, stormwater, sewer and water pipe, unless exempted by local ordinance. Lots being created must also conform to local zoning regulations, provided those regulations are not in conflict with the platting provisions of the Land Division Act.

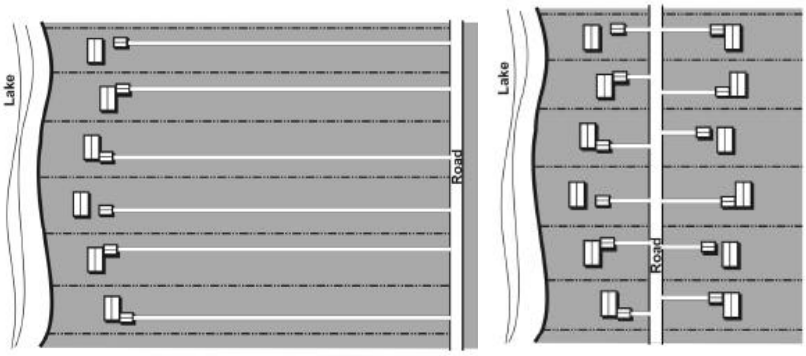
A Subdivision: Woodberry Estates in Macomb Township (not in the subwatershed)



Courtesy of Anderson, Eckstein, and Westrick

The primary environmental issues associated with land divisions and plats relate to lot width, depth, area, access and "buildability". Proper review and approval of land divisions and plats can dramatically reduce future problems associated with use of the lots. The process is similar to site plan review described earlier, except that in the case of plats, there are many statutorily required reviews by different entities, including the local government, the county road commission, drain commissioner, Michigan Department of Transportation (MDOT), and MDEQ, depending on the location and characteristics of the parcel being platted. For example, deep narrow frontage lots along shorelines will often result in long driveways and many structures close to the water. This often translates into considerable impervious surface and water runoff which can carry pollutants, nutrients and warm water into the lake, river, stream or pond. Shallow lots also often have considerable impervious surface and leave little room to site a structure farther from the shoreline. This may be critical in the case of a high risk erosion area, wetland, or floodplain. See Figure 7-3 for a comparison of long and short, narrow waterfront lots.

Figure 7-3. Long narrow vs. short narrow waterfront lots.



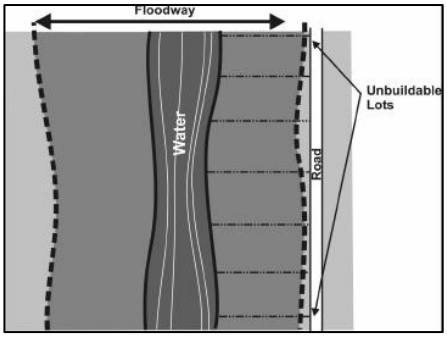
Source: John Warbach, Planning and Zoning Center, Inc.

A parcel size between the two types is more desirable, especially if each lot is wider along the lake. This will result in less impervious surface and adequate room to locate a structure outside of a floodplain.

Total area is a function of lot width and depth, so if one or both are short, then the total area of the parcel will often be small, leaving few options to mitigate potential environmental impacts, such as trying to avoid siting structures in a floodplain.

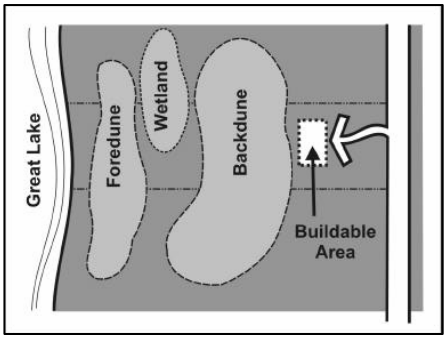
Access is an issue linked to connecting a driveway between a structure and the public or private road leading to the lot. Especially on long narrow lots, such as those in a designated environmental area, it may be difficult to site an access road without seriously and negatively impacting the sensitive natural features in the area. "Buildability" relates to the issue of whether a proposed lot of a certain size and shape results in an area of land on which a permanent residence or other structure may be built under existing environmental regulations. For example, a proposed land division of a parcel that is largely wetland and that includes no high ground, may have no place on which a residence and a septic field could be legally sited. Approval of such land divisions undermines the integrity of the environment, of environmental enforcement and sets up multiple governmental agencies for potential takings claims. On the other hand, ensuring that a lot is "buildable" under all applicable regulations prior to

Example of Unbuildable Lots



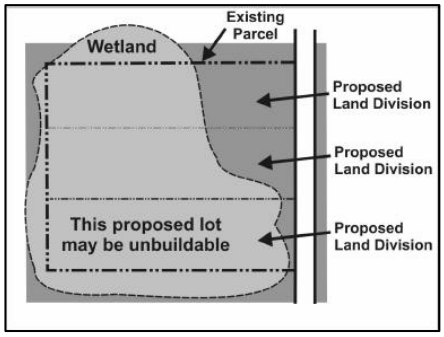
Source: John Warbach, Planning and Zoning Center, Inc.

Example of Access



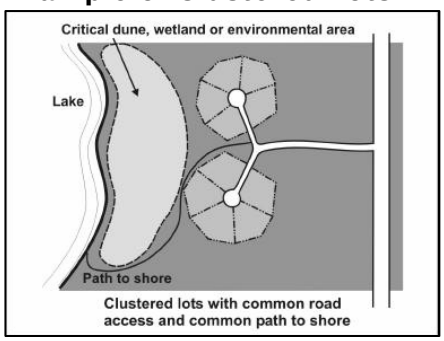
Source: John Warbach, Planning and Zoning Center, Inc.

Example of Buildability



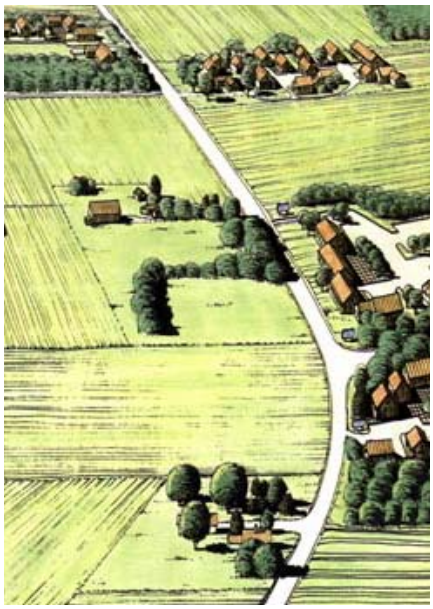
Source: John Warbach, Planning and Zoning Center, Inc.

Example of Clustered Lots



Source: John Warbach, Planning and Zoning Center, Inc.

Drawing of Clustered Lots



Source: NCSP, 2005.

approval, not only protects the environment, but also plays an important consumer protection function—people can buy a lot that is "buildable". Unfortunately, the land division provisions of Section 109 of the Land Division Act can be read to prohibit a community from denying approval of a proposed land division on the environmental regulations. As a result, many communities feel obliged to approve such land divisions, but then file a notice with the County Register of Deeds that such a lot does not conform to other applicable regulations. If it were purchased for a building use, such as for a residence or business, the land division request would be denied. This is a very awkward way to protect the consumer, but appears to be the only lawful way to do so under Section 109. Michigan appellate courts have upheld a township zoning regulation prohibiting counting unbuildable area on a site due to wetlands when calculating permitted density. See Frericks v. Highland Twp. 228 Mich App 575, appeal denied, 459 Mich 66 (1999).

The best proactive measures a community can take to prevent the creation of lots that do not undermine the integrity of the environment and are "buildable", are listed below:

- Adopt and consistently administer land division regulations;
- Adopt and consistently administer subdivision regulations;
- Try to persuade landowners who propose to create "unbuildable" lots not to do so. If unsuccessful, file a notice with the County Register of Deeds that runs with "unbuildable" parcels that informs purchasers of the unique status of such lots; and
- Put provisions in the shoreline district provisions or shoreline overlay provisions of the zoning ordinance which:
    - Require wide and deep lots with shared access; or
    - Ensure lots are clustered with all the common open space along the shoreline, sensitive environmental areas are avoided and all access is shared.

Public Spending and Capital Improvement Programs

Another important way to protect sensitive natural features is to watch how, where and when the public spends money on public facilities. Where new public facilities are constructed and where they are not can have profound effects on natural resources. The extension of sewer and water lines into a sensitive environmental area or the construction of a new road along a large wetland will have significant long term impacts–many of which could be negative. At the same time, the construction of a sewer line around an inland lake being contaminated by leaking septic tanks can help restore water quality in the lake. Communities that work with nature avoid creating the conditions which promote intensive development in areas with a large area of sensitive natural features.

Large capital improvements should be planned to meet future needs and should be based on the future land use plan or master plan–just as zoning should be. When the master plan has a solid foundation on a natural features inventory, future land uses will be planned in locations to avoid negative impacts on sensitive natural features. Subsequently, future capital improvements will then be located to accommodate needed community growth in locations that don't negatively affect sensitive natural features. The best tool for planning for future public improvements is the capital improvement program (CIP). This is a schedule of proposed capital improvements for future years. It specifies

where the facilities are proposed to be located, what their cost will be, the means of financing and when they will be constructed. Each year the CIP is updated. This process permits plenty of time to examine the CIP for its environmental friendliness and to ensure that public investments aid, rather than diminish, the quality of local natural resources.

Good Housekeeping and Pollution Prevention

Watershed protection requires that actions be taken to minimize the environmental exposure of pollutants. These actions include preventing the generation of potential pollutants, implementing procedures to ensure that existing compounds are handled and disposed of in such a way that they never become pollutants, and inspecting infrastructure that handles pollutants to ensure it is working correctly. Some examples for which pollution prevention and good housekeeping apply include: the storm sewer system (including illicit discharges), the sanitary sewer system, municipal facilities, managed and manicured turf, solid waste management facilities, commercial facilities (e.g. chemical spills), and septic systems.

Some agencies and programs that can provide assistance in this area are discussed in the following subsections.

Storm Sewer Outfall w/ Dry Weather Flow – *possible illicit discharge*

The Michigan Department of Agriculture

Information on the following programs can be obtained through the Michigan Department of Agriculture's (MDA's) website at http://www.michigan.gov/mda/.

The Michigan Groundwater Stewardship Program

The goal of the Michigan Groundwater Stewardship Program (MGSP) is to provide information and assessment tools for pesticide and nitrogen fertilizer users. The MGSP helps them identify risks to groundwater associated with their pesticide and nitrogen fertilizer use practices and to coordinate local, state, and federal resources to help individuals reduce those risks. The MGSP is designed to be voluntary, to be locally driven, to address the concerns of individuals, and to maintain a focus on financial and technical constraints which guide decision making. The following programs are administered through the MGSP:

*Home*A*Syst*

Home*A*Syst is a household assessment tool that can be used to help identify risks and provide information on how to lower your risks to groundwater contamination around the home. Home*A*Syst helps protect your drinking water, the environment, your health, and the health of your family.

Biosolids & Industrial Pretreatment

Drinking Water

Spill Response

While the MDEQ is generally responsible for implementing spill response activities for the waters of the state, the U.S. Coast Guard has the primary responsibility for spills on Lake St. Clair and in the nearshore area of the lake.

Emergency Response

Groundwater Discharge

Groundwater Modeling

Inland Lakes & Streams

MDEQ/USACE Joint Permit Application

Abandoned Well Closures

The objective of abandoned well closure is to reduce the risk of contaminants moving down an abandoned well and contaminating groundwater supplies. Stewardship Teams determine local cost-shares, which are often as high as 75 to 90 percent of the total cost.

MDEQ – Water Programs

Information on the following programs can be obtained through the MDEQ's website at http://www.michigan.gov/deq/.

Biosolids & Industrial Pretreatment Program

To further preserve and protect Michigan's water resources, the MDEQ encourages and enforces the use of wastewater treatment systems through the use of Biosolids and the Industrial Pretreatment Program.

Drinking Water

The MDEQ has primary enforcement authority in Michigan for the Federal Safe Drinking Water Act under the legislative authority of the Michigan Safe Drinking Water Act. The MDEQ also investigates drinking water well contamination, and oversees remedial activities at sites of groundwater contamination affecting drinking water wells.

The Michigan Wellhead Protection Program

This program assists local communities utilizing groundwater for their municipal drinking water supply systems in protecting their water source.

Emergency Response

The MDEQ operates the Pollution Emergency Reporting System (PEAS), a unified 24-hour hotline for reporting environmental emergencies, including those related to the twenty-six state and federal regulations requiring chemical release notification. The MDEQ is also responsible for implementing the Part 5 Rules - Spillage of Oil and Polluting Materials. The Part 5 Rules deal with the storage and release of oil, salt, and polluting materials.

Groundwater Discharge Program

The Groundwater Program regulates discharge to groundwater under Part 31, Water Resources Protection, of the Natural Resources and Environmental Protection Act, 1994 PA 451 and Part 22 Rules.

Groundwater Modeling Program

The Groundwater Modeling Program has provided groundwater modeling support on a department-wide basis since 1980 when an EPA grant was used to fund groundwater models for site remediation.

Inland Lakes and Streams

The State's water resources are monitored by the MDEQ and partnering organizations to determine water quality, the quantity and quality of aquatic habitat, and the health of aquatic communities, and compliance with state laws.

"Joint Permit Application"

This package covers permit requirements pursuant to state and federal (MDEQ and USACE) rules and regulations for construction activities where the land meets the water and including wetlands, often referred to as the land/water interface.

Surface Water

The MDEQ is committed to protecting and preserving Michigan's water resources. There are numerous programs supporting this goal, including:

Enforcement

The Surface Water Enforcement Unit is responsible for conducting all escalated enforcement actions taken by the division. These actions are conducted in response to violations of state water pollution control statutes and rules, violations of surface water discharge permits, and any violations of administrative or judicial orders.

NPDES Permits

The MDEQ administers the federal NPDES permitting program at the state level. This program restricts pollutant discharges to waterbodies and sets strict effluent concentration and loading limitations on those facilities that must discharge to waterbodies, such as waste water treatment plants.

Water Quality Trading Program

The State of Michigan is developing a statewide water quality trading program. Water quality trading will allow facilities facing high pollution control costs to meet their regulatory obligations by purchasing environmentally equivalent pollution reductions from another source at lower cost, thus achieving the same water quality improvement at lower overall cost.

Septage

The MDEQ enforces rules for the handling of domestic septage and licenses the haulers wishing to do so. The program provides technical assistance as well as contacts for staff, haulers, and end-users.

Sanitary and Combined Sewer Overflow

The MDEQ has broad regulatory authority to deal with SSOs and CSOs. The SSO/CSO program includes setting policy, reporting occurrences, and initiating enforcement actions against offending entities.

Water Management

The MDEQ regulates activities that may have potential impacts to the public trust, riparian rights, or may impair or destroy the waters or other natural resources of the state, including inland lakes and streams, the Great Lakes, wetlands, and groundwater.

Michigan Water Quality Monitoring

The MDEQ has several water quality monitoring programs that assist in keeping all of Michigan's waters clean. These programs include Beach Water Monitoring, Assessment of Michigan Waters, Inland Lakes Monitoring, and Public Swimming Pool Monitoring.

MDEQ – Other Programs

Land Development: On-Site Sewage Disposal Systems

The MDEQ has promulgated rules for on-site sewage disposal systems (OSDS) as they apply to the Land Division Act. The MDEQ also issues numerous reports regarding the status of OSDS in the state and provides technical assistance.

Waste and Hazardous Materials Division

The Waste and Hazardous Materials Division (WHMD) administers a diverse number of prevention programs to protect the environment and the public's health through proper management of hazardous products; solid, liquid, medical, and hazardous waste; and radioactive materials.

Cross-Jurisdictional Enforcing Agent
MDEQ, Water Bureau

County Enforcing Agents
Macomb County Public Works Office (MCPWO)
Oakland County Drain Commissioner (OCDC)

Authorized Public Agencies
Various State of Michigan Depts. (MDEQ, MDOT, etc.)
MCPWO
Road Commission of Macomb County
OCDC
Road Commission for Oakland County

Municipal Enforcing Agencies
City of Birmingham
City of Southfield
City of Sterling Heights
City of Troy

Conservation District
Macomb Conservation District
Oakland Conservation District

BMP Resources

Additional resources for stormwater BMPs include:

- The Stormwater Manager's Resource Center's *BMP Fact Sheets* (www.stormwatercenter.net).
- *Stormwater Management Guidebook*. Menerey, B.E., et al. (1999). MDEQ Land and Water Management Division;

(continued on following page)

The Michigan Department of Transportation

Information on the following programs can be obtained through the MDOT's website at http://www.michigan.gov/stormwatermgt/.

Educational Materials

MDOT provides educational and outreach materials that describe how pollution prevention and good housekeeping can be implemented on transportation, and related, structures. Available information includes the types of BMPs that can be implemented on or near roads and car care tips to prevent pollution.

Drainage Manual

The MDOT Drainage Manual defines specific practices and the standards thereof that are implemented to minimize the pollutant-related impacts of transportation infrastructure.

Stormwater Best Management Practices

As described by the US EPA, stormwater nonpoint source pollution diminishes water quality in the United States. To reduce the impact, it is important that watershed protection measures include examination of best management practices (BMPs) used to reduce the amount of pollution entering receiving water bodies. Since development causes hydrological changes in the watershed, BMPs must also be chosen to mitigate this effect. A number of BMP types are presented below:

Soil Erosion and Sediment Control

Good soil erosion and sediment control (SESC) is a critical watershed protection tool that protects surface waters from the effects of sedimentation, flooding, and other property damage. SESC can be divided into two distinct components: construction related and non-construction related.

Construction Related SESC

Although construction related SESC is not a requirement of the Watershed-based Permit, a brief discussion is warranted.

In the State of Michigan, county enforcing agents (CEAs) are authorized under Part 91 of Public Act 451 to require that a permit be obtained for any land disturbance greater than 1 acre or within 500' of a waterbody (except for exempted crop production practices). Authorized Public Agencies (APAs) are exempt from obtaining a permit, but must notify the appropriate enforcing agency in advance and must follow the SESC guidelines stipulated in the Act.

The MDEQ, through Part 31 of Public Act 451 (a.k.a., 'Permit by Rule'), requires any land disturbance greater than 5 acres to obtain a Notice of Coverage in addition to a soil erosion control permit from the local county enforcing agents (CEA) or municipal enforcing agents (MEA).

Persons engaged in agricultural practices may enter into an agreement with the conservation district instead of obtaining a permit from a CEA or MEA.

Additional information can be obtained from:

Michigan Department of Environmental Quality
Water Bureau, Storm Water Administration
PO Box 30657
525 West Allegan, 2nd Floor, Lansing, MI 48909-8157

Non-Construction Related SESC

This type of SESC includes any activity that is not undertaken in relation to an active construction site. General activities of non-construction SESC include:

- Repairing bare soil such as occurs on poorly maintained yards or eroding hillsides;
- Repairing and stabilizing stream banks that are eroding;
- Repairing roads and associated transportation structure that are eroding or causing nearby erosion;
- Excluding sensitive uses from occurring near waterbodies, especially within the riparian corridor;
- Insuring sediment generating sites install proper controls to prevent sediment from leaving the property;
- Providing controls in sensitive areas to ensure that sediment is not transported by wind;
- Installing structural controls at inlets to, or inside of, the storm sewer system to ensure sediment does not travel to receiving waterbodies; and
- Encouraging the implementation of agricultural runoff BMPs that prevent soil particles from traveling to nearby waterbodies.

Many other techniques, such as street sweeping, may be considered non-construction SESC. Many of these techniques have been included under other headings (e.g., street sweeping is considered pollution prevention).

Impervious Surface Mitigation

Impervious surface mitigation is a broad category comprised of practices designed to directly reduce impervious surface and/or treat the runoff from impervious areas. Some of these practices have the characteristics of the practices discussed in the following subsections ('Infiltration Practices', etc.) This category focuses on retro-fit implementation, but the practices herein can be implemented on new development and/or incorporated into ordinances, zoning, or development standards (discussed previously in this chapter). Common mitigation practices include:

- Vegetated Parking Lot Islands – vegetated depressions receiving runoff from parking lots and other impervious surfaces for infiltration into ground and filtration before discharging to storm sewer system or waterbody;
- Vegetated Road Medians and Side Ditches – vegetated channels in the median or along the side of a road, functioning similar to parking lot islands except they also convey runoff;
- Green Roofs – building roofs that are covered with vegetation and soil planted over a waterproof membrane to retain and evaporate rainfall and slow its runoff;
- Pervious Pavement and Asphalt / Paving Bricks – alternative paving types that allow for the percolation of water into subgrade soils or an engineered sub-base that facilitates infiltration and/or slow discharge to the storm sewer system;
- Rain Barrels and Cisterns – storing of rooftop runoff for later use as irrigation or other non-potable applications, these only provide benefits if water is used or drained between rainfall events;
- Bridge Scupper Drain Treatment – install piping on bridge scupper drains to ensure runoff does not directly drop into

BMP Resources (cont'd)

- *Guidebook of Best Management Practices for Michigan Watersheds*. Peterson, A., et al. (1998). MDEQ Surface Water Quality Division; and
- EPA's *National Menu of BMPs*; cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm

Some of these resources have been consulted in the development of this section.

Impervious Surface Mitigation Scorecard

Impervious surface mitigation practices provide wide-ranging water quality and water quantity benefits. The information presented below is for comparative purposes only. Values to be used for design purposes or to calculate pollutant load reductions should be determined through additional research.

WATER QUALTIY CATEGORY	REMOVAL EFFICIENCY*
TSS	60%
Phosphorus	45%
Metals (Cd, Cu, Pb, Zn)	55%
Nitrogen	50%
Pathogens	50%
Toxins	50%

* *Efficiency = % removal of influent concentration (median)*

Source: Winer, 2000.

WATER QUANTITY CATEGORY	APPLIC.**
Channel Protection	H/M/L
Overbank Flood Protection	M/L
Extreme Flood Protection	L
Recharge Volume	M/L

** *Applicability = suitability of practice for given purpose; H=High, M=Medium, L=Low*

Source: Minnesota, 2005.

Additional Considerations

Mitigating impervious surfaces can also be addressed by: 1) cutting out concrete and planting trees or constructing planter boxes; 2) placing planter boxes on top of existing impervious surfaces; and 3) utilizing native vegetation wherever possible.

Infiltration Systems Scorecard

Infiltration practices provide wide-ranging water quality and water quantity benefits. The information presented below is for comparative purposes only. Values to be used for design purposes or to calculate pollutant load reductions should be determined through additional research.

WATER QUALTIY CATEGORY	REMOVAL EFFICIENCY*
TSS	95%
Phosphorus	65%
Metals (Cd, Cu, Pb, Zn)	95%
Nitrogen	50%
Pathogens	n/a
Toxins	n/a

* *Efficiency = % removal of influent concentration (median)*

Source: Winer, 2000.

WATER QUANTITY CATEGORY	APPLIC.**
Channel Protection	M
Overbank Flood Protection	M/L
Extreme Flood Protection	L
Recharge Volume	H

** *Applicability = suitability of practice for given purpose; H=High, M=Medium, L=Low*

Source: Minnesota, 2005.

waterbody, but instead is treated through natural and/or structural means; and
- Impervious Surface Disconnection – altering drainage systems such that adjacent pervious areas are not hydraulically connected (i.e. routing rooftop downspouts to discharge onto grass instead of onto a driveway).

Benefits of impervious surface mitigation include:
- Reduced stormwater runoff volume;
- Increased groundwater recharge;
- Improved runoff water quality; and
- Simulation of pre-development hydrology.

Limitations of impervious surface mitigation include:
- May fail if not properly maintained; and
- May consume land or surfaces available for other uses.

Due the wide array of possible actions that fall in this category, cost and maintenance requirements range from low cost / low maintenance, such as impervious surface disconnection, to high cost / high maintenance, such as intensive green roof systems.

Infiltration Systems

In general terms, infiltration systems can be described as natural or constructed depressions located in permeable soils that capture, store, and infiltrate stormwater runoff. These depressions can be located at the surface of the ground or they can be designed as underground facilities. Common infiltration practices include:
- Rain gardens – small depressions typically planted with native vegetation, no structural infrastructure;
- Tree boxes – ground-level or raised vegetation-filled boxes with open bottoms connected to soils;
- Bioretention facilities – large depressed areas with engineered soils and native planting, typically with supporting infrastructure such as overflows to the storm drain system;
- Infiltration basins – natural or constructed impoundment;
- Infiltration trenches – shallow excavated trenches, 3 to 12 feet deep, backfilled with coarse stone aggregate;
- Porous pipe – underground pipes made of porous substance or with weep holes that allow infiltration as water flows;
- Dry wells – smaller variation of infiltration trench;
- Underground systems – typically pre-manufactured structures that are buried in space-limited locations; and
- Water spreading / irrigation – involves the reuse of stored runoff water for land-based functions such as crop irrigation.

Benefits of infiltration systems include:
- Reduced stormwater runoff volume;
- Increased groundwater recharge;
- Improved surface water quality;
- Thermal protection; and
- Simulation of pre-development hydrology.

Limitations of infiltration systems include:
- Unusual construction considerations;

- Potential for groundwater contamination;
- May lose effectiveness over time if not maintained;
- Not recommended in areas with steep slopes; and
- May require landscaping for drought/inundation conditions.

Infiltration systems require semi-annual inspections (clogging, vegetation health, structural elements), regular removal of accumulated trash and vegetation maintenance (mowing, pipe auguring for roots), and extensive rehabilitation upon failure. Construction costs range from 2$ to 7$ per cubic foot of stormwater treated with annual maintenance costs ranging from 5% to 10% of construction costs.

Filtration Systems

In general, filtration systems are structural controls that capture, temporarily store, and route stormwater runoff though a filter bed to improve water quality. Filtration systems can be off-line systems or designed as pre-treatment before discharging to other stormwater features. Common filtration practices include:

- Sand Filters – systems designed to route runoff through sand to remove pollutants, variations include: surface, pocket, underground, and perimeter;
- Organic Filters – generally a surface or pocket variant of sand filter that utilizes an organic media either alone or mixed with sand to increase filtration efficiency; and
- Re-circulating Variant – involves add-on structural components such as a holding tank and pump to store runoff greater than filter capacity for later treatment and to recirculate treated runoff for greater removal efficiency.

Benefits of filtration systems include:

- Good for highly impervious areas with low sediment/high pollutant load (e.g. urban land use and retrofit scenarios);
- High pollutant removal rates;
- May be used in a variety of soil types; and
- Good for the treatment of hotspots because it can be isolated from ground water if contamination concerns exist.

Limitations of filtration systems include:

- Some applications may require indoor location (e.g. dedicated heated building) to ensure proper functioning in Michigan's cold-weather climate;
- Higher maintenance requirements (facility should be kept dry before it freezes in late fall);
- Some installations (media filters) have higher construction costs;
- Potential to cause odor problems;
- Minimal treatment of soluble nutrients; and
- Potential for nitrification in media filters where aerobic conditions exist.

Filtration systems require monthly inspections to ensure that tributaries areas are stabilized and that the structural components are free of debris. Annual maintenance involves inspecting for clogging and sediment filling, checking the concrete walls, looking for signs of bypassing flow, and correcting these problems, if documented. Costs range from 2$ to 7$ per ft^3 with average annual maintenance costs near 5% of construction costs.

Filtration Systems Scorecard

Filtration practices provide wide-ranging water quality and water quantity benefits. The information presented below is for comparative purposes only. Values to be used for design purposes or to calculate pollutant load reductions should be determined through additional research.

WATER QUALTIY CATEGORY	REMOVAL EFFICIENCY*
TSS	85%
Phosphorus	50%
Metals (Cd, Cu, Pb, Zn)	50%
Nitrogen	35%
Pathogens	35%
Toxins	80%

* *Efficiency = % removal of influent concentration (median)*

Source: Winer, 2000.

WATER QUANTITY CATEGORY	APPLIC.**
Channel Protection	M
Overbank Flood Protection	L
Extreme Flood Protection	L
Recharge Volume	M/L

** *Applicability = suitability of practice for given purpose; H=High, M=Medium, L=Low*

Source: Minnesota, 2005.

Vegetated Buffers / Natural Conveyance Scorecard

Vegetated buffers and natural conveyance practices provide wide-ranging water quality and water quantity benefits. The information presented below is for comparative purposes only. Values to be used for design purposes or to calculate pollutant load reductions should be determined through additional research.

WATER QUALTIY CATEGORY	REMOVAL EFFICIENCY*
TSS	55%
Phosphorus	50%
Metals (Cd, Cu, Pb, Zn)	50%
Nitrogen	50%
Pathogens	50%
Toxins	50%

* *Efficiency = % removal of influent concentration (median)*

Source: Winer, 2000.

WATER QUANTITY CATEGORY	APPLIC.**
Channel Protection	M
Overbank Flood Protection	M
Extreme Flood Protection	L
Recharge Volume	M

** *Applicability = suitability of practice for given purpose; H=High, M=Medium, L=Low*

Source: Minnesota, 2005.

Vegetated Buffers and Natural Conveyance

In general, vegetated buffers and natural conveyance predominantly use vegetation and natural drainage to control stormwater runoff. Depending on the circumstances, some practices may require a minimal amount of structural features. These practices provide runoff reduction and water quality benefits in similar fashion to the infiltration and filtration practices, but do so as they provide water transport, as opposed to storage. Common practices include:

- Filter Strips - vegetated surfaces designed to treat sheet flow from adjacent surfaces, function by slowing runoff velocities and filtering out sediment and other pollutants, and by providing some infiltration into underlying soils;
- Buffers – areas of natural vegetation (grass, native vegetation, and forest) that filter stormwater as it drains overland, especially useful for treating runoff before it enters sensitive environmental areas such as groundwater recharge areas or streams, wetlands, and lakes;
- Grassed Channels – simple drainage ditches with flat bottoms and shallow slopes, a main alternative to curb and gutter in residential areas; and
- Swales – drainage ditches with enhanced natural vegetation types, compost, and/or rip-rap to enhance pollutant removal, two types include:
    - Dry Swales – incorporate engineered underdrains that route percolated runoff, which is treated, to the storm sewer system; and
    - Wet Swales – eventually intersect the ground water table.

The benefits of vegetated buffers/natural conveyance systems include:

- Reduced stormwater runoff volume;
- Increased groundwater recharge;
- Improved runoff water quality; and
- Simulation of pre-development hydrology.

The limitations of vegetated buffers/natural conveyance systems include:

- Pollutant removal may be limited;
- Space requirements;
- If not properly designed, they can change the natural flow of surface water and adversely affect downstream waters;
- If the design capacity is exceeded by a large storm event, the vegetation might not be adequate to prevent erosion and the channel might be destroyed. Clogging with sediment and debris reduces the effectiveness of for stormwater conveyance; and
- Ponding can allow mosquitos to breed.

The maintenance requirements of vegetated buffers/natural conveyance systems include:

- Mowing;
- Litter and sediment removal; and
- Spot vegetation repair.

The costs for these practices range from 0.25$ to 0.70$ per square foot with annual maintenance costs averaging $350/acre.

Retention and Detention

Retention and detention is generally accomplished through the use of stormwater ponds and/or stormwater wetlands. Both provide similar water quality benefits, but ponds generally provide more effective water quantity control. These practices are discussed below:

- Stormwater ponds – constructed basins that: 1) receive and hold runoff to improve water quality through settling and biological uptake; and 2) prevent downstream channel degradation or flood damage through peak flow reduction (detention) and total runoff reduction (retention); variation include:
  - Dry Detention – primarily designed for flood control; generally grass-lined so pollutant removal by settling only;
  - Wet – include a permanent pool of water which supports vegetation to enhance biological pollutant removal;
  - Wet Detention – a combination of a wet pond for water quality treatment and detention above the permanent pool for extreme runoff events;
  - Evaporation Basin – similar to a wet pond, but generally shallower to facilitate evaporation; and
  - Reuse – pond which acts as a source for water, primarily irrigation; and
- Stormwater wetlands – constructed shallow marshes that: 1) receive and hold runoff to improve water quality through settling and biological uptake; 2) provide detention and retention benefits similar to, but less effective than, stormwater ponds; and 3) provide additional benefits such as aesthetics and wildlife habitat; variation include:
  - Wetland/Marsh – provide shallow wetland areas and deep marsh areas for different biological treatment types;
  - Extended Detention – similar to the wetland/marsh but with extended storage above the normal water surface;
  - Wetland/Pond – the wet pond situated near the inlet allows pollutants to settle out prior to entering the more environmentally sensitive shallow wetland area; and
  - Submerged Gravel – more like a filtering system in which runoff is treated as it flows through a submerged bed of gravel that incorporates wetland vegetation.

Benefits of retention/detention systems include:

- Able to effectively reduce pollutant loads and control runoff;
- Relatively straightforward pond design procedure; and
- Potential wildlife habitat, aesthetic or recreational enhancement.

Limitations of stormwater ponds include:

- Relatively large space requirement;
- Increase water temperature / cause downstream thermal impact;
- Potential nuisance for insects or odor;
- Poor in areas of low slope, high water table, and shallow bedrock;
- More complicated wetland design procedure; and
- Water quality behavior can change seasonally.

Maintenance includes annual vegetation and sediment accumulation inspections, monthly debris removal, and 5-year to 20-year sediment removal. Construction costs range from $11,000-$57,000/acre-foot. Annual maintenance costs equal 3% to 5% of construction costs.

Retention / Detention Scorecard

Retention / detention practices provide wide-ranging water quality and water quantity benefits. The information presented below is for comparative purposes only. Values to be used for design purposes or to calculate pollutant load reductions should be determined through additional research.

WATER QUALTIY CATEGORY	REMOVAL EFFICIENCY*
TSS	75%
Phosphorus	40%
Metals (Cd, Cu, Pb, Zn)	50%
Nitrogen	35%
Pathogens	70%
Toxins	80%

* *Efficiency = % removal of influent concentration (median)*

Source: Winer, 2000.

WATER QUANTITY CATEGORY	APPLIC.**
Channel Protection	H/M
Overbank Flood Protection	H/M
Extreme Flood Protection	H/M
Recharge Volume	L

** *Applicability = suitability of practice for given purpose; H=High, M=Medium, L=Low*

Source: Minnesota, 2005.

Vegetation Management Actions to Consider for Natural Features and Resources Management

Some vegetation management actions to consider include:

- Maintaining or introducing native landscaping;
- Critical area plantings;
- Municipal buffer zones;
- Prescribed burnings;
- Reforestation;
- Urban forestry, tree plantings and protection ordinances;
- No mow zones;
- Protecting threatened and endangered species; and
- Eradicating exotic/invasive species.

Natural Features and Resources Management

While many of the actions under 'Ordinances, Zoning, and Development Standards' serve to protect natural resources, the techniques listed here promote a more active approach that encompasses not only the protection of existing natural features but also their enhancement and restoration, where appropriate.

Land Reserves

Conservation of land helps protect existing water quality from degradation and prevents encroachment into important natural areas such as riparian corridors, wetlands, or critical habitat. Methods for conserving land include: purchasing land, development rights transfer, conservation easements, land trusts, leases, deed restrictions, and covenants.

Many programs are available that conduct or assist with land conservation efforts that can be implemented by any organization, including the WMP participants. Many of these programs, listed below, also provide assistance for natural feature protection and restoration (discussed in the next sub-section).

The Nature Conservancy

The Nature Conservancy's (TNC) mission is to preserve the plants, animals and natural communities that represent the diversity of life on Earth by protecting the lands and waters they need to survive. TNC has developed a strategic, science-based planning process, called Conservation by Design, which helps them to identify the highest-priority places that, if conserved, promise to ensure biodiversity over the long term. In other words, Conservation by Design allows TNC to achieve meaningful, lasting conservation results. The TNC website is located at http://nature.org/

Michigan Natural Resources Trust Fund

The Michigan Natural Resources Trust Fund (MNRTF) has been in place since 1976. It provides financial assistance to local governments and the Department of Natural Resources (DNR) to purchase land or rights in land for public recreation or protection of land because of its environmental importance or its scenic beauty. It also assists in the appropriate development of land for public outdoor recreation.

The Trust for Public Land

The Trust for Public Land (TPL) is a national, nonprofit, land conservation organization that conserves land for people to enjoy as parks, community gardens, historic sites, rural lands, and other natural places, ensuring livable communities for generations to come. The TPL website is located at http://www.tpl.org/.

Michigan Nature Association

The Michigan Nature Association, established in 1952, is a conservation organization dedicated to protecting Michigan's most exceptional natural habitats and extraordinary or endangered species. Our mission is not only to preserve exceptional land and natural flora, but also to carry on programs of conservation education and scientific study. With the help of our members, MNA now has 163 nature sanctuaries throughout the state for people to enjoy today and forever. The association's website is located at http://www.michigannature.org/.

Southeast Michigan Land Conservancy

Southeast Michigan Land Conservancy is a non-profit organization dedicated to the preservation and stewardship of natural and agricultural land in the southeast Michigan counties of Livingston, Macomb, Monroe, Oakland, St. Clair, Washtenaw, and Wayne. They also work to educate the public and public policy makers about land conservation issues.

SMLC protects land by purchasing it, by accepting donations of land, and by holding conservation easements to preserve natural features on private parcels. Their focus is on open spaces close to home, and their activities also include participation in coalition efforts to coordinate land use policy, protect open space, preserve scenic beauty, and defend watersheds from harmful development and pollution. The conservancy's website is located at http://www.southeastmichiganlandconservancy.org/.

Macomb Land Conservancy

The Macomb Land Conservancy (MLC) is dedicated to the preservation of forests, wetlands, wildlife habitats, farmlands, rivers, and streams in Macomb County through: identification and preservation significant natural areas and habitats, supporting the preservation of farmland and the agricultural economy of Macomb County, assisting local communities to plan for growth and development, and conducting public education programs that encourage residents and communities to become stewards of public and private land. The conservancy's website can be found at http://www.savingplaces.org/.

Oakland Land Conservancy

The mission of the Oakland Land Conservancy (OLC) is to 'preserve, protect, and connect natural areas and open spaces to enhance the quality of life in and around Oakland County. The OLC is currently active in the management of approximately 562 acres of land. The conservancy's website can be found at http://www.oaklandlandconservancy.com/.

Natural Feature Protection and Restoration

Not only is conserving land important, but protection and restoration practices must be employed on this land and on private land to ensure that the greatest natural functioning is achieved. Many programs are available that directly participate in these types of activities or provide technical and financial assistance to implement them.

Michigan Department of Natural Resources

The Michigan Department of Natural Resources (MDNR) is responsible for the stewardship of Michigan's natural resources and for the provision of outdoor recreational opportunities; a role it has relished since creation of the original Conservation Department in 1921. Federal funds support programs for wildlife and fisheries habitat and development, forest management, recreation and other natural resource efforts. The MDNR's website is located at http://www.michigan.gov/dnr/.

Landowner Incentive Program

The primary goal of the Landowner Incentive Program is to help private landowners and non-profit organizations create, restore, protect, enhance, and manage habitat for species that are rare and/or declining (including wetlands, prairies, savannas, etc.). They do this by providing advice, technical assistance, management plans, and funding to individuals and organizations throughout the state that qualify.

Forest Stewardship Program / Forest Land Enhancement Program

To promote the wise use and stewardship of privately owned forestlands is the goal of the Forest Stewardship Program. Candidates for the program are those landowners who are both interested in and committed to long term management that is economically viable and socially, ecologically and environmentally responsible.

The Forest Land Enhancement Program (FLEP) is intended to promote sustainable forest management on non-industrial private forest lands by offering educational, technical and financial assistance to private forest landowners.

Cost-sharing in the program is available for a number of activities including: management plan development, reforestation, forest stand improvement, water quality improvement, and watershed protection, fish and wildlife habitat improvement, forest health and protection, invasive species control, and wildfire and catastrophic event rehabilitation.

Natural Resources Conservation Service

The Natural Resources Conservation Service (NRCS) works hand-in-hand with the American people to conserve natural resources on private lands. They help land-users and communities approach conservation planning and implementation with an understanding of how natural resources relate to each other and to all of us and how our activities affect these resources. More information of the NRCS can be found at http://www.nrcs.usda.gov/.

Grassland Reserve Program

The NRCS, Farm Service Agency and Forest Service coordinate the Grassland Reserve Program (GRP) which is a voluntary program offering landowners the opportunity to protect, restore, and enhance grasslands on their property.

Wildlife Habitat Incentives Program

The Wildlife Habitat Incentives Program (WHIP) is a voluntary program for people who want to develop and improve wildlife habitat primarily on private land. NRCS provides both technical assistance and up to 75 percent cost-share assistance to establish and improve fish and wildlife habitat.

Wetlands Reserve Program

The Wetlands Reserve Program is a voluntary program offering landowners the opportunity to protect, restore, and enhance wetlands on their property. The NRCS provides technical and financial support to help landowners with their wetland restoration efforts.

Other notable NRCS programs include: the Watershed Protection and Flood Prevention Operations, Conservation Technical Assistance, the Environmental Quality Incentives Program, the Conservation Security Program, and the Resource Conservation and Development Program.

Michigan Department of Agriculture

Conservation Reserve Enhancement Program

The MDA's Conservation Reserve Enhancement Program was created to help protect our environment and wildlife. Michigan is partnering with the federal government to implement conservation practices of great significance to the state and value to the nation, in matters of soil erosion, water quality, and wildlife habitat. Information on the program can be obtained through the MDA website at http://www.michigan.gov/mda/.

Stewardship Network

The Stewardship Network is a grassroots cooperative organization working to protect, restore, and manage Michigan's natural lands and waters. It helps individuals, organizations, and businesses manage specific sites through sharing ideas, resources, and information. The network's website is located at http://www.stewardshipnetwork.org/.

Michigan Conservation Districts

Michigan's Conservation Districts (CDs) are "unique" local resource management agencies that coordinate and implement resource and environmental programs utilizing state, federal and private sector resources. The guiding philosophy of the Conservation Districts is that decision on conservation issues should be made at the local level, by local people and interests, with technical assistance provided by the government. The Conservation Districts carry out many diverse programs, including programs that deal with land management, erosion control, flood prevention, water use, groundwater, farms, forestry, wildlife, water quality, recreation, and community development. The Michigan Association of Conservation Districts can be accessed through http://www.macd.org/.

Macomb Conservation District

The Macomb CD was established in 1950 with the mission of "ensuring that land, water, forest, and wildlife, and all natural resources of the county are managed for sustained use for future generations".

Oakland Conservation District

The Oakland CD was established in 1945 with the mission "to provide natural resource assistance to private landowners, local municipalities, and non-profit organizations, to help make managing your natural resources as easy as possible".

Conservation District Websites

Macomb Conservation District
www.macombcd.com

Oakland Conservation District
www.oaklandcd.org

U.S. Fish and Wildlife Services

The goal of the U.S. Fish and Wildlife Services (FWS) is to conserve, protect, and enhance fish, wildlife, plants, and their habitats. The FWS works with the public and other government agencies to conduct environmental reviews for habitat protection and restoration, environmental contaminants, and federally threatened and endangered species. Their Partners for Fish and Wildlife Program provides assistance to landowners to restore wetlands and native prairies. Through its Coastal Program, the service focuses its efforts in bays, estuaries, and watersheds around the U.S. coastline, including Lake St. Clair. The agency's website is located at http://www.fws.gov/.

Federal Interagency Committee for the Management of Noxious and Exotic Weeds

The committee coordinates information regarding the identification and extent of invasive plants in the U.S. and federal agency management of these species by developing and sharing scientific and technical information, fostering collaborative efforts, providing recommendations for national and regional level management of invasive plants, and sponsoring technical/educational conferences and workshops concerning invasive plants. The committee's website is located at http://www.fws.gov/ficmnew/.

Geese

In many locations, geese are considered a nuisance and may contribute to water pollution, especially where they congregate in large numbers. There are many options available to control geese populations, including: a MDNR egg replacement program, a MDNR molt migration program (destroying nests to induce migration), and professionally trained border collies.

North American Waterfowl Management Plan

The North American Waterfowl Management Plan is an international action plan to conserve migratory birds throughout the continent. The Plan is a partnership of federal, provincial/state and municipal governments, non-governmental organizations, private companies and many individuals, all working towards achieving better wetland habitat for the benefit of migratory birds, other wetland-associated species and people. The Plan's unique combination of biology, landscape conservation and partnerships comprise its exemplary conservation legacy. Plan projects are international in scope, but implemented at regional levels. These projects contribute to the protection of habitat and wildlife species across the North American landscape. In fact, the North American Waterfowl Management Plan is considered one of the most successful conservation initiatives in the world. The plan can be accessed on the internet at http://www.nawmp.ab.ca/.

Bear Creek Restoration Project

The Bear Creek Restoration Project was developed to clean up waterways and improve the quality of life for Center Line, Hazel Park, Madison Heights and Warren residents. Its goal is to rehabilitate Bear Creek to support aquatic life, wildlife and recreational opportunities - such as canoeing and swimming - downstream and along Lake St. Clair.

Grant-funded by the MDEQ, the Bear Creek Restoration Project was coordinated by the CRWC and led by a committee of county and city officials, business leaders and concerned citizens.

Pheasants Forever

Pheasants Forever is a non-profit conservation organization dedicated to the protection and enhancement of pheasant and other wildlife populations in North America. This mission is carried out through habitat improvement, land management, public awareness, and education. The organization's website is located at http://www.pheasantsforever.org/.

Ducks Unlimited

The Ducks Unlimited Great Lakes/Atlantic Regional Office, located in Ann Arbor, MI and established in 1998, provides comprehensive conservation solutions to help restore and protect diminishing wetlands in 18 states, from Wisconsin to Virginia and north to Maine. The organization's website is located at http://www.ducks.org/.

Trout Unlimited

Trout Unlimited's mission is to conserve, protect and restore North America's trout and salmon fisheries and their watersheds. Trout Unlimited accomplishes this mission on local, state, and national levels with an extensive and dedicated volunteer network. The organization's website is located at http://www.tu.org/.

Michigan Audubon Society

Michigan Audubon Society works to foster the appreciation and protection of birds and their habitats through education, research, and conservation/preservation. The organization's website is located at www.michiganaudubon.org/.

Sierra Club

The Sierra Club is a diverse organization protecting communities and the planet. Their mission statement has four tenets: 1) to explore, enjoy, and protect the wild places of the earth; 2) to practice and promote responsible use of the earth's ecosystems and resources; 3) to educate and enlist humanity to protect and restore the quality of the natural and human environment; and 4) to use all lawful means to carry out these objectives. The club's website is accessible at http://www.sierraclub.org/.

Clean Water Action

Clean Water Action is a national citizens' organization working for clean, safe and affordable water, prevention of health-threatening pollution, creation of environmentally-safe jobs and businesses, and empowerment of people to make democracy work. The group's website is located at http://www.cleanwateraction.org/.

Natural Resources Defense Council

The Natural Resources Defense Council's (NRDCs) purpose is to safeguard the Earth: its people, its plants and animals and the natural systems on which all life depends. They work to restore the integrity of the elements that sustain life (air, land and water); to defend endangered natural places; to establish sustainability and good stewardship of the Earth as central ethical imperatives of human society; and to protect nature in ways that advance the long-term welfare of present and future generations. The council's website is available at http://www.nrdc.org/.

East Michigan Environmental Action Council

The East Michigan Environmental Action Council (EMEAC) works with a broad variety of stakeholders to solve environmental problems. They help residents address community concerns by providing information, research, and tools for working with local government. They also meet with business and political leaders to find practical alternatives to industrial practices that pollute air and water. The council's website can be accessed at http://www.emeac.org/.

Great Lakes Panel on Aquatic Nuisance Species

Since 1991, the Great Lakes Panel on Aquatic Nuisance Species has worked to prevent and control the occurrence of aquatic nuisance species in the Great Lakes. The Great Lakes Panel on Aquatic Nuisance Species is directed to perform the following tasks:

- Identify Great Lakes priorities;
- Assist / Make recommendations to a national Task Force on Aquatic Nuisance Species;
- Coordinate exotic species program activities in the region;
- Advise public and private interests on control efforts; and
- Submit an annual report to the task force describing prevention, research and control activities in the Great Lakes Basin.

More information on the panel can be obtained at http://www.glc.org/ans/panel.html.

U.S. Department of Agriculture – Animal and Plant Health Inspection Service

Among other functions, the service works with state and local agencies as well as private landowners and managers to eliminate invasive plants on private lands, as well as regulating importation of biological control agents. The service's website is located at http://www.aphis.usda.gov/.

Aquatic Nuisance Species Task Force

The Aquatic Nuisance Species Task Force (ANSTF) is an intergovernmental organization dedicated to preventing and controlling aquatic nuisance species and implementing the Nonindigenous Aquatic Nuisance Prevention and Control Act of 1990 and the National Invasive Species Act of 1996.

Michigan Invasive Plant Council

The Michigan Invasive Plant Council (MIPC) is a non-profit organization spanning a wide array of groups from governmental agencies, to commercial enterprises, conservation organizations, educational institutions and the gardening public. The council's website is located at http://forestry.msu.edu/mipc/.

Michigan's Aquatic Nuisance Species Council

The purpose of the Council is to advise the Office of the Great Lakes and the MDEQ, MDNR, MDA, and MDOT on implementation of the Aquatic Nuisance Species Management Plan, including: the state's efforts to prevent and control aquatic nuisance species' introduction and spread within Michigan; information/education activities about aquatic nuisance species; the coordination of research and monitoring activities pertaining to aquatic nuisance species; and revising and updating Michigan's Aquatic Nuisance Species State Management Plan as necessary.

Michigan State University Extension

The Michigan State University Extension focuses on bringing educational programs to the people of the state to improve their lives and communities. Today, county-based staff members, in concert with on-campus faculty members, serve every county with programming focused on agriculture and natural resources; children, youth and families; and community and economic development. The program's website is located at http://www.msue.msu.edu/home/.

Michigan Natural Features Inventory

The goal of the Michigan Natural Features Inventory (MNFI) is "to actively contribute to decisions that impact the conservation of biological and ecological diversity by collecting, analyzing, and communicating information about rare and declining plants and animals, and the array of natural communities and ecosystems native to Michigan." The Inventory's website can be found at http://web4.msue.msu.edu/mnfi/.

Clinton River Watershed Council

The CRWC operates numerous educational and stewardship programs that seek to enhance and natural resources. These include assessments for wetland protection, restorations of water resources, and educational guides.

The United States Geological Survey

The United States Geological Survey (USGS) serves as an independent fact-finding agency that collects, monitors, analyzes, and provides scientific data about natural resources. The USGS has no regulatory or management mission. Through its National Water Quality Assessment Program (NAWQA), the USGS is conducting water quality investigations throughout the United States. The survey's website is located at http://www.usgs.gov/.

Great Lakes Gap Analysis Program

The goal of the Great Lakes Aquatic GAP Program is to evaluate the biological diversity of aquatic species and their habitats, and to identify gaps in the distribution and protection of these species and their habitats within the Great Lakes basin. This information will provide managers, planners, scientists, and policy makers with the information they need to identify priority areas for conservation before a species is threatened or endangered.

Recreation Promotion and Enhancement

While not generally considered an essential component of watershed protection, recreation-related actions are important for a number of reasons. First, input from the public generally contains references to increased recreation opportunities. Second, recreational access to natural areas serves to foster a stewardship ethic through a greater appreciation of the watershed as a resource.

The following programs can provide assistance with recreation-related issues in the subwatershed.

Clinton River Watershed Council

The CRWC hosts many recreation activities in the watershed, including River Day in which individuals, businesses, community groups, and local governments across the watershed join forces to protect, enhance, and celebrate the Clinton River and Lake St. Clair through activities ranging from nature hikes, canoe trips, fishing derbies, and fly-fishing lessons to storm drain stenciling, river clean-ups, habitat restoration, and native landscaping. The CRWC also acts as a clearinghouse for identifying other recreation facilities and activities within the watershed through their Clinton River Watershed Recreation Guide.

Huron-Clinton Metropark Authority

The Huron-Clinton Metropark Authority is a regional special park district encompassing Wayne, Oakland, Macomb, Washtenaw and Livingston counties. Currently, 13 Metroparks covering almost 24,000 acres, serve about 9.5 million visitors annually. The Metroparks are located along the Huron and Clinton rivers, providing a greenbelt around the Detroit metropolitan area. The authority's website is available at http://www.metroparks.com/index.php.

Rails-to-Trails Conservancy

The Rails-to-Trails Conservancy is a nationwide organization "creating a nationwide network of trails from former rail lines and connecting corridors to build healthier places for healthier people." The conservancy's website can be found at http://www.railstrails.org/.

Michigan Department of Natural Resources

The MDNR regulates many of the recreational activities throughout the state of Michigan including hunting, fishing, boating, and off-road vehicle use. The department also operates numerous state forest lands, campgrounds, parks, recreation areas, harbors, and trails.

State Historic Preservation Office

Historic preservation enhances the quality of our environment and lives. Urban areas find renewal. Small towns retain the character that set them apart from other communities. Cultural landscapes are protected from uncontrolled development. The office's main function is to provide technical assistance to local communities in their efforts to identify, evaluate, designate, and protect Michigan's historic resources. The State Historic Preservation Office (SHPO) also administers an incentives program that includes state and federal tax credits and pass-through grants available to Certified Local Governments.

A Storm Sewer Outfall to the Red Run: IDEP Programs Target These to Identify Illicit Discharges

Photo courtesy of MCPWO.

CRWC Stream Leaders

Courtesy of CRWC

CRWC Adopt-A-Stream

Courtesy of CRWC

Macroinvertebrates

Backbone-less organisms that are large enough to see with the naked eye. Two examples are insects and benthic organisms.

Monitoring

This section discusses existing programs that can be leveraged and other protocols that can be utilized to obtain data for measuring success of the WMP.

Existing Programs

The programs listed in this sub-section are currently being implemented by their respective organizations.

County and Municipal Illicit Discharge Elimination Programs

Based on Watershed-based Permit requirements, the county departments and municipal governments are conducting field work to identify illicit connections to and discharges from the storm sewer infrastructure. A significant portion of this work involves walking waterbodies and sampling outfalls for a number of pollutants. These programs should be kept in mind for leveraging and combining field work and data collection.

County Health Departments – Surface Water Quality Monitoring

The Macomb County Health Department (MCHD) conducts a number of monitoring programs that document water quality conditions throughout the subwatershed, including the Lake St. Clair Assessment, Beach Monitoring, Surface Water Testing, and the Lake St. Clair Regional Monitoring Project. Oakland County also has various programs generating water quality data.

Clinton River Watershed Council - Stream Leaders Program

Across the watershed, students and teachers are learning about water quality issues and helping protect their community's water resources by becoming volunteer water quality monitors. They are analyzing water samples for dissolved oxygen, nutrients, pH, temperature, and a host of other chemical constituents; evaluating the health of stream habitats and aquatic biological communities; inventorying physical stream-side conditions and land uses that may affect water quality; cataloging and collecting river, lake and beach debris; restoring degraded habitats; and making community presentations.

Clinton River Watershed Council - Adopt-A-Stream

Twice a year, teams visit their adopted sites and collect data, including physical information (such as extent of streambank erosion and surrounding land use) and chemical information (such as water temperature and pH). They collect and identify benthic macroinvertebrates that live in the streambed and surrounding vegetation. Different macroinvertebrates need specific conditions in which to survive and reproduce. Some are very pollution sensitive while others can tolerate highly polluted water. A stream's health can be determined by the number and types of macroinvertebrates that live in it.

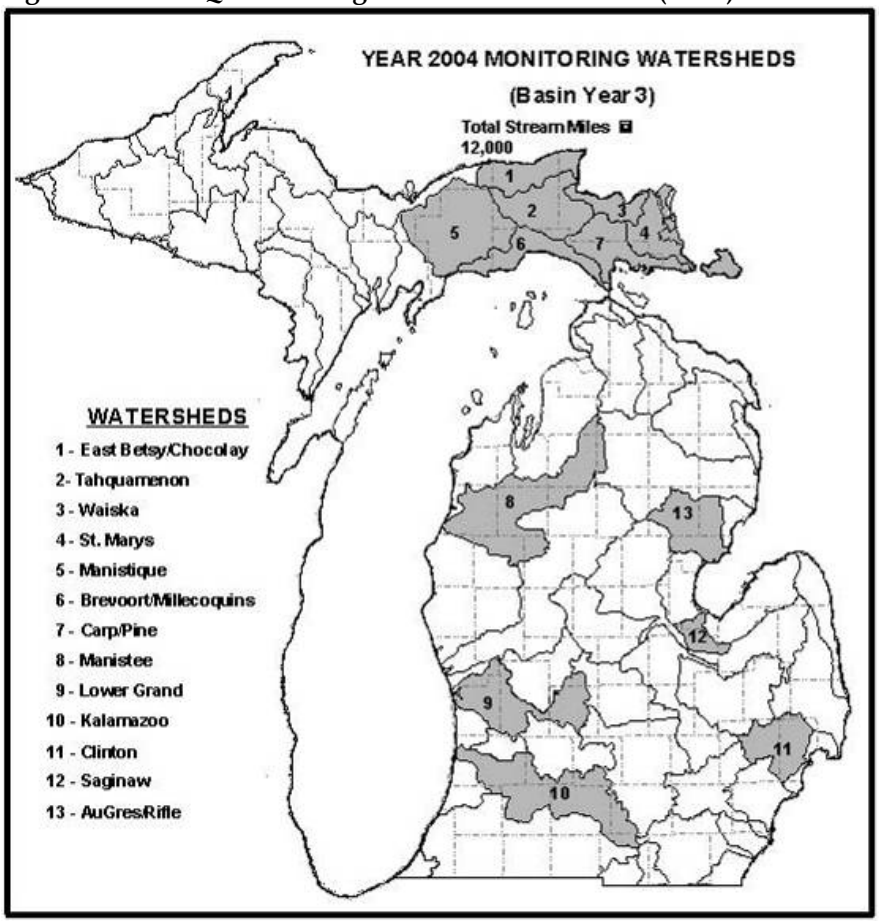
Public Education Plan Evaluation

The public education plans (PEPs) for all of the permittees in the subwatershed are currently being implemented (since 2004), including an assessment of the measures of success associated with the PEP actions. The data for these assessments should also be considered with respect to the assessments to be conducted in evaluating and revising this WMP.

Michigan Department of Environmental Quality

The Michigan Department of Environmental Quality (MDEQ) routinely collects data that include water quality, macroinvertebrate sampling, and fish studies. The environmental monitoring program incorporates four main goals, including assessment of current conditions of waters of the state, identifying whether water quality standards are being met, measuring water quality trends, evaluating water quality protection and prevention program effectiveness, and recognize emerging water quality problems. The data collection occurs on a five-year cycle, as depicted in the sidebar figures and Figure 7-4 which depicts Basin Year 3 (2004).

Figure 7-4. MDEQ monitoring basins for Basin Year 3 (2004.)



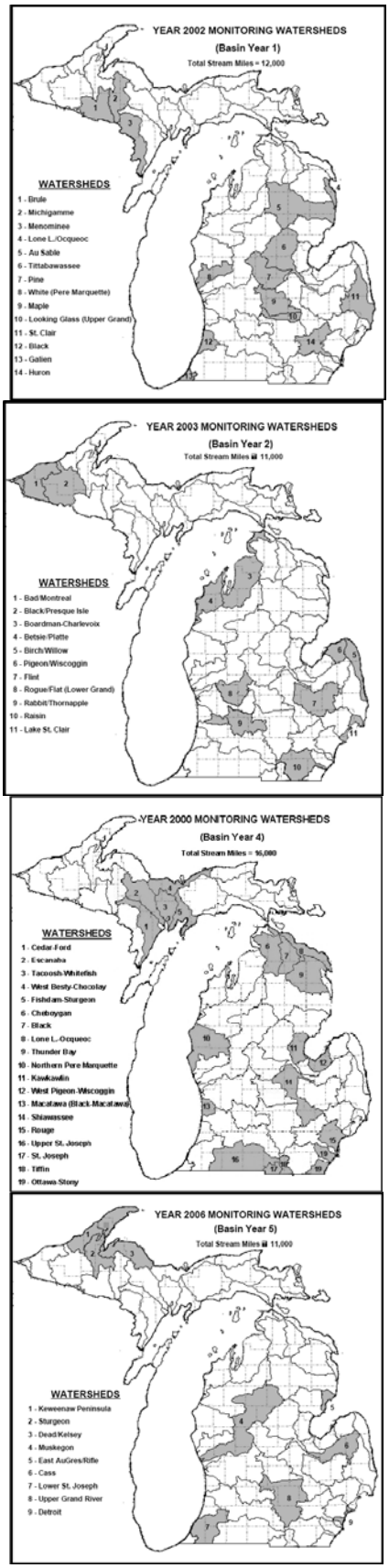
Source: MDEQ, 2006.

The five year rotating basin watershed monitoring activities include fish contamination studies, macroinvertebrate evaluations, water and sediment chemistry studies, and wildlife contamination studies. Information from the studies is summarized and available to the public. For more water quality monitoring program information, see Chapter 3 of this plan or visit the MDEQ web site at www.michigan.gov\deq\.

Southeast Michigan Council of Governments – Social and Municipal Surveys

The Southeast Michigan Council of Governments (SEMCOG) conducted a social survey to establish a baseline level of knowledge among the residents in the region, including the subwatershed. Additionally, SEMCOG conducts surveys with respect to its municipal training and

MDEQ Basin Years 1,2,4 & 5



Source: MDEQ, 2006.

other educational activities. These data, and data from future surveys, can be used in assessing many of the measures of success in this WMP.

Michigan Department of Natural Resources

The Michigan Department of Natural Resources (MDNR) routinely collects data similar to the MDEQ's but with a greater focus on macroinvertebrates and especially fish studies (including habitat, diversity of fish, abundance of fish, contaminants in fish tissue, and taste and odor tests). A wildlife action plan was generated for Michigan to identify and prioritize conservation needs of native species and habitats. The plan gives a greater emphasis on species of greatest conservation needs. Other monitoring and management programs include the fish consumption advisory study, fish identification programs, and amphibian surveys.

Environmental Protection Agency

In some cases, the U.S. Environmental Protection Agency (EPA) may be involved in obtaining water quality data. This data may be documented in specific reports and also stored in the agency's STORET database. This database also contains data provided by outside sources.

United States Geological Survey

The United States Geological Survey (USGS) is involved in obtaining stream-flow data and some water quality data. The USGS maintains the National Water Information System that houses and organizes this data for easy access.

United States Army Corps of Engineers

The United States Army Corps of Engineers (USACE) conducts sediment and water quality sampling as part of its maintenance dredging program under the Rivers and Harbors Act.

Other Existing Programs

Many other existing programs may exist that can provide data to use in assessing the measures of success. Some organizations to consider for the possibility of programs to generate these additional data include the National Oceanic and Atmospheric Administration (NOAA), the International Joint Commission (IJC), and the Great Lakes Commission (GLC).

Other Protocols

The protocols listed below are not currently implemented on a regular basis but should be considered as methods to obtain appropriate data for conducting assessments.

Road-Stream Crossing Surveys

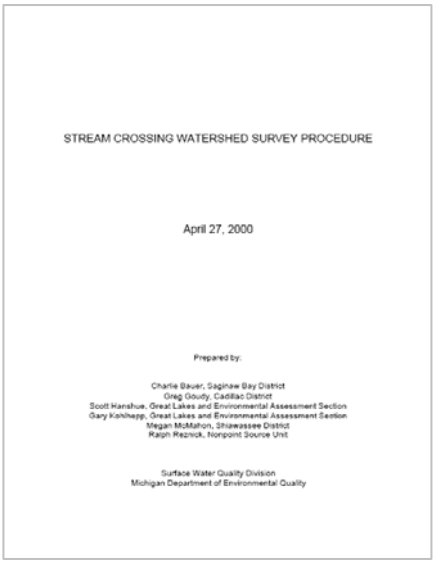
The stream crossing watershed survey is an approach used to collect information about the quality of a stream. A standard data collection form is used to ensure uniformity throughout the watersheds. The physical habitat of the site including water characteristics, stream characteristics, plant life, foam and trash presence, substrate type, stream morphology, land use, and corridor description are recorded. Also potential sources of pollution upstream and downstream of the site are identified if apparent.

The MDEQ maintains a statewide database and standard protocol set that can easily be implemented. The MDEQ may provide training upon request.

U.S. EPA STORET

"STORET (short for STOrage and RETrieval) is a repository for water quality, biological, and physical data and is used by state environmental agencies, EPA and other federal agencies, universities, private citizens, and many others." (U.S. EPA, 2006)

The database may be accessed at http://epa.gov/storet/.


STREAM CROSSING WATERSHED SURVEY PROCEDURE

April 27, 2000

Prepared by:

Charlie Bauer, Saginaw Bay District
Greg Cloudy, Cadillac District
Scott Hanshue, Great Lakes and Environmental Assessment Section
Gary Kohlhepp, Great Lakes and Environmental Assessment Section
Megan McMahon, Shiawassee District
Ralph Reznick, Nonpoint Source Unit

Surface Water Quality Division
Michigan Department of Environmental Quality

Stream Assessment

During this effort the participants walk reaches of a stream looking for and recording issues potentially impacting the waterbody such as outfalls, bank erosion, buffer, channel modifications, trash and debris, and impacts from utilities. Issues such as substrate, water clarity, plant and wildlife, shade cover can also be noted. Some data collected during the assessments overlap with data collected using other methods.

Stream corridor assessments may be conducted as part of a canoe trip on waterways large enough to support canoeing.

This method is similar to the Road-Stream Crossing Surveys but is conducted on entire stretches of stream as opposed to discrete sites where streams and roads cross. Example methodologies include that which is developed by the Center for Watershed Protection (CWP) and outlined in 'Unified Stream Assessments: A User's Manual' Version 2.0 and the method developed by the U.S. EPA .

Unified Subwatershed and Site Reconnaissance

The Unified Subwatershed and Site Reconnaissance (USSR) survey, developed by the CWP (2005), involves conducting quick but thorough characterizations of upland areas. The goal of the USSR is to identify major source types and areas that potentially contribute pollutants to waterbodies. The four major components of this survey include: neighborhood source assessments, hotspot site investigations, pervious area assessments, and street and storm drains assessments.

Hot Spot Testing

Parts of the watershed encompass land once and currently used for industrial and commercial purposes. Prior to government regulation, a number of pollutants were released without realizing their potential impacts on public health and safety and water quality in aquatic environments. In addition to this historical pollution, various hot spots of pollution may exist due to accidental release or intentional, illegal releases. Any known or discovered hot spots may be monitored for the applicable pollutants.

BMP Monitoring

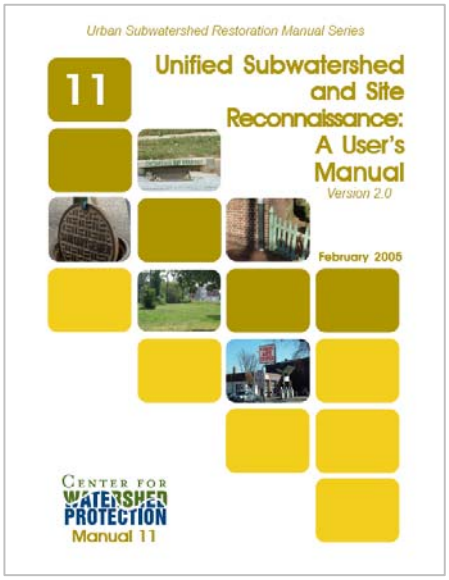
In order to properly document load reductions (Level Four), monitoring may be done at sites where BMPs are installed both before and after implementation. Alternately, load reductions can be calculated using standard values.

Wet Weather Discharge Sampling

Currently, the various IDEP programs are responsible for monitoring dry weather discharges from the storm sewer systems. However, to properly document changes in water quality discharged from the storm sewer systems (Level Five), sampling will need to be done during wet weather conditions.

Additional Methodologies

Additional methodologies may be required to properly assess the effectiveness of this plan. Possibilities for these include assessments of: the R-B flashiness index; the extent of channelization; the level of imperviousness; open space; development in the floodplain; basement flooding, CSOs, and/or SSOs; the status of the designated and/or beneficial uses for waterbodies; groundwater conditions; septic system distribution and performance; and beach closings.



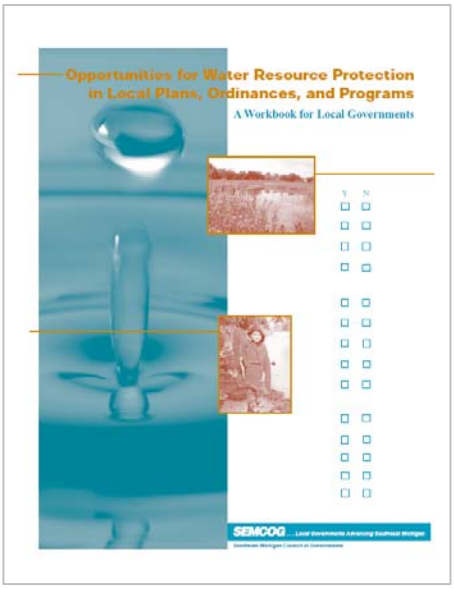
Water Quality Index

Many different analytical chemistry tests may be performed to determine the quality of surface water. The tests may be considered individually or combined together in an index. An example of one such index was created and designed by the National Sanitation Foundation (NSF) in 1970 called the Water Quality Index (WQI). The purpose of the index is to measure water quality changes in a particular river reach over time and provide a means to compare results with different reaches of the same river or other rivers. The WQI includes testing the water for dissolved oxygen, fecal coliform, pH, biochemical oxygen demand (BOD), temperature, total phosphate, nitrates, turbidity, and total solids. The nine resulting values are then added, with weighting factors, to arrive at an overall water quality index (Mitchell, 2000).

Other Resources

A vast number of other resources may be utilized or consulted in implementing watershed protection, including:

- The Michigan Department of Community Health;
- The United States Forest Service;
- Other Department of the Interior Agencies (in addition to the previously mentioned Fish and Wildlife Service and USGS);
- World Wildlife Fund;
- Wildlife Habitat Council;
- The Conservation Fund;
- The National Wildlife Federation;
- United States Army Corps of Engineers;
- United States Coast Guard;
- United States Department of Homeland Security; and
- United States Department of Transportation.



Summary

As the 'Current Subwatershed Protection Practices' section of Chapter 3 detailed, the level of aquatic resource protection in the subwatershed is less than optimal. This chapter detailed many actions that can be taken towards improving aquatic resource protection and achieving the goals and objectives presented in Chapter 6. Also included were actions for meeting natural feature protection / restoration and recreational goals and objectives.

When determining the specific actions to implement, each entity represented by the plan can reference "Opportunities for Water Resource Protection in Local Plans, Ordinances, and Programs" (SEMCOG, 2002) to help determine deficiencies and suggested improvements in the following categories:

- Storm Water Management Standards;
- Engineered Best Management Practices;
- Infiltration Practices;
- Impervious Surface Reduction, including:
  - Parking Lots and Streets; and
  - Lot Setbacks, Widths, and Coverage;
- Land Conservation and Development Techniques, including:
  - Open Space and Parks Acquisition;
  - Conservation Easements and Similar Tools;
  - Urbanized Community Activities;
  - Rural Community Activities; and
  - Clustering and Open Space Development;
- Soil Erosion and Sediment Control;
- Sanitary Sewer Planning and Infrastructure, including:
  - Septic Systems; and
  - Illicit Discharge Elimination;
- Groundwater Protection;
- Green Infrastructure;
- Natural Area Preservation and Restoration, including:
  - Habitat;
  - Native Plant Species;
  - Wetland Protection;
  - Woodlands Preservation; and
  - Stream Corridors and Floodplains;
- Capital Improvement Plan;
- Watershed-based Activities;
- Public Education;
- Pollution Prevention / Good Housekeeping; and
- Development Review Process.

The list of actions that will be implemented is presented in Chapter 8. The selection of the actions was done in an adaptive management setting based in part on the information presented in this chapter.

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