

## ***Chapter 6 – Best Management Practices***

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To meet the watershed goals and objectives outlined in Chapter 4, a series of tasks, or Best Management Practices (BMPs), will be selected by each Phase II permittee to address the pollutants, impairments and concerns that are affecting the designated and desired uses in the NEW. This chapter defines a wide range of BMPs that can be implemented to work towards achieving the goals and objectives established in this Watershed Management Plan (WMP). Each permittee will be identifying their level of commitment to implementing applicable BMPs in an “Action Plan Matrix” as outlined in Table 7.1 of Chapter 7. The permittee-specific commitments will then be elaborated upon and included in their Stormwater Pollution Prevention Initiative (SWPPI) which is due for submittal to the MDEQ by May 1, 2007. The level of commitment for each BMP will be determined based on each permittees unique situations, staffing, and funding resources.

### **6.1 Management Alternatives**

BMPs are the main tools to help control the quality and quantity of storm water runoff from construction sites, urban areas, agricultural areas, roadways, and recreational areas—the most common areas that nonpoint source pollutants can be picked up by storm water runoff. There are four main goals associated with the effective use of BMPs:

- A. To minimize or treat the pollutants picked up by runoff before it enters surface waters and groundwater,
- B. To promote pollution prevention,
- C. To minimize the amount of impervious surfaces and directly-connected impervious areas, thereby reducing runoff quantities, and
- D. To promote infiltration.

BMPs can be grouped into two main categories:

1. **Non-structural BMPs:** These practices aim to prevent or reduce runoff problems in receiving waters by reducing potential pollutants or managing runoff at the source. These BMPs may include regulatory controls (codes, ordinances, regulations, standards or rules) or voluntary pollution prevention practices. The regulatory controls typically apply to land use practices and the voluntary pollution prevention practices primarily involving education and outreach activities. A description of the basic types of nonstructural BMPs is provided below:

- A. **Managerial (Operational) BMPs:** These practices can be categorized under two basic topics:

- i. The modification or enhancement of municipal operations (pollution prevention and good housekeeping); and,
- ii. Land use planning that involves the adoption and enforcement of development codes, ordinances and other regulations that aim to preserve natural resources that promote effective storm water management, or encourage/require development procedures that address storm water quality and quantity issues.

The goal for implementing these BMPs is to promote pollution prevention and protect and improve water and natural resources.

**B. Educational and Outreach BMPs:** These practices involve strategies that employ public education of residents, visitors, businesses, contractors, industries, developers and municipal officials and employees on storm water pollution prevention and protection of natural resources. This will be one of the key components of BMP implementation in the NEW WMP as they aim to promote pollution prevention.

**2. Structural BMPs:** These practices involve “brick and mortar” technologies and “vegetative” practices that are designed and engineered to manage or alter flow, velocity, duration, and other characteristics of runoff by physical means. These BMPs aim to control volume, peak discharge rates, and in some cases, improve water quality. Installation of these BMPs may also reduce downstream erosion, provide flood control, filter pollutants from runoff, and promote groundwater recharge. These BMPs are typically categorized as site controls, as opposed to source controls.

As part of the Phase II regulatory process, the permit aims to address “six minimum measures” to minimize and reduce the discharge of pollutants to the waters of the state to the maximum extent practicable (MEP). A system of BMPs will be used to address these minimum measures in addition to other natural resource concerns in the watershed. The first six measures listed below are the minimum measures that should be addressed to have an effective storm water management plan. The seventh measure has been added in order to have a means to assess progress and work cooperatively towards meeting the goals and objectives of this WMP:

1. Public Education and Outreach
2. Public Involvement and Participation
3. Illicit Discharge/Connection Elimination
4. Construction Site Stormwater Runoff Control
5. Post-Construction Stormwater Management in New Developments and Redevelopments
6. Pollution Prevention/Good Housekeeping for Municipal Operations
7. Watershed Plan Implementation

## **6.2 Best Management Practice Descriptions**

A description of each type of recommended BMP is summarized in the following paragraphs. Chapter 7 (Watershed Action Plan) contains the action plan matrix that delineates which BMPs will act to achieve the watershed plan goals and objectives, as well as which BMPs each permittee will begin implementing, or will continue to implement.

### **6.2.1 Public Education and Outreach**

Since most of the land use activities and behaviors associated with activities on the land lie in the public’s hands, this is the audience that is largely responsible for the health of the water and natural resources of a watershed. The goal of public education BMPs is to help people understand the watershed impact of some of their day-to-day activities and help them implement actions that will improve and protect water quality. Each permittee in St. Clair County’s Northeastern Watersheds (NEW) must implement a Public Education Plan (PEP) that was submitted to the Michigan Department of Environmental Quality (MDEQ) on November 1, 2004. The plan addresses educating the public about pollution prevention activities and other key topics in regards to:

- Raising awareness and knowledge among residents of St. Clair County’s watersheds and how daily activities impact this resource;

- Educating the public regarding the importance of watersheds as a significant natural resource and community asset by fostering watershed stewardship and enthusiasm for the resource;
- Improving understanding of the impacts of individual and group behaviors on water quality; and,
- Increasing the number of individuals, schools, and other organizations participating in water education and stewardship activities.

In the case of managing agricultural runoff, there is little regulatory framework for municipalities to control how agricultural landowners manage runoff. As such, pressure to correct problems in the form of notification letters and public education measures for agricultural landowners/managers will be essential. Organizations such as the Natural Resources Conservation Service (NRCS), the St. Clair and Sanilac County Conservation Districts, and Michigan State University (MSU)-Extension already help interested agricultural landowners by providing them with site walks and information that will help them assess the impacts their land may have on the environment and the best ways to mitigate harmful practices. Some of the most common nonpoint source pollutants associated with agricultural runoff are sediment, plant nutrients (nitrogen and phosphorus), pesticides, salts and pathogens (livestock waste). In addition, uncontrolled runoff quantities from tiled fields and ditching practices contribute to flashy hydrological conditions in downstream tributaries.

Additional information on public education and outreach BMPs is available at: [http://cfpub.epa.gov/npdes/stormwater/menuofbmps/pub\\_ed.cfm](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/pub_ed.cfm).

An extensive website clearinghouse of available public education and outreach materials is available through the US EPA's website at: <http://www.epa.gov/nps/outreach.html>.

### **Develop and Distribute Outreach Materials on Watershed Awareness and Stormwater Management (BMP 1)**

The St. Clair County Health Department (SCCHD), in coordination with other Phase II permittees, has identified a number of educational approaches to increasing the public's knowledge of storm water management principles, increasing watershed awareness, and how individual actions can impact the watershed. The approaches that are or will be developed to share this information is available through newsletters, brochures, websites, workshops, presentations, public events/fairs, and television and newspaper media. These actions are outlined in Chapter 8, Section 8.2, Information and Education Implementation Strategy, and St. Clair County's PEP, which is included in Appendix M.

Permittees are encouraged to call the SCCHD for more information on any of the programs or go to their website at: <http://www.cis.stclaircounty.org/planning8441673.asp>.

### **Utilize the "Seven Simple Steps to Clean Water" Campaign Materials and Mass Media Efforts (BMP 2)**

Most permittees are a member of SEMCOG, which offers the Southeast Michigan Partners for Clean Water program. As part of this program, each permittee participates in the Seven Simple Steps to Clean Water campaign by making available the program's educational materials through their website and cable television station, and distributing brochures, tip cards, and other print media to stakeholders and residents. A portable display that highlights these materials is available on free loan from the SCCHD. This display can be used with SEMCOG's tip cards at fairs, annual meetings, or placed on display at local offices. These materials provide a means to convey the importance of the protection of water quality as it relates to seven key topics including: storm drain awareness, fertilizer usage, household hazardous waste disposal, pet waste disposal, water conservation, landscaping for water quality, and car

wash/auto care. Seven Simple Step tip cards and posters are available for free download on SEMCOG's website at: <http://www.semcog.org/OursToProtect/OurstoProtect.htm>.

**Encourage the Use of Generally Accepted Agricultural Management Practices (GAAMPs) (BMP 3)**

Considering that the watershed is predominately agricultural, efforts to protect water quality from excess nutrients, bacteria and soil erosion from agricultural lands is a significant consideration in watershed management. State agencies have chosen to manage agricultural practices through measures known as Generally Accepted Agricultural Management Practices (GAAMPs). These practices provide agricultural landowners with guidelines to follow in regard to nutrient and pesticide application and storage, manure management, groundwater protection, and many other BMPs to protect surface and groundwater supplies, as well as habitat. Municipalities are encouraged to send notification letters to agricultural landowners in violation of GAAMPs and encourage compliance through communication and education. The NRCS District Conservationist for St. Clair County recommends that these letters be copied to the local Conservation Districts, the NRCS office, and the MSU-extension office for follow-up contact and information regarding available assistance and funding sources. The SCC's District Conservationist has identified cattle exclusion as the first priority to educate agricultural landowners, followed by encouraging conservation buffers as the second priority. Other practices that may be encouraged include conservation tillage, crop nutrient management, weed and pest management—or integrated pest management (IPM), and the use of waste storage facilities on agricultural lands.

The US EPA has reported that over 40% of Section 319 funding is typically used to help design and build management approaches to prevent and control nonpoint source pollution from agricultural lands.

Additional information on GAAMPs can be obtained at:

[www.nrcs.usda.gov/technical/efotg](http://www.nrcs.usda.gov/technical/efotg) or at [http://www.michigan.gov/mda/0,1607,7-125-1567\\_1599\\_1605---,00.html](http://www.michigan.gov/mda/0,1607,7-125-1567_1599_1605---,00.html).

An excellent resource for public education materials for agricultural landowners is available through the USDA at: <http://www.unl.edu/nac/pubs.html>.

**Encourage Reduced Fertilizer, Pesticide and Herbicide Usage (BMP 4)**

Provide information to the public regarding the negative impacts from the overuse/misuse of fertilizers/pesticides/herbicides to area waterways and aquatic life. In addition, permittees should implement programs that aim to reduce the amount of fertilizers and pesticides/herbicides used for grounds maintenance.

Staff that maintains publicly-owned lands should implement nutrient and pesticide reduction programs in order to protect water quality and aquatic habitat. Staff should be educated on the proper rates, times, and methods of applying both fertilizers and pesticides. Approaches such as soil testing (BMP 13) to determine the right types of fertilizers to use, and an approach known as Integrated Pest Management (IPM) should be utilized to reduce the need for the use of harmful pesticides and herbicides. Additional information on IPM is available at: [www.ipm.msu.edu](http://www.ipm.msu.edu). Practices such as installing and maintaining native landscaping (BMP 67) and establishing no-mow zones along riparian corridors (BMP 69) will aid in reducing the need for these chemical applications.

**Seek Participation from the Public during Earth Fair and River Day (BMP 5)**

The public will be educated about pollution prevention and watershed awareness and stewardship at the annual Earth Fair and River Day events. The public will also be encouraged to participate in watershed awareness activities such as storm drain marking, adopt-a-stream, and adopt-a-road programs during

these events. More information on participating in these activities can be obtained from the SCCHD Storm Water Program which helps coordinate these events on an annual basis.

#### **Implement Employee Training Programs (BMP 6)**

Education is an integral component of nonpoint source pollution prevention. The general watershed permit states that a training program is required of staff employed by permittees as it pertains to:

- Illicit discharge detection and elimination,
- Soil erosion and sedimentation control,
- Operation, inspection, and maintenance procedures of structural and nonstructural storm water management BMPs that are owned and operated by permittees,
- Operation and maintenance of roadways, parking lots, storage yards, and maintenance garages,
- Practices related to grounds and fleet maintenance such as mowing practices, fertilizer and pesticide applications, hazardous materials storage, and methods for servicing and washing vehicles, and
- Disposal practices of operation and maintenance wastes.

In order to achieve many of these training objectives, the SCCHD is currently working with a SEMCOG education subcommittee to develop training materials which will be available to interested permittees as they are developed. SEMCOG released the first of these materials promoting BMPs for “Maintenance and Storage Yards” in a workshop in July 2006. SEMCOG plans to offer future materials and training that will address the above bulleted activities over the next couple years.

#### **Promote St. Clair County’s 24-Hour Water Quality Hotline (BMP 7)**

The SCCHD maintains a 24-hour hotline for the public to report failing on-site septic disposal systems, illicit discharges or illegal dumping. This hotline also provides information on current beach closures and an option for the caller to leave a water quality question. The phone number is “**877-504-SWIM**”. Permittees should advertise the hotline on their website, in newsletters or brochures, or via other media. The SCCHD plans to work with local schools each year and sponsor an annual drawing contest in which the winning design is turned into the water quality hotline advertisement for the year. More information about this contest and posters is available at the SCCHD.

#### **Develop and Distribute Outreach Materials on Low-Impact Design (BMP 8)**

Provide educational materials to local officials, developers, contractors and land use planners on low-impact design (LID) principles and design strategies. Materials could include brochures, presentations, workshops, and information in newsletters or on a website. Additional information on LID is available at: [www.lowimpactdevelopment.org](http://www.lowimpactdevelopment.org). The Southeast Michigan Council of Governments (SEMCOG) and the MDEQ have partnered to develop a statewide manual on LID guidance. It is anticipated that the manual will take approximately 1.5 years to complete. This manual will provide an additional resource for local communities to utilize in updating their zoning ordinances for water quality and natural resource protection.

#### **Encourage the Use of Household Hazardous Waste Disposal and Electronics Recycling Programs (BMP 9)**

The St. Clair County Environmental Services (SCCES) Department offers a household hazardous waste disposal program for county residents that is available through out the year, Monday through Friday, 9am – 2pm. An appointment must be made before drop off. The program allows residents to safely dispose of harmful household, lawn/garden, and workshop chemicals that can not be disposed of by regular means. Permittees should encourage the use of the program through various media (brochures,

newsletter, website, etc.) SCC hosts a website that explains the program, and is available at: [http://www.stclaircounty.org/offices/landfill/hhw\\_drop.asp](http://www.stclaircounty.org/offices/landfill/hhw_drop.asp).

Electronics often contain harmful metals that can contaminate soils and groundwater when disposed of in landfills. Recycling of electronic waste should be encouraged to reduce the environmental impacts from these materials. For a small fee, the SCCES will accept a variety of electronic materials for recycling. Information on the materials accepted and fees charged by the SCCES is available at: <http://www.stclaircounty.org/Offices/landfill/electronics.asp>.

#### **Install Watershed Signage (BMP 10)**

Permittees are encouraged to install watershed signage in order to increase the public's awareness of their location in a watershed and increase awareness on the location of area waterways. The SCCHD has developed a design template for watershed signage that should be used for a consistent look throughout the county. Information on placement, ordering, and installation of the signs is available from the SCCHD. The SCCRC will install signs for Cities/Township's for a standard fee if the sign falls within the road right-of-way.

#### **Promote the Adopt-A-Stream Program (BMP 11)**

The St. Clair County MSU-Extension office offers an Adopt-A-Stream program through their 4-H Youth Program that helps promote watershed education by providing education and tools to civic groups for monitoring of a local waterway. The program is designed to encourage community involvement and open to youth clubs, schools, churches, neighborhood associations, lake associations, businesses, civic organizations, etc. Local municipalities can encourage local residents or civic groups to participate in this program and provides an them with an effective way to involve and educate residents, as well as obtain local water quality monitoring data. As part of the program, volunteers can implement streambank clean ups, conduct streambank surveys, monitor stream insects and gauge water quality, and learn about the watershed as a whole. These activities are generally conducted twice a year in the spring and fall.

In order to begin an Adopt-A-Stream program in a desired area, the following conditions must be met:

1. A group of approximately ten (10) people including adult advisors and one group leader are needed per half mile of stream, and
2. An "Adopt-a-Stream Application" form should be filled out. Applications are available online at: <http://msue.stclaircounty.org/4H/AdoptAStreamApp.htm> or the program coordinator, Liane Allen, can be contacted via phone at: (810) 989-6935 or email at: [msue@stclaircounty.org](mailto:msue@stclaircounty.org).

At no cost, group leaders are trained and provided with all equipment necessary prior to spring and fall monitoring dates.

#### **Promote the Adopt-A-County Road Program (BMP 12)**

This program is offered through the St. Clair County Road Commission and is designed to bring the community together to beautify the county's roadsides and reduce the amount of trash, litter, and debris that can enter area waterways in surface water runoff. Implementation of this program can help protect water quality and aquatic habitat, as well as increase aesthetics throughout the watershed.

The program requires that a group of at least six (6) people and three (3) alternate participants should be formed. Groups commonly associated with the program include scout troops, activity and youth groups, businesses, clubs, and service organizations. Crew members must be a minimum of 12 years old, and children between the ages of 12 to 15 must have adult supervision at a ratio of one adult for every three

(3) children. Participants are asked to pick up litter a minimum of three (3) times per year from the primary roadsides in their designated area. There is no fee to be a part of the program and safety vests, required to be worn by participants, are provided at no cost by the Road Commission. Litter bags and pickup service of the filled bags is also provided. Additional information on the Adopt-A-County Road Program is available at: <http://www.sccrc-roads.org/adoptahighway.htm>.

**Provide Information on the Soil Testing Program (BMP 13)**

The SCC MSU-Extension office offers a soil testing program for county residents for a minimal fee to ensure the proper use and application of the right type of fertilizers for their lawn, gardens, and farm fields in order to reduce the amount of nutrient loading in the watershed. Permittees are encouraged to advertise the program to area residents through flyers, newsletters, websites, and other applicable media. More information on SCC MSU Extension soil testing services is available at: <http://web1.msue.msu.edu/monroe/soilweb2/testing.htm>.

**Encourage Participation in the Citizen Planner Program (BMP 14)**

There are two (2) MSU-Extension offices surrounding the SCC area that offer the Citizen Planner Program. One program is offered through the Macomb County Extension office and the other is offered by the Sanilac County Extension office. The Citizen Planner Program is designed to address the basic ongoing training needs of citizens appointed to serve on local land use planning boards and commissions. A primary goal of the program is to equip community leaders and interested citizens with the technical knowledge and understanding of the legal framework of planning and zoning, and leadership skills to perform their duties more effectively and to create a forum to build a volunteer core of program participants/graduates to advance good land use education within their communities. Additional details on program offerings are available online at: <http://web1.msue.msu.edu/cplanner/>. Phase II permittees in the NEW are highly encouraged to support attendance of their local planning boards and commission members to stay informed on emerging land use issues and to gather and implement the most useful tools to achieve many of the goals and objectives of this WMP.

**Provide Education on the Identification of Failing Onsite Septic Disposal Systems (BMP 15)**

Failing onsite septic disposal systems (OSDS) provide a conduit for excess nutrients and harmful pathogens to enter surface waters or groundwater supplies by overland flow or through infiltration. A number of educational materials are available to area residents regarding proper OSDS operation and maintenance. The SCCHD offers an informational brochure on OSDS operation and maintenance guidelines, and a variety of education assistance programs are available, including the local MSU-extension office's Home\*A\*Syst program. Phase II permittees in the NEW are encouraged to educate area residents on the proper operation and maintenance of OSDS through the various media available (websites, newsletters, brochures, etc.). Brochures on OSDS operation and maintenance can be obtained by calling the SCCHD.

**Encourage Reduced Use of Road Salt and Promote Alternative Deicing Chemicals (BMP 16)**

Conventional road salt (sodium chloride) is highly soluble in water and can easily wash off pavement into surface waters and leach into soil and groundwater. High concentrations of salt can damage and kill vegetation, disrupt fish spawning in streams, reduce oxygen solubility in surface water, interfere with the chemical and physical characteristics of a lake, pollute groundwater making well water undrinkable, disintegrate pavement, and cause metal corrosion of bridges, cars and plumbing. Managers are encouraged to consider the use of alternatives to conventional salt, such as calcium chloride, or to ensure proper calibration of salt spreaders to reduce the amount of salt needed to the maximum extent practicable.

Education regarding alternative materials can also be passed on to residents and business owners that commonly use these materials. In addition, information regarding safe application rates can also be

provided through various means via website, newsletters, news articles, brochures, training programs, and workshops.

### **Encourage Golf Course Nutrient Management (BMP 17)**

There are several golf courses throughout the NEW and management of these lands is important to minimize input of nutrients to surface waters. There are a number of voluntary programs available to educate golf course managers about nutrient management. Organizations such as the United States Golf Association conduct research and publish BMPs for environmentally-sound turf management practices. The local MSU Extension office also has educational resource materials available.

## **6.2.2 Public Involvement and Participation**

These BMPs will aim to involve the public in the decision-making process for how to best manage storm water pollution and prevention principles and plan for those strategies. Interaction with the public will come into play at public meetings, workshops, public education events (waterfests, monitoring events, etc.) and through other media such as the internet, cable television, and newspaper.

Additional information on public involvement and participation BMPs is available at: [http://cfpub.epa.gov/npdes/stormwater/menuofbmps/pub\\_inv.cfm](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/pub_inv.cfm).

### **Perform Storm Drain/Catch Basin Marking (BMP 18)**

Storm drain marking is an inexpensive way to help the public become more aware of storm drain systems, and gain understanding of how storm water runoff gets collected into these systems and is discharged to area waterways untreated. The messages conveyed in the markers outline the importance of pollution prevention for catch basins and storm sewer systems to protect water quality downstream. Template storm drain markers with a common SCC design have been created by the SCCHD. Permittees are encouraged to call the SCCHD for information on ordering these markers and how a volunteer event to place the markers can be organized and conducted.

### **Seek Input from the Public on Development of Ordinances for Water Quality and Quantity Protection (BMP 19)**

The municipalities and agencies will follow regular protocol for obtaining public input whenever a new or amended ordinance is pending in their community.

### **Seek Participation from the Public at St. Clair County's NEW Watershed Advisory Group Meetings (BMP 20)**

During implementation of St. Clair County's NEW watershed management plan (WMP), the public should be invited to provide input and recommendations on all components. Citizens should be invited to WAG meetings where a topic relevant to their interests is discussed. In addition, the public should be solicited for input during selection for revisions of the WMP in the future.

Other BMPs defined in the previous section of this chapter that will also aim to achieve the objectives of involving the public in water quality protection initiatives include:

- **BMP 5:** Seek Participation from the Public during Earth Fair and River Day
- **BMP 11:** Promote the Adopt-a-Stream Program
- **BMP 12:** Promote the Adopt-a-County Road Program

### **6.2.3 Illicit Discharge/Connection Elimination**

Permittees are required to fulfill the tasks outlined in their Illicit Discharge Elimination Plans (IDEP) which also include providing information to the public regarding illicit discharge/connection elimination.

Additional information on illicit discharge/connection elimination BMPs is available at:

<http://cfpub.epa.gov/npdes/stormwater/menuofbmps/illicit.cfm>.

#### **Implement Illicit Discharge Elimination Plan (IDEP) (BMP 21)**

Illicit discharge detection and elimination requires:

1. The prevention, detection and removal of all physical connections to the storm water drainage system that conveys any material other than stormwater,
2. The implementation of measures to detect, correct and enforce against illegal dumping of materials into storm drains, lakes and streams, and
3. Implementation of spill prevention, containment, cleanup and disposal techniques of spilled materials to prevent or reduce the discharge of pollutants into stormwater.

To fulfill the above requirements, municipalities may require dye-testing at the time of Certificate of Occupancy or develop a program to inspect local waterways. Currently, the SCCHD is grant funded to inspect all county drains, road drains and natural waterways. If funding is lost, the SCCHD may limit future inspections to county roads and drains only, leaving local waterway inspections up to local governments or watershed-funded initiatives. For inspection of local waterways, crews must be trained on how to identify illicit discharges and locate illicit connections. Although this effort can be labor intensive, the pay off is a reduction in the amount sanitary sewage and chemicals that enters surface waters. This activity is a minimum measure required of Phase II storm water permittees.

Each permittee developed and submitted their IDEP on November 1, 2004 and began implementing the plan by February 1, 2005. The plan involves the investigation of illicit connections/discharges and outlines a plan for elimination of those connections. A component of education of both the public and private sectors on illicit discharge detection and elimination is also factored into the plan. Implementation of an IDEP addresses public education and the detection/elimination of illicit discharges from OSDS, industrial/business connections, recreational sewage (travel trailer sanitary wastes), wastewater connections to storm drains, and illegal dumping.

#### **Sanitary System Planning—Manage Lagoon Systems and Package Wastewater Treatment Plants (BMP 22)**

There are several lagoon systems in operation throughout the NEW, and one package wastewater treatment plant is currently being proposed. Permittees have expressed concern over the compliance of these facilities with their discharge permits. Evidence of excess nutrients and aesthetic concerns has been documented for some of the lagoon systems (see Section 2.3.6.3 of Chapter 2). Typically, these types of systems are used in areas where septic system failures have occurred or where other waste treatment options were not viable. Though these types of systems can adequately treat and release discharges to surface waters, there may be times when discharges may not be in compliance. In the event that state regulatory agencies are unable to provide adequate oversight of compliance activities due to lack of funding or personnel constraints, local units of government should consider a regulatory mechanism (such as a Community Sewer System ordinance) to ensure that operations, maintenance and discharges from these systems are in compliance with water quality standards. If a facility is found to be in non-compliance, an enforcement mechanism should be in place to remedy the situation. Currently, the

St. Clair County Drain Office (SCCDO) reviews new discharge permits from these types of facilities and provides comments, as necessary.

Other options for local communities to manage the probability of developments having to use these types of systems are to utilize land use planning tools such as mapping soils with limitations for septic systems and using this information to determine zoning designations, mapping sewer service areas, and limiting higher-density developments to areas where sewer services are available.

**Eliminate Sanitary Sewer Overflow Events (BMP 23)**

As discussed in Section 2.3.5 of Chapter 2, numerous sanitary sewer overflow (SSO) events in the City of Marysville and less numerous events in the City of St. Clair are a significant concern. These communities should implement programs to eliminate SSO events including:

- “Infiltration and Inflow (I & I) Studies” to determine where storm water and/or groundwater inputs are over-burdening the sanitary sewer systems, and
- Upgrading infrastructure to eliminate surface and groundwater inputs. Practices such as manhole rehabilitation and replacement, sewer lining and replacement, and downspout disconnection programs should be implemented to reduce extra burdens on sanitary sewer infrastructure.

**Eliminate Combined Sewer Overflow Systems (BMP 24)**

As discussed in Section 2.3.5 of Chapter 2, overflow events associated with combined sewer systems, known as combined sewer overflows (CSOs), are a concern in the City of Port Huron. Work to completely eliminate discharges of sewage to the Black and St. Clair Rivers is ongoing with plans for completion by 2012.

**Implement St. Clair County Public Bathing Beach and Water Quality Monitoring Program (BMP 25)**

The SCCHD conducts water quality monitoring at 16 public beaches and several tributary sites throughout the NEW. Sampling and analysis of the water is conducted at beach sites weekly from Memorial Day to Labor Day and tributary sites sampling on a weekly, monthly or as needed basis. Samples are generally taken one foot below the water surface in water that is between three and six feet deep. The SCCHD maintains a 24-hour Water Quality Hotline which provides quick, accurate information and advisories on beach conditions. Individuals can contact the hotline at “877-504-SWIM” or go online to [www.deq.state.mi.us/beach](http://www.deq.state.mi.us/beach).

**Study, Develop, Adopt and Enforce an Illegal Dumping Ordinance (BMP 26)**

The adoption and enforcement of an illegal dumping ordinance will ensure that violators will be assessed a fine for introducing contaminants such as household hazardous waste, litter, trash and debris into the environment that is not only aesthetically unpleasing, but can also cause water quality and habitat degradation. Washtenaw County’s illegal dumping ordinance is available online at:

[http://www.ewashtenaw.org/government/departments/environmental\\_health/pollution\\_prevention/illegal\\_dumping/eh\\_illegaldumpreg.html](http://www.ewashtenaw.org/government/departments/environmental_health/pollution_prevention/illegal_dumping/eh_illegaldumpreg.html).

**Study, Develop, Adopt and Implement Illicit Discharge/Connection Elimination Ordinance (BMP 27)**

An illicit discharge is defined as any discharge to the municipal separate storm sewer system that is not composed entirely of stormwater, except for discharges allowed under a NPDES permit or waters used for firefighting operations. These non-storm water discharges occur due to illegal connections to the storm drain system from residential, business or commercial establishments. As a result of these illicit connections, contaminated wastewater can enter into storm drains, open conveyance systems or directly

into local surface waters before receiving treatment from a wastewater treatment plant. Illicit connections may be intentional or may be unknown to the owner. Additional sources of illicit discharges can be failing septic systems, illegal dumping practices, and the improper disposal of sewage from recreational practices such as boating or camping. Illicit discharge detection and elimination programs are designed to prevent contamination of ground and surface water supplies by monitoring, inspection and removal of these illegal non-storm water discharges. An essential element of these programs is an ordinance granting the authority to inspect properties suspected of releasing contaminated discharges into storm drain systems. Another important factor is the establishment of enforcement actions for those properties found to be in noncompliance or that refuse to allow access to their facilities. Model ordinances are available through the US EPA at:

<http://www.epa.gov/owow/nps/ordinance/discharges.htm>.

#### **Support County-wide Onsite Septic Disposal System Ordinance (BMP 28)**

At present, there is no county-wide or local municipal ordinance that requires regular inspection of onsite septic disposal systems (OSDS) to ensure that they are not failing and introducing excess nutrients and pathogens to surface water and groundwater. The SCCHD oversees programs to properly locate and construct OSDS in new developments and has a “water quality hotline” for residents to refer failing systems to the SCCHD for follow-up inspections. They also provide a number of educational print materials on proper OSDS operation and maintenance. The county or municipalities may want to consider the adoption of an OSDS inspection ordinance requiring regular inspections of OSDS. There are several counties in southeast Michigan, such as Macomb, Wayne, and Washtenaw, which currently have a “Time-of-Sale” ordinance which requires OSDS inspection when a house is sold (or in cases of title transfer). Oakland County is also currently considering an OSDS inspection ordinance. Washtenaw County’s OSDS ordinance is available online at:

<http://www.epa.gov/nps/ordinance/documents/WashtenawCounty.pdf>.

Other BMPs defined in previous sections of this chapter that will also aim to achieve the objectives of illicit discharge detection and elimination includes:

- **BMP 6:** Implement Employee Training Programs
- **BMP 7:** Promote St. Clair County’s 24-Hour Water Quality Hotline

#### **6.2.4 Construction Site Stormwater Runoff Control**

These BMPs will target many aspects of on-site controls used during the construction phase of development to control excess runoff, as well as offsite soil erosion and sedimentation. The St. Clair County Department of Public Works (SCCDPW) is responsible for handling County-wide inspections of jobsites for proper placement and maintenance of construction site BMPs such as silt fences, catch basin filters, gravel access roads, and street sweeping to eliminate sediment from being deposited off-site and into area catch basins and storm sewer systems, or into other nearby surface water bodies. The construction site runoff control program should address runoff control, erosion control, sedimentation control and good housekeeping practices.

The following websites provide additional information on applicable BMPs for construction site storm water runoff control measures:

[http://cfpub.epa.gov/npdes/stormwater/menuofbmps/con\\_site.cfm](http://cfpub.epa.gov/npdes/stormwater/menuofbmps/con_site.cfm)

[http://www.epa.gov/owow/nps/urbanmm/pdf/urban\\_ch08.pdf](http://www.epa.gov/owow/nps/urbanmm/pdf/urban_ch08.pdf) and

[http://www.epa.gov/owow/nps/urbanmm/pdf/urban\\_ch11.pdf](http://www.epa.gov/owow/nps/urbanmm/pdf/urban_ch11.pdf).

### **Implement and Enforce the Soil Erosion and Sedimentation Control Ordinance and the SESC Program (BMP 29)**

Typically, the most environmentally dangerous period of development is the initial construction phase when land is cleared of vegetation and graded to create a proper surface for construction. The removal of natural vegetation and topsoil makes the exposed area particularly susceptible to erosion, causing transformation of existing drainage areas and disturbance of sensitive areas.

The St. Clair County Board of Commissioners adopted Resolution 03-40, *The St. Clair County Soil Erosion and Sedimentation Control Ordinance* on November 12, 2003 which “provides procedures, standards, and enforcement mechanisms to manage soil erosion and sedimentation to promote the safety, public health and general welfare of the community through effectively sustaining the goal of clean water in St. Clair County and the State of Michigan.” The St. Clair County Board of Commissioners designated the St. Clair County Department of Public Works (SCCDPW) as the County Enforcing Agency (CEA) responsible for the administration and enforcement of this Ordinance under the authority of the rules promulgated in Part 91, Soil Erosion and Sedimentation Control, of the Natural Resources and Environmental Protection Act, 1994 PA 451, as amended. Public Works personnel perform plan reviews and authorize the issuance of the required SESC permit. Permit requirements state that new developments that cause an earth change within 500 feet of a lake or stream, or which disturbs one acre or more of land must apply for and obtain a soil erosion and sedimentation control permit through the SCCDPW. The developer must submit an SESC Plan that includes:

- Information on site location, predominant land features, proximity to lakes, streams and wetlands, and contour intervals and slope information;
- Soils information and legal description;
- Physical limits of the earth change;
- Location of existing and proposed drainage patterns;
- Timing and sequencing of each proposed earth change;
- Description of all temporary and permanent erosion and sedimentation control measures; and,
- A schedule for maintaining all control measures.

Recommended BMPs that may be required during the construction phases of development include:

- Phased Construction
- Maintaining buffer strips next to watercourses
- Limiting clearing of existing vegetation
- Use of silt fences
- Use of gravel access roads, etc.

Additional details on the SESC Program, including permit fees and other program elements can be found on the SCCRC’s website at: <http://www.sccrc-roads.org/>.

All municipalities can help support this program by educating residents and field staff about the SESC requirements and instructing field staff to report soil erosion problems to the SCCDPW (see BMP 6).

Other BMPs defined in previous sections of this chapter that will also aim to achieve the objectives of construction site storm water runoff control includes:

- **BMP 6:** Implement Employee Training Programs
- **BMP 7:** Promote St. Clair County’s 24-Hour Water Quality Hotline

### 6.2.5 Post-Construction Stormwater Management in New Developments/Redevelopments

The primary goal of post-construction storm water management BMPs is to reduce the impacts of urbanization on water quality and aquatic habitat. Common impacts on surface waterbodies from urbanization include:

- Flashy hydrology associated with higher peak flows from wet weather events and lower stream flows during extended periods of dry weather;
- Reduced streambank vegetation;
- Increased streambank erosion;
- Increased stream temperature and pollutant loadings; and,
- Degraded aquatic habitats and fish communities.

To thoroughly mitigate impacts from urbanization, there are many options that can be implemented by permittees. A comprehensive approach will include BMPs such as:

- Managerial practices, including:
  - Mechanisms to ensure proper operation and maintenance of structural and vegetative BMPs that have been installed;
  - Ordinances and land use policies that direct growth and protect a community's remaining natural resources;
- Structural and vegetative storm water controls that aim to reduce storm water runoff quantities and improve runoff quality.

Implementation of the various structural and non-structural (managerial) BMPs outlined below will achieve the objectives of Part I.B.2.a.1.b) and c) of the Watershed Permit, which fulfills the Post-Construction Control component of "Evaluating and Implementing Site Appropriate, Cost-Effective Structural and Non-Structural BMPs" for areas of new development and redevelopment.

Additional information on applicable BMPs for post-construction storm water management can be found on the US EPA's website at:

- <http://cfpub.epa.gov/npdes/stormwater/menuofbmps/post.cfm>
- <http://www.epa.gov/owow/nps/urbanmm/mm10.pdf>
- <http://www.epa.gov/owow/nps/urbanmm/mm05.pdf>
- <http://www.epa.gov/npdes/pubs/fact2-7.pdf>.

Additional resources on Land Use Planning BMPs can be found in the publication, "*Opportunities for Water Resource Protection in Local Plans, Ordinances and Programs—A Workbook for Local Governments*" (SEMCOG, 2002), available at the following web sites:

- <http://www.crow.org/programs/watershedmgmt/scwetlands/relatedtools.html>
- <http://www.partnershipsforchange.cc/plannededuc0124.asp>
- <http://www.rougeriver.com/ordinance/>
- [http://macombcountymi.gov/planning/+Model\\_Envir\\_Ordinances.asp](http://macombcountymi.gov/planning/+Model_Envir_Ordinances.asp).

#### 6.2.5.1 Managerial Storm Water Management Controls

##### **Study, Develop, Adopt and Implement Storm Water Management Ordinance/Design Standards for Storm Water Management Systems (BMP 30)**

To ensure protection of water quality and minimize increase in runoff quantities from areas of new development and redevelopment, design criteria for storm water management systems should be

developed to provide guidance for designers on what kinds of practices they can implement on a site to achieve the designated criteria.

A comprehensive set of design standards for storm water management should address three key principles:

1. Protection of water quality,
2. Stream channel protection, and
3. Flood control.

The standards should also outline specifications for the non-structural and structural storm water practices that are allowed on development sites, especially as it pertains to buffer requirements, landscaping requirements, and operation and maintenance requirements.

The St. Clair County Drain Commissioner has a set of drainage rules (updated in 2004) that apply to the following types of development:

- Platted Subdivisions
- Condominium Developments
- Private Road or Land Split Developments
- Manufactured Housing Communities/Mobile Home Parks
- Commercial or Industrial Developments
- Direct or Indirect Storm Water Discharges to an Established Drain
- Drain Crossings, Culverts, Tiling, and/or Enclosing an Established Drain
- Drain Widening, Deepening, or Relocation, and
- Adding or Subtracting Land to/from a Drainage District and/or Construction of a Drain for AscRIPTION as an Established Drain

Any proposed development that falls under one of these categories is required to obtain a Drainage Permit from the Drain Commissioner and must meet the criteria for storm water management on the site. A review of the Drain Commissioner's standards can be found in Appendix N.

Local governments can also establish a set of standards for storm water management. They may choose to adopt a stand-alone storm water management ordinance, or write the criteria directly into their zoning ordinance. A local government's standards may simply adhere to the County's standards, or they may be even stricter, such as requiring a lower allowable release rate of runoff from the site, or requiring the use of particular BMPs, such as Wet Ponds or Constructed Wetlands as opposed to Dry Detention Ponds, etc. The local unit of government would apply these rules for the developments that fall under their jurisdiction and meet the requirements for site plan reviews as outlined in their zoning ordinance, or they may forward the review onto the Drain Commissioner, at which time the Drain Commissioner's guidelines would be used to approve the storm water management measures for the site plan.

The St. Clair County Road Commission addresses road drainage criteria in its "Procedures for Plat Street Development" (updated as of 2003), under Section V, Parts D and E. In particular, this criterion establishes allowable slope and stabilization requirements of open ditches and requirements associated with the construction of enclosed systems. They also specifically state that sump pump discharges are strictly prohibited to discharge into open ditches and may only be hooked up to storm sewer manholes at the time the manhole is constructed. The Road Commission currently requires all new developments discharging to the road right-of-way to discharge at a predevelopment flow rate. Although this standard

is not written in their “Procedures for Plat Street Development”, they have never had a problem ensuring that this standard is met.

An issue that the Road Commission has expressed problems with is ensuring that inspections by Road Commission personnel are granted prior to a municipality granting a certificate of occupancy. Currently only some of the watershed’s municipalities consistently ensure that these inspections are performed. Ensuring these inspections will help protect roadside ditches from problems associated with erosion and water quantity issues, such as illegal sump pump discharges to ditches in the road right-of-way or inappropriately sized road culverts. The Road Commission has stated the best way for this issue to be addressed would be for the municipalities to incorporate this inspection requirement into their zoning ordinance and ensure its enforcement.

A comprehensive comparison of design standards for storm water management facilities for several counties in Southeast Michigan, including Wayne, Oakland, Livingston, Washtenaw, and St. Clair, is included in Appendix N. The MDEQ also has a guidance document entitled, “Hydrologic Impacts Due to Development: The Need for Adequate Runoff Detention and Stream Protection” that can be used to help develop or revise a community or agency’s current design standards. The document is available online at:

[http://www.deq.state.mi.us/documents/deq-water-mgmt-Impact\\_4620\\_7.pdf](http://www.deq.state.mi.us/documents/deq-water-mgmt-Impact_4620_7.pdf).

Model storm water management ordinances are available at:

<http://www.epa.gov/owow/nps/ordinance/postcons.htm>, and

[http://macombcountymi.gov/planning/Model Envir Ordinances.asp](http://macombcountymi.gov/planning/Model_Envir_Ordinances.asp). The ordinances include language dealing with each of the issues noted above and it is recommended that communities examine each ordinance for the language that is appropriate for their storm water program.

### **Study, Develop and Adopt Development Standards for Water Quality and Quantity Protection (BMP 31)**

There are a number of development principles outlined in the Center for Watershed’s publication, “Better Site Design: A Handbook for Changing Development Rules in Your Community” that address the following principles:

- Protect local streams and lakes
- Reduce storm water pollutant loads
- Reduce soil erosion during construction
- Reduce development construction costs
- Increase local property values and tax revenues
- Create more pedestrian friendly neighborhoods
- Provide more open space for recreation
- Protect sensitive forests, wetlands and habitats
- Create a more aesthetically pleasing and naturally attractive landscape
- Construct safer residential streets
- Determine more sensible locations for storm water facilities
- Provide for easier compliance with wetland and other resource protection regulations
- Develop neighborhood designs that provide a sense of community
- Provide urban wildlife habitat through natural area preservation

Development principles apply to:

1. Residential Streets and Parking Lots (Principles 1-10)
2. Lot Development (Principles 11-16)
3. Conservation of Natural Areas (Principles 17-22)

This resource is available for purchase online at: <http://www.cwp.org/publicationstore/bsd.htm>, and additional details on the development principles are available at: [http://www.cwp.org/better\\_site\\_design.htm](http://www.cwp.org/better_site_design.htm). The modification of development standards to address these principles will directly achieve the goals and objectives of the NEW WMP.

Another term used to describe the approaches listed above is Low-Impact Design (LID). A resource that provides guidance on implementation strategies can be found in the publication, “Low-Impact Development Design Strategies—An Integrated Design Approach” by Prince George’s County, Maryland, Department of Environmental Resource Programs and Planning Division, 9400 Peppercorn Place, Largo, Maryland, 20774 (January, 2000). Additional information on LID is also available at: [www.lowimpactdevelopment.org](http://www.lowimpactdevelopment.org). A LID Design Manual developed in 2004 by the United States Department of Defense is available online at: [http://www.wbdg.org/ccb/DOD/UFC/ufc\\_3\\_210\\_10.pdf](http://www.wbdg.org/ccb/DOD/UFC/ufc_3_210_10.pdf).

The Southeast Michigan Council of Governments (SEMCOG) and the MDEQ have partnered to develop a statewide manual on LID guidance. It is anticipated that the manual will take approximately 1.5 years to complete. This manual will provide an additional resource for local communities to utilize in updating their zoning ordinances for water quality and natural resource protection.

#### **Update Master Plan to Incorporate Watershed Management Plan Goals and Objectives (BMP 32)**

Incorporation of the goals and objectives of the NEW WMP into a community’s Master Plan will ensure that the supporting language is present for resource protection BMPs that will be implemented to achieve compliance with the Phase II storm water permit. In addition, the SCCMPC officially adopted an updated county-wide Master Plan in April 2000. While the Master Plan’s time frame is 20 years, from 2000 to 2020, it is intended to be periodically amended over this time period based on community or citizen needs, new information, land use patterns, and growth requirements. The SCCMPC’s Master Plan has a series of recommendations that are intimately tied to the goals of this WMP and involve the following categories:

- Urban and General Services Districts
- Rural Residential Districts
- Rural and Agricultural Conservation Districts
- Redevelopment and Renewal Areas
- Existing Commercial and Community Centers
- Sand and Gravel Resources
- Sensitive Environments
- Open Space Corridors, Environmental Areas, Trails, and Parks
- Forest Preservation Areas
- Transportation Improvements
- Noise Zones
- Transit Corridors
- Infrastructure Planning

The Plan shows the Commission's careful review and insight into a sustainable future for the county as it relates to land use and change management, environment, economy, transportation, and public facilities and services. The county's Master Plan should also be used by local governments to update their Master Plans to ensure a coordinated watershed management approach.

Each community's Master Plan and Zoning Ordinance was analyzed as part of the planning process. Summaries of those reviews are found in Chapter 5. Access to each community's Master Plan and Zoning Ordinance documents is available at:

<http://www.cis.stclaircounty.org/planning0008.asp>.

### **Study, Develop, Adopt and Implement Aquatic (Riparian) Buffer Ordinance (BMP 33)**

Aquatic or riparian buffers are made up of the vegetation that grows along streambanks and lakeshores. The plants help protect water quality by filtering pollutants, sediment, and nutrients from runoff. Other benefits of buffers include flood control, streambank stabilization, stream temperature control, and room for lateral movement of the stream channel. Effective aquatic buffer ordinances require this natural boundary between local waterways and existing or proposed development. These ordinances usually specify the size and management of the stream buffer and are a specific planning tool to protect stream quality and aquatic habitat. Additional information on riparian buffers is available at: <http://www.unl.edu/nac/riparian.html>. Adopting a natural feature setback ordinance will also aim to achieve the same objectives of a buffer ordinance and is often used interchangeably. A model natural features setback ordinance is available at:

[http://macombcountymi.gov/planning/Model Envir Ordinances.asp](http://macombcountymi.gov/planning/Model_Envir_Ordinances.asp).

Model aquatic buffer ordinances are available through the US EPA at:

<http://www.epa.gov/owow/nps/ordinance/buffers.htm>.

### **Study, Develop, Adopt and Implement Floodplain Management Ordinance (BMP 34)**

Floodplains perform vital natural functions such as temporary storage of floodwaters, moderation of peak flood flows, maintenance of water quality, groundwater recharge, prevention of erosion, and provide habitat for diverse natural wildlife populations, recreational opportunities, and aesthetic quality. These functions are best served if floodplains are kept in their natural state. Wherever possible, the natural characteristics of floodplains and their associated wetlands and water bodies should be preserved and enhanced. A floodplain management ordinance identifies floodplain protection as important to protect the health, safety, and welfare of residents, as well as to protect the water and natural resources associated with floodplain areas. This ordinance will ensure that floodplain protection is achieved through the review of all activities proposed within both FEMA-mapped floodplains, as well as floodplains associated with smaller tributaries, and by the issuance of permits for those activities that comply with the objectives of the ordinance. A model floodplain ordinance is provided in Appendix O.

### **Study, Develop, Adopt and Implement Wetland Protection Ordinance (BMP 35)**

Wetlands provide many benefits to our environment by reducing storm water runoff velocities and peak flows, promoting infiltration of surface runoff to recharge groundwater supplies, and wetland plants absorb some pollutants from runoff. Wetlands also provide habitat for numerous wildlife species. A subset of all wetlands is regulated by state and federal authorities if they meet the following criteria: if they are located in counties with 100,000 people or more, are 5 acres or larger, and/or are located within 500 feet of a waterbody. A local wetland protection ordinance that is more stringent than the state or federal government regulations is necessary to protect the smaller, isolated wetlands from impairment or destruction. A model ordinance can be found in Appendix O and on the web at:

<http://www.epa.gov/owow/nps/ordinance/documents/E5-Croton.pdf> or

[http://macombcountymi.gov/planning/Model Envir Ordinances.asp](http://macombcountymi.gov/planning/Model_Envir_Ordinances.asp).

**Study, Develop, Adopt and Implement a Woodlands/Tree Protection Ordinance (BMP 36)**

A woodland/tree protection ordinance is a common regulatory measure used by communities striving to attain healthy, vigorous, and well-managed trees. Ordinances can be used to protect individual trees, such as trees in an urban community, or tree-rows and woodlands in a more rural community. Tree protection ordinances can also be used to promote creative design and construction techniques that maximize preservation. To enhance its effectiveness, an ordinance should be supported by the goals and objectives of a community's Master Plan, and other report(s) or inventories that identify tree resources to be protected. Inventories, maps, and other information of a community's tree resources can be used to identify areas for priority protection and to measure the effectiveness of the ordinance based on the change in tree resources over time. A model ordinance can be found in Appendix O and on the web at: [http://macombcountymi.gov/planning/Model Envir Ordinances.asp](http://macombcountymi.gov/planning/Model_Envir_Ordinances.asp).

**Perform High-Quality Natural Features Inventories throughout the Watershed (BMP 37)**

To ensure the protection of high-quality natural features such as woodlands, wetlands, lakes, streams and wildlife habitat, it is important that community Master Plans include inventories of these assets. The inventories provide the basis for goals and policies in the Master Plan that help the community reach its vision for natural feature preservation. They also identify where these special features are located, allowing the planning officials to protect them during site plan review. The inventories also provide the legal basis for ordinance language that works to preserve these features.

**Incorporate High-Quality Natural Features Inventories into Master Plan (BMP 38)**

Once high-quality natural features inventories are completed throughout the watershed (BMP 37), the data and maps generated from the inventories should be incorporated into a community's Master Plan. A variety of zoning ordinances should then be implemented to protect the priority natural features identified, such as adopting a Resource Protection Overlay District Standard (BMP 39).

**Study, Develop, Adopt and Implement Resource Protection Overlay District Standards (BMP 39)**

Once a community has updated its Master Plan with natural feature inventories (BMP 38), an Overlay District can be adopted into the zoning ordinance to ensure that property is developed in a manner consistent with its zoning designation, and the proposed physical elements are designed and arranged to protect the priority resource protection areas both on the site and in the vicinity of the site as identified by the community. The Overlay District establishes procedures to enable the applicant and community to achieve the mutually compatible objectives of reasonable use of land and protection of vital natural resources. A model ordinance can be found in Appendix O and on the web at: <http://www.partnershipsforchange.cc/planningeduc0136.asp>.

**Develop/Update Natural Areas Plan (BMP 40)**

The purpose of a Natural Areas Plan is to identify environmentally significant areas of a community that should be preserved in their natural state and those that can be compatibly integrated with development. Furthermore, the Natural Areas Plan works toward creating a system of open spaces that are linked to one another through naturally-occurring or human-made corridors. This plan represents an ecosystem approach to open space planning that will help preserve both the natural areas themselves, and as importantly, the functioning of the systems these areas represent. A Natural Areas Plan combines data from natural feature inventories (such as wetlands, water features, woodlands, steep slopes, and other significant features) on a map to see where areas with the most sensitive features overlap. These areas then become "Priority Preservation" areas. Connections, or wildlife and non-motorized transportation corridors, between these areas are then identified and mapped. The Natural Areas Plan then provides implementation strategies and action items (such as Conservation easements, land conservancy donations, and preservation techniques like ordinance regulations for buffers, water quality protection, etc.) on how to keep these areas preserved and functioning.

### **Perform Stream/Drain Inventories and Water Quality Monitoring throughout the Watershed (BMP 41)**

Inventories of the physical conditions of watercourses (streams, drains, rivers, etc.) and road/stream crossings conducted on a scheduled basis can aid dramatically in assessing watershed conditions in terms of the status of hydrological conditions that may be impacting water quality and aquatic habitat. Water quality monitoring could also be conducted during the inventories. Although road crossing inventories were conducted by the SCCHD during the summers of 2004 – 2006, there is still a significant information gap in terms of the known hydrological and water quality conditions throughout much of the watershed. Performing additional inventories and gathering monitoring data will greatly enhance this understanding and help to determine additional restoration or prevention measures that should be taken to achieve many of the goals and objectives of this WMP. These types of inventories, and water quality monitoring strategies, could be coordinated by the NEW WAG or conducted within a single community to establish a long-term source of monitoring data. The MDEQ will provide training for these types of inventories although the expertise of an engineering consultant will most likely be needed to provide recommendations on actions that should be taken based on the data collected.

### **Identify Areas for Recreation Enhancement (BMP 42)**

Residents and other stakeholders in the NEW have identified a desire to have additional parkland along water features for passive and active uses. Each municipality is encouraged to explore the options for the acquisition of open space for riparian recreational uses. Opportunities for additional recreational areas will help to increase public awareness and stewardship for area rivers, wetlands, streams and lakes, as well as the surrounding wildlife habitats associated with open spaces. Park land could also be used as demonstration sites to increase public awareness and education on the environmental benefits of storm water pollution prevention (i.e. install native vegetation areas or a rain garden) and protection of natural resources.

### **Develop/Update Recreation Plans (BMP 43)**

Each year the Michigan Department of Natural Resources (MDNR) offers recreation grants for the acquisition and development of parks and recreation facilities through the Michigan Natural Resources Trust Fund and the Land and Water Conservation Fund. Any local unit of government that has a current recreation plan approved by the MDNR is eligible to apply for one of these recreation grants. To be approved by the MDNR, a recreation plan must determine the community's recreation needs and develop a five-year action plan of proposed recreation projects to meet those needs. Only those recreation projects included in the five-year action plan are eligible for recreation grant financing. Additional information on the available MDNR grant programs is available at:

[http://www.michigan.gov/dnr/0,1607,7-153-10366\\_37984\\_37985---,00.html](http://www.michigan.gov/dnr/0,1607,7-153-10366_37984_37985---,00.html),

and additional information on another funding source through Transportation Enhancement grants is available at:

[http://www.michigan.gov/mdot/0,1607,7-151-9621\\_17216\\_18231---,00.html](http://www.michigan.gov/mdot/0,1607,7-151-9621_17216_18231---,00.html).

### **Implement Greenway Corridor Vision Plans (BMP 44)**

Greenway corridors provide unfragmented, linearly connected woodlands, wetlands, and other natural features that provide protected habitat for wildlife, protect water quality, and provide recreational and public access opportunities to the natural resources throughout the watershed. The St. Clair County Metropolitan Planning Commission (SCCMPC) has identified the existing, planned, and concept greenway corridors in its county-wide Master Plan. The greenway corridors vision map is provided as Figure 3.1, Section 3.2.2.2 of Chapter 3. Each community should consider adding a greenway plan to their planning documents, and include the County's concept greenway corridors in their plan. A source of funding for recreation areas, especially bike trails, is through the Greenways initiative. Additional information is available at:

<http://greenways.cfsem.org/about/index.html>.

#### **Initiate Hydrologic and Hydraulic Studies (BMP 45)**

A comprehensive study of the hydrology of the NEW system would provide an understanding of the interaction of precipitation, infiltration, surface runoff, stream flow rates, and water storage. A hydraulic study would yield information about the velocity, flow depth, flood elevations, channel erosion, storm drains, culverts, bridges and dams and how they impact conveyance systems throughout the watershed. Information resulting from these studies would ultimately provide greater detail on the sources and causes of problems related to hydrology-induced erosion. These types of studies are recommended as prerequisites to identify the most appropriate BMPs and most suitable locations for BMPs that can act to restore the hydrology of stream systems. These types of studies could be coordinated by the NEW Watershed Advisory Group (WAG) with the help of other organizations such as state or federal regulatory agencies, or engineering consultants that may have more expertise in these types of studies.

Typical models used for such studies are available on the Center for Watershed Protection website at: <http://www.stormwatercenter.net/monitoring%20and%20assessment/hydrology.htm>.

#### **Study, Develop and Update Site Plan Review Process to Require Hydrogeological Investigations (BMP 46)**

Local units of government should consider adopting requirements for landowners or developers that intend to withdraw large amounts of groundwater (typically over 100 gallons per minute peak capacity) to conduct hydrogeological investigations to ensure that high-volume water wells or well systems for groundwater withdrawals will be sited appropriately and so as to avoid impacts from reduced groundwater supplies to neighboring wells. Typically, outlying townships that are more rural and are not serviced by water main infrastructure, and that rely on groundwater wells for their water supply, should consider this BMP. Greenwood Township currently requires this type of investigation be submitted with site plans that propose to utilize this type of well system, and the requirement is written into Section 15.21, "High Volume Water Well or Well System", of their zoning ordinance. The MDEQ, Land and Water Management Division, also has additional guidance on typical requirements for hydrogeological investigations.

#### **Encourage Participation in the Purchase of Development Rights Program (BMP 47)**

A purchase of development rights (PDR) program is a means of compensating farmers for their willingness to accept a deed restriction on their land which limits or prohibits future development of the land for non-agricultural purposes (i.e. giving up the development rights). Generally, landowners are compensated for the fair market value of their land, based on the difference between what it could be sold for on the open market with no restrictions and what it could be sold for once an easement restricting development is placed on the land. An easement is a restriction on private property which is legally binding on present and future landowners. It is recommended that PDR be used as part of a storm water management strategy that focuses on headwater areas and areas of intense value (i.e. high-quality natural areas).

The St. Clair County Board of Commissioners voted unanimously to approve a PDR ordinance in 2004 which can be used to complement the program offered by the State. A copy of the ordinance and applicable program materials is available at: <http://www.cis.stclaircounty.org/planning1942464.asp>.

#### **Encourage Participation in the Farmland Preservation Program (P.A. 116 Program) (BMP 48)**

An important tool used across the State in protecting farmland from urban development is the Farmland and Open Space Preservation Act, P.A. 116 of 1974. Under the terms of this Act, an owner of certain kinds of agricultural lands may enter into a Development Rights Agreement (see BMP 47) with the State, whereby the landowner agrees to keep the land in question in agricultural use for at least ten (10) years

(or up to 99 years, as established in the agreement). In return for this Agreement, all property taxes paid in excess of 7% of the landowner's income will be refunded in the form of a State income tax credit. In addition, the property in question will be exempt from any local special assessments. If the landowner breaks the Agreement before it expires, all benefits received up to that point must be repaid to the State, plus interest (except for special cases, where repayment terms may differ). Agreements may be renewed for a minimum 7-year term. Eligible agricultural lands include:

- An operating farm of more than 40 acres in size;
- An operating farm of 5 to 40 acres with a gross annual income of \$200 per tilled and cleared acre; or
- An operating specialty farm (as designated by the Michigan Department of Agriculture [MDA]) of at least 15 acres with a gross annual income of at least \$2,000.

At least 51% of the land in an operating farm must be under active cultivation or in pasture. The property owner does not have to provide public access to the land and the property may be sold. New owners, however, are bound by the agreement until it expires.

Although this is a State program, local communities are responsible for processing and approving applications to enroll in the program. Furthermore, the community can encourage owners of prime and unique agricultural land with the community (and lands designated for agricultural use in the Master Plan) to enroll in the program. Some communities in the NEW are already utilizing this program.

#### **Encourage the Use of Conservation Easements (BMP 49)**

A conservation easement is a method of preserving open space without purchasing all rights to a parcel of property. A community (or non-profit land trust or land conservancy) can purchase (similar to the purchase of development rights programs (see BMP 47) or acquire by gift an easement to the property. Initiation of easements by a landowner is voluntary; however, after signing, the easement is an enforceable document binding both parties. Under Michigan law, conservation easements may extend for a limited period of time (i.e. 10 or 20 years), or they may be permanent. To benefit from Federal income tax and estate tax deductions, a permanent conservation easement must be in place. Conservation easements must be donated to a government agency, a university, or a non-profit organization to be eligible for tax deductions.

Local governments can encourage the use of conservation easements by:

1. Identifying priority resource areas where conservation easements would be beneficial for the protection of water quality, wildlife habitat, and environmentally sensitive lands and resources.
2. Contacting landowners in the selected areas, informing them of the option of easements and related financial incentives, and
3. Encouraging the participation of local land trust and land conservancy organizations (such as the Blue Water Land Conservancy or the Southeast Michigan Land Conservancy) to promote the easement concept and to receive conservation easements if there is a high degree of citizen interest for the preservation of open space. Land trusts and land conservancies are non-profit organizations directly involved in protecting land for its natural, recreational, scenic, historical, or agricultural value.

#### **Study, Develop, Adopt and Implement Agricultural Buffer Zoning Ordinance (BMP 50)**

Agricultural buffer zoning is a transitional zoning technique that can be used to help protect the long-term integrity of prime or unique agricultural lands. A rural residential/agricultural zone is created in appropriate areas of the community, between more intensive development and large tracts of agricultural

land. This transitional area, or buffer zone, allows for rural residential lifestyle opportunities and isolates agricultural operations from higher intensity uses. The buffer district should be placed in areas not considered prime or unique for agriculture, and in areas with relatively smaller parcel sizes that are not well suited for agriculture.

The nature of regulations of these buffer districts will vary with each community. Minimum lot sizes typically range from 1 to 3 acres in these districts. Supplementary regulations that should be considered include:

- Minimum lot width-to-depth ratios (to prevent excessively long, narrow lots);
- Clustering options (to preserve open space and reduce cost of providing public services);
- Regulation of lot splits;
- Regulation of private roads (to prevent creation of substandard roads that the community may eventually be responsible for).

### **Study, Develop, Adopt and Implement Rural Clustering Ordinance (BMP 51)**

Rural clustering is a set of techniques (primarily zoning) that focus on preservation of open space in rural areas by encouraging new residential development to cluster in a few selected areas on a parent parcel, rather than being spread across the entire site. This permits large portions of the parent parcel to remain open. The dwelling units are clustered in areas that are screened from roads (unless there is no other location), and in locations where they can be effectively provided with services. Open spaces remaining after clustering are protected in perpetuity through a range of legal mechanisms (such as conservation easements).

While the development rights of open space on a parcel approved for rural clustering will have been permanently retired, the land can still be actively farmed, used for woodlots, nurseries, pasture, or recreation. Ownership typically remains with a property owners association, a condominium association, or the open space can be transferred to a conservancy or the community. Two principal variations include:

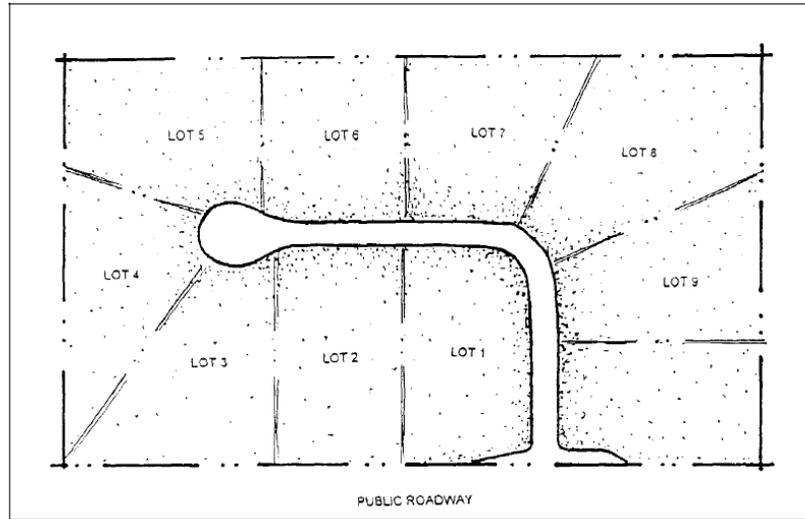
1. Clustering options that create common landscaped open space for recreation by residents of clustered units in addition to the larger, more natural (unaltered) open space; and,
2. Cluster layouts that focus more on individual lot open space that is integrated with the larger, more natural open space area.

Guidelines for rural clustering recommend that:

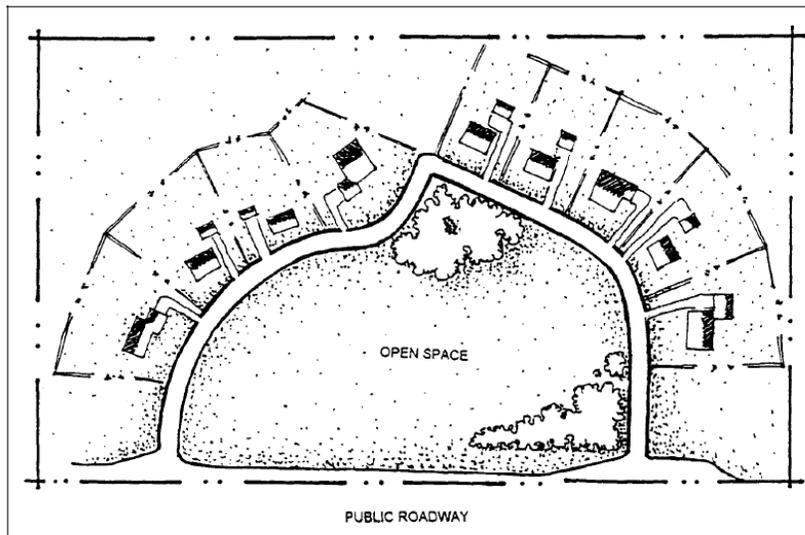
- Rural cluster zoning is most suitable in rural-to-suburban transition areas.
- Cluster district boundaries should be consistent with the boundaries of resource production areas and natural features.
- Total development in the district should be limited by gross density restrictions.
- Cluster projects should be carefully sited to minimize impact on neighbors, infrastructure systems, and the environment.
- Procedures for review and approval should be no more difficult than for subdivisions. Where they are a necessary contribution to an open space network, they should be mandatory.
- Protected open space should be large enough and usable to achieve intended purposes.
- Residential development should be confined to identified cluster areas.

- Lot dimensions, building heights, and setbacks should be compatible with rural character and provide the privacy, seclusion, and access to open space that are normally expected in rural areas.

Figures 6.1 and 6.2 illustrate examples of a standard subdivision and a cluster subdivision on the same parcel. Both subdivisions contain nine buildable lots, but the cluster development only uses a fraction of the original parcel.



**Figure 6.1 Standard Subdivision Parcel Arrangement**



**Figure 6.2 Cluster Subdivision Parcel Arrangement**

#### **Study, Develop, Adopt and Implement Mixed Use Zoning Ordinance (BMP 52)**

Mixed use zoning allows residential, office, and retail buildings in the same development which allows for a greater intensity of development on a more compact scale. This reduces the total amount of land needed on a per unit basis. Mixing uses also allows for a greater range of transportation options and opportunities for shared parking, which will potentially reduce the amount of impervious surfaces constructed for roads and parking lots.

### **Study, Develop, Adopt and Implement Private Road Ordinance (BMP 53)**

A private road ordinance complements efforts to reduce directly connected impervious surfaces (BMP 54) by permitting roads to be built that are narrower and have greater allowable slopes than county road standards. Narrower, steeper roads produce a smaller area of impervious surface and require less clearing of roadside vegetation. The ordinance can promote rural character by allowing narrow roads in certain development. Sample ordinance language is available at:

<http://www.partnershipsforchange.cc/planningeduc0140.asp>.

### **Minimize Directly Connected Impervious Areas (BMP 54)**

After strategies have been employed to reduce overall site imperviousness in new developments and redevelopment, additional environmental benefits can be achieved and hydrologic impacts reduced by disconnecting the unavoidable impervious areas to the maximum extent practicable (MEP). Strategies for this include:

- Disconnecting roof drains and directing flows to vegetated areas or to dry wells.
- Directing flows from paved areas, such as driveways, to stabilized vegetated areas.
- Breaking up flow directions from large paved surfaces.
- Encouraging sheet flow through vegetated areas.
- Carefully locate impervious areas so that they drain to natural systems, vegetated buffers, natural resource areas, or infiltratable zones/soils. In doing so, ensure that flow velocities are maintained so as to not degrade the natural, vegetated filtering system.

### **Study, Develop, Adopt and Implement Yard Waste Composting Facility Ordinance (BMP 55)**

To achieve the reduction of contaminants (excess nutrients, increased Biological Oxygen Demand, etc.) associated with storm water runoff from commercial composting sites that operate within the watershed, communities with these types of facilities should consider adopting an ordinance that states the requirements and standards that need to be implemented to protect surface water and groundwater quality, and control runoff quantities. St. Clair Township currently has such an ordinance that can be used as a comprehensive example of what to include in such an ordinance. The ordinance is available in the Resource Directory (CD).

### **Prevent and Remove Stream Flow Obstructions (BMP 56)**

Prevention and removal of stream flow obstructions (log jams) involves the detection of stream blockages caused by debris such as sediment, trash, and branches or trees that have fallen into the waterway. While removal of blockages is not always necessary or desirable (many blockages provide important in-stream habitat for aquatic wildlife), any necessary clean-up practices should cause the least amount of upset to in-stream habitat. The removal of flow obstructions should not include practices such as snagging, channelization, or other severe hydromodifications. In addition, removal should be completed before major obstructions are formed. To achieve adequate maintenance measures, periodic monitoring of waterway conditions should be made to ensure that flows are unobstructed. In the case of flow obstructions in natural waterways, since there is no federal, state or local government that is responsible for removing blockages of natural waterways, this work typically falls on volunteers. The NEW WAG or local governments can coordinate volunteer groups to perform this work, but will need a Land and Water Division construction permit from the MDEQ. Information on the permit and the permit application can be found at:

[http://www.michigan.gov/deq/0,1607,7-135-3307\\_29692\\_24403---,00.html](http://www.michigan.gov/deq/0,1607,7-135-3307_29692_24403---,00.html).

The Wayne County Department of Environment has a recommended strategy for woody debris management which defines a “clean and open method” of management. This method typically focuses on removal of debris without changing the streambed or banks and therefore does not require a permit from the MDEQ. The management alternative is to clear an opening in the debris that will allow

unobstructed flow in the channel without having to completely remove potential habitat features. Wayne County's recommended strategy for debris removal can be found in Chapter 7 of their design standards manual and can be obtained at:

<http://www.waynecounty.com/doe/watershed/docs/standardsManual/chapter7.pdf>.

#### **Study, Develop, Adopt and Implement Hazardous Materials Cleanup Ordinance (BMP 57)**

Local units of government should consider adopting and implementing a hazardous materials cleanup ordinance that requires the reimbursement of costs of abatement, containment, cleanup, disposal, and restoration from property owners or those responsible for the leaking, spilling, or otherwise allowing certain dangerous or hazardous substances or materials to escape containment. The City of Marine City currently has such an ordinance for reference.

#### **6.2.5.2 Structural and Vegetative Storm Water Management Controls**

The structural and vegetative storm water management controls outlined below could be encouraged or required as outlined in a permittees design criteria for storm water management systems (specifically BMPs 58-60), or they may be implemented by permittees on properties under their jurisdiction. All permittees must also have a plan in place to ensure the long-term operation and maintenance of permittee-owned BMPs.

#### **Install and Maintain Storm Water Management Structures (BMP 58)**

This BMP encompasses the installation and maintenance of structural storm water management BMPs that will reduce the amount of pollutants that may be present in storm water discharges off of a site after passing through these structures. These BMPs would either be installed on permittee-owned properties, or encouraged or required as storm water management BMPs for new development/redevelopment (as part of a permittees storm water management design standards or ordinance, as applicable). Several BMPs to consider include:

- **Sediment Trapping Devices**

Sediment trapping devices such as a barrier, basin or other devices are designed to remove sediment from runoff by slowing the water enough so that the heavier soil particles (such as sand) can settle out of the water column. Sediment basins should be located at the downstream end of drainage areas larger than 5 acres, and before a treatment train of other BMPs such as a wet detention pond or constructed wetland that is built to treat excess sediments and other pollutants. Dikes, temporary channels and pipes should be used to divert runoff from disturbed areas into the basin and runoff from undisturbed areas around the basin. Simpler devices for areas less than 5 acres include a sediment trap and sand bag barrier, and silt fences. Silt fences can be placed along level contours downstream of exposed areas where only sheet flow is anticipated. Sediment trapping devices can also be used on storm drain inlets and can include filter fabric, excavated drop traps, gravel filters and sandbags. Maintenance is a key requirement of any of these soil erosion control BMPs and requirements for their maintenance should be part of the design standards or rules requiring these devices. Sediment traps, barriers, basins and filters should be inspected frequently for repairs and sediment removal.

- **Catch Basin Inserts**

A catch basin is an inlet to the storm drain system that typically includes a grate or curb inlet and a sump to capture sediment, debris, and associated pollutants. A number of proprietary technologies are now available to augment the pollutant capture of these systems. These technologies generally employ additional sump chambers to enhance the capture of solids, and many employ filtering media to capture additional pollutants or fractions of the pollutant

inflows. The generic term “catch-basin inserts” is used here to describe a variety of in-sump or in-line designs.

- **Media/Sand and Organic Filters**

Sand filters have proven effective in removing several common pollutants from storm water runoff. Sand filters generally control storm water quality, providing very limited flow rate control. A typical sand filter system consists of two or three chambers or basins. The first is the sedimentation chamber, which removes floatables and heavy sediments. The second is the filtration chamber, which removes additional pollutants by filtering the runoff through a sand bed. The third is the discharge chamber. The treated filtrate normally is then discharged through an underdrain system either to a storm drainage system or directly to surface waters. Sand filters take up little space and can be used on highly developed sites and sites with steep slopes. They can be added to retrofit existing sites. Sand filters are able to achieve high removal efficiencies for sediment, biochemical oxygen demand (BOD), and fecal coliform bacteria. Total metal removal, however, is moderate, and nutrient removal is often low.

- **Oil/Grit Separators**

These structures are multi-chambered structures designed to remove coarse sediment and oils from storm water prior to delivery to a storm drain network, the ground, or other treatment system. Separators are often used as pretreatment for infiltration BMPs such as Porous Asphalt Pavements, Modular Pavement or Infiltration Trenches. They are generally used on parking lots, streets or other areas which receive vehicular traffic. Each separator would generally receive runoff from a drainage area of less than 1 acre.

- **Oil and Grease Traps**

Oil and grease traps remove high concentrations of petroleum products, grease and grit by gravity and coalescing plates. These devices are particularly useful on industrial sites, vehicle maintenance and washing facilities, areas where heavy mobile equipment is used, restaurant kitchens, and restaurant dishwashing equipment. Conventional oil/water separators have the appearance of septic tanks, but are much longer in relationship to the width. Separators for large facilities have the appearance of a municipal wastewater primary sedimentation tank. These devices are only effective for reducing abnormally high concentrations of oils and greases. Their performance is unproven for urban storm water runoff; however, communities with Phase II storm water permits must address grease pollution so traps may be an appropriate tool to employ as part of a device necessary when designing or retrofitting storm water management facilities.

### **Install and Maintain Storm Water Infiltration Practices (BMP 59)**

Infiltration practices may be structural or vegetative BMPs that promote infiltration of surface water runoff thereby reducing runoff quantities, recharging groundwater supplies, and minimizing the discharge of pollutants in storm water runoff. These BMPs would either be installed on permittee-owned properties, or encouraged or required as storm water management BMPs for new development/redevelopment (as part of a permittees storm water management design standards or ordinance, as applicable). Several BMPs to consider include:

- **Storm Water Retention/Infiltration Basins and other Infiltration Devices**

Storm water infiltration basins are any storm water device or system which causes the majority of runoff from small storms to infiltrate into the ground rather than be discharged to a stream. Most infiltration devices also remove waterborne pollutants by filtering water through the soil. Storm water infiltration can provide a means of maintaining the hydrologic balance by reducing impervious areas. Infiltration devices can include any of the following: basins, trenches,

permeable pavement, modular pavement or other systems that collect runoff and discharge it into the ground. Infiltration devices should only be used on locations with gentle slopes, permeable soils and relatively deep water tables and bedrock levels and thus are not ideal for most portions of the NEW. New developments that are located in areas of sandy soils would be candidates for these types of practices.

- **Grassed Swales**

Grassed swales are open channel management practices designed to treat and attenuate storm water runoff. As storm water runoff flows through these channels, it is filtered first by the vegetation in the channel, then through a subsoil matrix, and finally infiltrates into the underlying soils. Grassed swales are improvements on the traditional drainage ditch and are well suited for treating highway or residential road runoff. Grassed channels are the most similar to a conventional drainage ditch, with the major differences being flatter side and longitudinal slopes and a slower design velocity for water quality treatment of small storm events. The type and coverage of vegetation grown in the swales will influence pollutant treatment. Pollutant reduction values in this analysis assume the use of well-established turf grasses consistent with traditional residential settings. Other plantings may provide greater pollutant reduction, but may also alter conveyance hydraulics. Swales planted with native plantings are termed bioswales and are preferable for most areas of the NEW due to the heavy clay soils and the plantings ability to increase infiltration due to their extensive root systems. Another type of swale is a depressed median—a recessed, landscaped area within paved areas. Using vegetation in these applications is important in order to filter contaminants that may enter the median from the surrounding pavement. Drainage swales are applicable on virtually all development sites.

- **Vegetated (“Green”) Roofs**

Rooftop greening is a technique that uses vegetation on roof tops which may provide many benefits including increased quality and decreased quantity of storm water runoff from roof tops, reduced temperature of storm water runoff, reduced air conditioning costs, and significant reduction of the life-cycle maintenance costs of the roof. It has been estimated that green roofs can reduce cadmium, copper and lead in runoff by over 95% and zinc by 16%. Nitrogen levels may also be lowered. Green roofs can also provide improved aesthetic appeal and can also provide the benefit of transforming rooftops into usable open space for building tenants. Key considerations for implementing green roofs include the structural and load-bearing capacity of the building, plant selection, waterproofing, and drainage or water storage systems.

There are two types of green roofs that can be constructed: extensive and intensive systems. Extensive systems are made of 2-4 inches of soil and weigh an estimated 12 to 40 pounds per square foot of roof area. Short plants with shallow root systems that are easy to maintain make up the plant species. On the other hand, intensive systems are similar to gardens on the ground. They are made up of a minimum of 6 to 12 inches of soil, weigh 80-150 pounds per square foot, host deep-rooted plant species—including trees, shrubs, which require more maintenance. The more intensive systems will result in more storm water benefits. Both systems are appropriate for residential, commercial, industrial and institutional properties. The Ford Rouge Plant in Dearborn, Michigan installed 10.4 acres of green roof and it is expected to retain half the annual rainfall that falls on the site per year. The first residential green roof was installed in St. Clair County in 2005 (see Figure 6.3) and the first municipal green roof will be installed on Ira Township’s fire hall in 2006.



**Figure 6.3 Residential “Extensive” Green Roof**

- **Rain Gardens (Bioinfiltration)**

The term “rain garden” refers to a constructed depressional area that is used as a small landscape tool, usually located in residential yards or roadway ditches, to improve water quality. Rain gardens are sometimes also referred to as bioinfiltration systems on a larger scale. Rain gardens should be placed strategically to intercept water runoff, and typically are placed beside impervious surfaces such as driveways, sidewalks, or below downspouts. Rain gardens are designed to allow for ponding “first flush” and increased infiltration. Nutrient removal occurs as the water comes in contact with the soil and the roots of the trees, shrubs or other vegetation planted in the depression. To enhance nutrient removal, plant choices should center on native wildflowers and grasses that are adapted to local conditions. Suitable applications for bioinfiltration systems, or rain gardens, are parking lot islands, residential developments utilizing swale drainage for pre-treatment, commercial developments utilizing filter strips adjacent to parking lots for pre-treatment, and campus developments utilizing swale drainage and filter strips for pre-treatment. Rain gardens are not ponds and should be designed to drain within 48 hours. Engineered soil mixes should be incorporated into the design to facilitate drainage in areas with less suitable soil conditions (such as clay or clay loam). Under-drainage is also typically installed to facilitate drainage. It is also recommended that runoff is pre-treated with grassed swales or filter strips prior to entering the garden to avoid sediment accumulation. Additional information on rain gardens is available at:

**<http://www.socwa.org/nature/PDF/Rain%20Gardens.pdf>**

- **Pervious Pavements**

Pervious pavements can be made of concrete, stone or plastic and promote the absorption of rain and snowmelt. The most common type of permeable pavement is paving blocks and grids which are modular systems that contain openings filled with sand and/or soil. Some can support grass or other suitable vegetation providing a green appearance. Permeable paving can be effective in reducing the quantity of surface runoff for small to moderate-sized storms, and may also reduce the amount of pollutants associated with these events. Typically, these systems will work better when overlaid on sandy, permeable soils (as opposed to less permeable clay soils). Effectiveness of these pavements can be improved by maximizing the opening in the paving material and

providing an effective sub-layer of at least 12 inches that helps to promote greater infiltration capacity. This type of pavement is particularly applicable for overflow and special event parking, driveways, utility and access roads, emergency access lanes, fire lanes and alleys.

- **Rain Barrels**

Rain barrels are used to collect and store rooftop runoff from moderate storms that can be reused for irrigation. The effectiveness of rain barrels (or cisterns) is a function of their storage volume in comparison to the size of the roof. For example, a standard residential home with a 1,200 square foot roof could utilize 55-gallon barrels to store runoff from downspouts at the four corners of the house. The storage is equivalent to about 0.3 inches of runoff. The limitation with rain barrels is that they would be typically emptied when used as irrigation for lawns and landscaping—as such, storage capacity would be closely linked to the growing season. These systems are appropriate for residential, commercial and institutional properties.

- **Dry Wells**

A dry well is a small excavated trench filled with stone to capture and infiltrate rooftop runoff.

### **Install and Maintain Detention/Retention Systems (BMP 60)**

The installation and maintenance of detention/retention ponds is a storm water management practice that controls runoff quantities and improves runoff quality from areas of new development/redevelopment. These BMPs would either be installed on permittee-owned properties, or encouraged or required as storm water management BMPs for new development/redevelopment (as part of a permittees storm water management design standards or ordinance, as applicable). Several BMPs to consider include:

- **Extended Wet Detention Ponds**

Wet ponds, or extended wet detention ponds, are designed to hold a permanent pool of water and not only provide flood control, but also provide an opportunity for solids to settle out of the storm water runoff. Pollutant uptake can then occur by biological means through organisms living in the bottom of the pool. Wet ponds are among the most cost-effective and most commonly used storm water management practices. Wet ponds should be encouraged over dry ponds in the design specifications for storm water management systems.

- **Wet Detention Ponds**

Wet detention ponds are small man-made ponds or shallower areas with emergent wetland vegetation around the banks designed to capture and remove particulate and certain dissolved constituents. Wet ponds and wetlands are ideal for large, regional tributary areas (10 to 300 acres) where there is a need to achieve high levels of particulate and some dissolved nutrient removal. They can be used on individual sites, as well. The pond or wetland should be sized to treat runoff, accumulate sediment and route floods. The outlet should be sized based on the design method. The pond should be configured for aesthetics, safety and maintenance. Landscaping design requirements should include a natural vegetated buffer around the pond/wetland to reduce pollutants entering the area as well as decrease waterfowl habitat, and increase aesthetics. Floating vegetation should be used in the pond to shade water and prevent algae blooms as opposed to using chemical herbicides. It should be noted that the successful establishment of emergent and other wetland plants, and specific wetland hydrology, will only be achieved with proper monitoring and maintenance for approximately five to ten years after construction.

- **Wetland Restoration**

A restored wetland is the rehabilitation of a drained or degraded wetland where the soils, hydrology, vegetative community, and biological habitat are returned to the natural conditions to the greatest extent possible. A constructed wetland is a man-made wetland with over 50% of its surface area covered by wetland vegetation. It is ideal for large, regional tributary areas (10 to 300 acres) where there is a need to achieve high levels of particulate and nutrient removal. Wetland size and configuration, hydrologic sources, and vegetation selection must be considered during the design phase. Constructed wetlands provide a suspended solid removal of approximately 70%, while nutrient removal varies greatly due to a lack of standard design criteria, but it is typically in the range of 40-80%. These wetlands also benefit the area by providing fish and wildlife habitat and aesthetic benefits.

It should be noted that wetland restoration and construction of man-made wetlands (which are one form of a storm water management facility that may be built to meet the requirements of a storm water management plan in new developments) should be secondary management measures. Protection and preservation of natural wetlands should take priority on any development site.

**Utilize In-stream/Shoreline Habitat Restoration Techniques (BMP 61)**

Habitat restoration techniques include in-stream structures that may be used to correct and/or improve fish and wildlife habitat deficiencies over a broad range of conditions. Examples of these techniques include: channel blocks, boulder clusters, covered logs, tree cover, bank cribs, log and bank shelters, channel constrictors, cross logs and revetment, and wedge and “K” dams. The majority of these structures require trained installation with hand labor and tools. After construction, a maintenance program must be implemented to ensure long-term success of the habitat structures. In areas that experience high storm water peak flows, in-stream habitat restoration should be installed after the desired flow target is reached so as to ensure the success of the habitat improvement project.

Shorelines along the Black and St. Clair Rivers that either have seawalls in place or are in need of some form of stabilization on private property should be encouraged to utilize the methods outlined below for controlling erosion and restoring aquatic habitat. In addition, the water quality benefits of utilizing vegetative buffers should be emphasized. For publicly-owned lands, the methods outlined below should be utilized to ensure improved aquatic habitat, water quality, stabilization, and increased public access to the water resource should also be considered in the design.

1. **Vegetation:** Shoreline vegetation (with preference to native plant species) protects property naturally, effectively, and inexpensively. Trees offer excellent erosion control because of their deep root systems, which bind the soil, and their leaves, which intercept rain before it impacts and erodes the soil. Trees and shrubs not only hold soil and nutrients that may otherwise pollute area waterways, but also provide an aesthetically pleasing screen to protect the privacy of waterfront property owners. Nearshore water plants protect the shoreline against waves and provide excellent fish habitat. Invasive plant species such as purple loosestrife, reed canary grass, and Phragmites should be avoided. An example of a well buffered shoreline with vegetation is illustrated in Figure 6.4.



**Figure 6.4 Vegetative Buffer along the St. Clair River Shoreline in East China Township**

2. **Bioengineering:** In cases where steeper slopes need to be stabilized along shorelines, property owners may need to utilize innovative engineering techniques known as “bioengineering” to restore shoreline vegetation. Bioengineering can cost more than either vegetation or riprap alone; however, bioengineering methods can effectively protect highly vulnerable shorelines less expensively than seawalls or retaining walls. Also, unlike a solid seawall, bioengineering also maintains the valuable shoreline habitat and increases in strength over time as the plants grow.
3. **Stone or riprap:** Large stones placed on top of gravel or a filter blanket will stabilize gradual to moderately sloped shorelines by holding soils and dissipating wave action. Use of large stones also provides a rocky, natural-appearing shoreline with some habitat value, particularly if vegetation grows up with it (see Figure 6.5). Variations in depth along the shoreline provide diverse habitat for different species of plants and animals. Fish, turtles, crayfish, and other animals look for food and protect their eggs and young among vegetation and gaps in the rocks.



**Figure 6.5 Example of Riprap Shoreline Stabilization Practice**

4. Concrete or sheet piling: This approach should only be taken in cases where conditions exist such as extremely high wave energy, vertical bluffs, at marines which support intense boat traffic, or in settings where other solutions are not feasible. If concrete or sheet piling is the chosen alternative, the negative impacts of a vertical seawall can be reduced by facing the seawall with glacial stone or riprap on the lakeward side. This approach can help to replace some of the lost habitat value and minimize erosion due to wave reflection.

#### **Implement Alternative Drain Practices and Rehabilitation (BMP 62)**

While the primary responsibility of the Drain Commissioner is flood control, there are many opportunities to accomplish this goal in more sustainable ways where drains are particularly suitable for alternative practices. Drains that may fall under this category may be ones that were at one time streams and agricultural land has been or will soon be converted to a new development. In contrast to conventional methods, such as cutting vegetation and dredging which have been shown to increase erosion and sedimentation, destroy habitat, and increase long-term maintenance costs to drainage district residents, these alternative drain practices attempt to return drains to more natural systems that are self-maintaining. These methods require little maintenance, improve habitat, and may include restoration of floodplains, two-stage ditching, tree planting in the riparian corridors to prevent vegetation growth in the middle of drains, and construction of regional wetland retention systems. The Road Commission should also consider incorporating a two-stage ditch design for roadside ditches if adequate space is available in the road right-of-way. This design can help to reduce maintenance costs by providing additional capacity for increased runoff quantities while reducing bank erosion.

#### **Install and Maintain Streambank Stabilization Measures (BMP 63)**

Streambank stabilization measures are treatments used to stabilize and protect banks of streams or constructed channels, and shorelines of lakes and reservoirs. Understanding the cause of the erosion problem should be addressed before implementing any streambank stabilization measure. If the cause of erosion is due to extreme peak storm water flows, then the issue of peak flow problems should be addressed before stabilization measures can be expected to mitigate the problem. Streambank stabilization measures work by either reducing the force of flowing water and/or by increasing the

resistance of the bank to erosion. Vegetating streambanks also provides important ecological benefits such as shading water and providing crucial habitat for both terrestrial and aquatic wildlife species.

Three types of streambank stabilization methods exist: engineered, bioengineered and biotechnical, as outlined below.

- Engineered structures include riprap, gabions, deflectors and revetments, such as j-hook vanes and cross-vanes. Additional information on these structures is available at: <http://www.wildlandhydrology.com/assets/cross-vane.pdf>.
- Bioengineering refers to the use of live plants that are embedded and arranged in the ground where they serve as soil reinforcement, hydraulic drains, and barriers to the earth movement and/or hydraulic pumps. Examples of bioengineering techniques include: live stakes, live fascines, brush mattresses, live crib walls and branch packing. Additional information on these structures is available at: <http://www.crjc.org/pdffiles/streamstab.pdf>.
- Biotechnical measures include the integrated use of plants and inert structural components to stabilize channel slopes, prevent erosion, and provide a natural appearance. Examples of biotechnical techniques include: joint plantings, vegetated gabion mattresses, vegetated cellular grids and reinforced grass systems. Bioengineered or biotechnical methods should be implemented in lieu of engineered methods, where possible, so as to increase habitat and aesthetics. Additional information on these methods is available at: <http://www.unl.edu/nac/agroforestrynotes/an24sa07.pdf>.

#### **Replace Undersized Culverts/Repair Misaligned or Obstructed Culverts (BMP 64)**

In the case of undersized, perched, or obstructed road culverts, problems such as streambank erosion due to altered flow patterns can occur. Culverts should be replaced using a recommended six step approach known as “MESBOA” (S. Verry, 2005):

- Match Culvert Width to Bankfull Stream Width
- Extend Culvert Length through Side Slope Toe
- Set Culvert Slope the same as the Stream Slope
- Bury Culvert 4” to 1’ (2’ – 6’ Culverts, dig 10” – 1.5’ below bottom)
- Offset Multiple Culverts (one at floodplain level; the other about 1’ higher than lower culvert)
- Align Culvert with Stream (or dig approach using stream sinuosity)

Additional information on Roadway BMPs can be found on the US EPA’s website at:

<http://www.epa.gov/owow/nps/roadshwys.html>.

#### **Stabilize Eroding Road and Bridge Surfaces (BMP 65)**

In the NEW, soil erosion at road/stream crossings and along roadside ditches has been observed along both paved and unpaved (sand/gravel) roadways. The gravel and sand/gravel composite used for the road surface can be the source of sediment pollution to surface waters when precipitation washes it into the stream or when road grading builds piles of the surface along the sides of the road. In some cases, the roadside ditches may be inadequately stabilized with vegetation, may not exist, or were poorly constructed to move roadside drainage to discharge points without transporting excess sediment to the waterway. In addition, some unimproved roads have constructed bridges with scupper drains that provide a direct conduit for storm water laden with sediment to fall directly to the stream below.

Stabilization of eroding road and bridge surfaces may involve structural techniques such as retrofitting the bridge to prevent runoff from entering the stream, or managerial techniques such as altering grading practices and selecting a different road and bridge surface, or sweeping bridge surfaces to remove sediment buildup from its surface.

Additional information on roadway BMPs can be found on the US EPA's website at:

<http://www.epa.gov/owow/nps/roadshwys.html> or  
<http://www.epa.gov/owow/nps/urbanmm/mm07.pdf>.

Additional resources on gravel roadway BMPs can be found on the US EPA's website at:

<http://www.epa.gov/owow/nps/gravelroads/>.

### **Install and Maintain Gauge Stations (BMP 66)**

Currently, there is only one year-round United State Geological Survey (USGS) gauge station in the NEW which is maintained by the USGS and is located on the Lower Black River near Jeddo, MI (accessible at: <http://waterdata.usgs.gov/mi/nwis/uv?04159492>). Gauge stations provide invaluable data on the range of flow fluctuations and peak flows related to wet weather events in stream reaches. This type of data can be very valuable as an indicator of how stream velocities respond to wet weather events and can help to delineate where excessive storm water quantities may be coming from in an upstream reach. The availability of this data can be helpful to mitigate the source of storm water runoff quantities that can lead to a series of costly problems downstream (i.e. streambank erosion from flashy hydrology). The watershed partners are encouraged to explore the options of applicable gauge sites, particularly in coordination with the local USGS offices. If a suitable site is present, the watershed partners should consider installing the station. The station would likely be maintained by USGS office personnel, but could be maintained by a group effort or the Drain Commissioner's office.

Another BMP defined in previous sections of this chapter that will also aim to achieve the objectives of post-construction storm water management include:

- **BMP 6:** Implement Employee Training Programs

### **6.2.6 Pollution Prevention/Good Housekeeping for Municipal Operations**

Municipalities, county agencies, and schools have properties and infrastructure that can contribute various pollutants to storm water during routine operation and maintenance activities. As such, measures should be taken to ensure that both staff and contractors employed by permittees are educated through training programs on how to best prevent storm water pollution. Training, inspection, and maintenance procedures are required for various activities on permittee-owned properties and controls as outlined in the General Stormwater Permit (MIG619000) including, but not limited to:

1. Maintenance activities (both preventative and corrective), maintenance schedules, and inspection procedures for storm water structural controls.
2. Controls used for reducing or eliminating discharges of water and pollutants from:
  - a. Streets and roadways
  - b. Highways
  - c. Parking lots
  - d. Maintenance garages, and
  - e. Storage yards.
3. Procedures for the disposal of operation and maintenance waste from the separate storm water drainage system, such as:
  - a. Dredge spoil

- b. Accumulated sediments
  - c. Floatables, and
  - d. Other debris.
4. Procedures to ensure that flood management control projects assess impacts on water quality of the receiving waters.
  5. Implementation of controls to reduce the discharge of pesticides, herbicides, and fertilizers.

Many of the structural and vegetative BMPs outlined in the previous section (Section 6.2.5.2) on Post-Construction Stormwater Management Controls have a maintenance component incorporated into their description and the maintenance activities associated with these permittee-owned controls will be part of the information reported in a permittees SWPPI. As such, those BMPs will not be re-listed in this section. The implementation of the additional BMPs listed below is all intended to achieve the prevention of nonpoint source pollution.

Additional information on applicable pollution prevention/good housekeeping BMPs can be found on the US EPA's website at:

<http://www.epa.gov/owow/nps/urbanmm/mm09.pdf> and  
<http://cfpub.epa.gov/npdes/stormwater/menuofbmps/poll.cfm>.

#### **Install and Maintain Native Landscaping (BMP 67)**

“Native” plant species are those that have evolved and are adapted to a specific geographic region. Many have very deep root systems which help break up heavy clay soils, provide a source of infiltration for stormwater, and don't require watering during droughts. Because they have adapted to the soils in their geographic zone, they also don't need fertilizers, pesticides or other harmful chemicals once established to thrive. In addition, native landscaping provides habitat for native and migrating birds, butterflies, and insects. Using native plants is a low-cost alternative to traditional landscaping that typically utilizes turf grass and non-native ornamental plantings. Because of these qualities, native plants help to reduce storm water runoff quantities, filter pollutants in stormwater, promote infiltration of water, and effectively stabilize soils to reduce soil erosion and protect streambanks or the banks along the waterline of wet detention basins from erosion. Suitable applications for native plantings include river or wetland edges, detention basin and drainage features, parks, green roofs, residential and garden areas, and commercial, industrial, and institutional developments.

Permittees are encouraged to install and maintain native landscaping on their publicly-owned properties, as well as encourage or require native landscaping be used in new developments/redevelopments (i.e. incorporate into design standards or storm water management ordinance). Installing native plants and educational signage on municipal properties has been an extremely successful way other southeastern Michigan municipalities have educated residents about the storm water management benefits of native plants.

An excellent online resource containing images of native plants of Michigan is available at:  
<http://www.wildflower2.org/NPIN/Gallery/State.asp?StateField=MI&submit2.x=10&submit2.y=6>.

#### **Install and Maintain Riparian Buffers (BMP 68)**

The effects of urbanization on low order streams (1<sup>st</sup>-3<sup>rd</sup> order, which represent headwater and small to moderately sized streams) are well documented, and include alterations that result in degraded stream habitat and aquatic communities. Riparian buffers (Figure 6.6) consist of streamside vegetation managed for the enhancement of water quality through control of nonpoint source pollution and protection of the stream environment. Riparian buffers may be placed along a lake or pond shoreline, stream or wetland. The primary function of this practice is to physically protect and separate the natural feature from future disturbance or encroachment by development. Buffers remove storm water pollutants such as sediment,

nutrients and bacteria, slow runoff velocities, and also deter Canadian Geese from moving in. The degree to which buffer systems remove pollutants is dependent on loading rates from upland land uses, stream order and size, and the successful establishment and sustainability of the practice (Lowrance, et. al, 1997). Design and size of the buffer also plays a large role in effectiveness. It has been discussed in the NEW WAG that a good starting point for sizing buffers is requiring 25 feet of buffer along any waterbody. A more detailed approach to sizing buffers is the three-tiered system recommended by the Center for Watershed Protection. This method is detailed in their publication, “Better Site Design: A Handbook for Changing Development Rules in Your Community”, which is summarized at the following website: [http://www.cwp.org/better\\_site\\_design.htm](http://www.cwp.org/better_site_design.htm). On agricultural lands, land owners can be eligible for USDA programs that provide cost share to install the practices and provide rental payment for the land taken out of production.



**Figure 6.6 Riparian Buffer along Agricultural Land (USDA NRCS)**

**Implement and Maintain No-Mow Buffer Zones (BMP 69)**

Practices that employ no-mow zones along watercourses or other sensitive environmental areas can help to encourage a healthy vegetative buffer in order to protect water quality, reduce runoff quantities, and promote both aquatic and wildlife habitat protection. Other strategies such as using a low-mow turf grass or ensuring that mower heights are at least 3” should be encouraged by grounds maintenance staff.

**Perform Retrofitting of Storm Water Management Facilities (BMP 70)**

Over time, storm water management facilities may develop reduced capacities to handle the storm water runoff quantities that they were originally designed to handle due to a lack of maintenance (overgrown vegetation or excessive sedimentation), or other structural modifications (i.e. outlet/inlet failures or modifications). Facilities may need to be evaluated on a scheduled basis to ensure proper water quality and quantity functions; if those facilities are found to no longer be adequate, improvements such as retrofitting may need to be considered. Retrofits may include resizing, re-planting with native plantings or establishing buffer strips to reduce nutrient, sediment, and bacteria loadings, and/or to increase aquatic and wildlife habitat opportunities. Such improvements may also enhance passive recreation opportunities.

**Perform Curb/Street Sweeping (BMP 71)**

Street sweeping is a managerial practice employed by municipal operations that involves cleaning pavement of debris such as sediment, trash, and other solid particles that may get picked up by storm water runoff and get deposited into surface waters through storm sewer systems or by overland flow.

Street sweeping can also be useful prior to spring snowmelt to remove the buildup of residual road salt from roadways before it is carried off by storm water into area lakes and streams.

**Implement Catch Basin Cleaning Program (BMP 72)**

As part of a regular maintenance schedule of the municipality, road commission or drain commissioner, catch basins should be cleaned of accumulated sediment, trash, and other debris on a scheduled basis to reduce the concentration of pollutants during the first flush of storms, prevent obstructions of downstream systems, restore the catch basin sediment trapping ability, and allow the in-system storage capacity of the structures to be maximized. Catch basin cleaning requires the use of a high-power vacuum truck (vactor truck) to clean debris from the sumps of catch basins and should be properly disposed of to avoid the particulates from re-entering the storm sewer system. This program can be augmented by the utilization of catch basin inserts (see BMP 57).

**Utilize RETAP to Identify Improvements to Municipal Housekeeping Practices (BMP 73)**

The Retired Engineer Technical Assistance Program (RETAP) is made up of a group of retired engineers that assist local governments and institutions with pollution prevention. The program provides a team of retired professional engineers and scientists to review municipal operations for potential waste reduction strategies and opportunities, including pollutant source reduction, reuse, recycling and energy efficiency. The program is administered through the MDEQ and is free of charge. Additional information is available at: <http://www.michigan.gov/deq/0,1607,%207-135-3304-11899--,00.html>.

**Perform Storm Sewer System Maintenance and Drain Cleaning (BMP 74)**

As part of the regular maintenance schedule of the municipality, road commission or drain commissioner, storm sewer systems should be evaluated on a scheduled basis to ensure proper working order. This could be performed as part of the IDEP dry weather screening work (i.e. perform visual inspections and look for degraded infrastructure or leaking infrastructure). In addition, the storm sewer system and/or open drains should be cleared of the buildup of sediment, trash or other debris on a regular basis to ensure the reduction of pollutants carried off by storm water inputs to the conveyances to the MEP.

**Manage Public Facilities (BMP 75)**

Public agencies must have programs in place to effectively manage facilities to treat, control or eliminate any sources of environmental degradation from these sites. Facilities should have management plans to address the containment of potential pollutants such as salt storage, hazardous chemicals, oil and gasoline, fertilizers, herbicides, pesticides, stockpiles of particulate (sand/gravel, etc.) or organic (mulch) matter. In addition, programs should address the proper application rates, times and locations of such potential pollutants as fertilizers, pesticides, herbicides and salt, etc. Public facilities might also address the elimination of sources of pathogens/nutrients from pet waste or waterfowl by putting up “don’t feed the waterfowl” signage or assembling pet waste pickup stations in parks.

**Develop and Implement Procedures for Disposal of Operation and Maintenance Wastes (BMP 76)**

Procedures should be in place for the proper disposal of operation and maintenance wastes removed from the permittee-owned separate storm water drainage system such as:

1. Dredge spoils,
2. Accumulated sediments,
3. Floatables,
4. Other debris.

Procedures should cover:

1. Methods for dewatering from catch basin cleanouts.
2. Procedure for solid waste disposal in appropriate landfill.
3. Procedure for handling and disposing of known toxic or hazardous materials.
4. Cleaning of oil/water separators (if used).

**Maintain Sanitary Sewer Infrastructure (BMP 77)**

As part of a regular maintenance schedule of the municipality, sanitary sewer infrastructure should be evaluated on a scheduled basis to ensure that there are no leaks or breaks in the system that provides a conduit for excess nutrients and pathogens to the surrounding environment. Sanitary sewer infrastructure may also be evaluated to ensure that storm water or groundwater is not infiltrating the sanitary system providing an added burden of treatment to the municipal wastewater treatment plant. Infiltration studies, sanitary sewer televising, smoke testing or dye testing may all be necessary to identify failures of cross-connections in a sanitary sewer system.

**Develop and Implement a Pollution Incident Prevention Plan (BMP 78)**

The development and implementation of a Pollution Incident Prevention Plan (PIPP) is a requirement for owners of facilities that store salt, oil, or other chemicals noted in Rule 9 of Part 5 of the Administrative Rules pursuant to Part 31, Water Resources Protection of the Natural Resources and Environmental Protection Act, 1994 P.A. 451 that meet or exceed the threshold management quantities (outlined below). The PIPP contains information on spill notification, spill control, and clean-up procedures, polluting material inventory, secondary containment information, and a site plan. After the development of a PIPP, written certification needs to be provided to the MDEQ that it has been developed, and the health department notified that it is available upon request. Guidance on the Part 5 Rules is provided at: <http://www.deq.state.mi.us/documents/deq-ead-tas-pipp5summary.pdf>

The threshold management quantities for both indoor and outdoor use, storage, and other management areas of potentially harmful chemicals are as follows:

Salt:

- Any location that has 1,000 gallons or more of salt in liquid form;
- Any location that has 5 tons or more of salt in solid form. This would include salt and sand mixtures that contain 1% or more of salt.

Oil or Fuel Storage Areas with Above-ground Holding Capacity of:

- 660 gallons or large holding capacity in any single tank or container;
- 1,320 gallons or larger capacity of all oil tanks, drums and other containers anywhere on site.

Materials listed in Rule 9 stored at a facility or other use areas in the following amounts:

- 2,200 pounds or more in indoor locations;
- 440 pounds or more at outdoor locations (approximately one 55-gallon drum).
- Any compound or product that contains 1% or more by weight of the materials listed in Rule 9 based on the materials safety data sheet (MSDS).

Flammable and combustible liquids that fall under the Michigan Fire Protection Code regulations are exempt from the Part 5 Rules.

The MDEQ has an environmental emergency hotline known as the “Pollution Emergency Alerting System” or PEAS hotline at: **1-800-292-4706**. The PEAS hotline should be used to report environmental

pollution emergencies such as tanker accidents, pipeline breaks, and releases of reportable quantities of hazardous substances as required. The hotline goes to an answering service which is staffed 24 hours a day. Between 8 a.m. and 5 p.m. on normal working days (Monday-Friday), the operators give callers the option of contacting the appropriate Department of Environmental Quality (DEQ) district office serving the area where an incident has occurred, or the operators will take the information and dispatch the calls to the district offices for the caller. During non-business hours (after 5 P.M., holidays and weekends), calls are referred to an MDEQ employee who is on-call for the PEAS. That individual completes a Report of Incident and determines whether immediate referral is necessary or if the information can be referred during normal business hours. Calls are directed to MDEQ staff or other agencies depending on the nature of the situation. The nature of MDEQ staff response is generally to provide technical advice to first responders on actions they can take to minimize environmental damage.

Other BMPs defined in previous sections of this chapter that will also aim to achieve the objectives of pollution prevention and good housekeeping for municipal operations include:

- **BMP 4:** Implement Reduced Fertilizer, Pesticide, and Herbicide Usage
- **BMP 6:** Implement Employee Training Programs
- **BMP 9:** Encourage the Use of Household Hazardous Waste Disposal and Electronics Recycling Programs
- **BMP 13:** Utilize Soil Testing Program
- **BMP 16:** Implement Reduced Use of Road Salt and Consider Alternative Deicing Chemicals
- **BMP 29:** Implement Soil Erosion and Sedimentation Control Ordinance and SESC Program
- **BMP 30:** Implement Storm Water Management Ordinance/Design Standards for Storm Water Management Systems on Permittee-Owned Properties

### **6.2.7 Watershed Plan Implementation**

#### **Implement Financial Solutions (BMP 79)**

The programs and projects that will be implemented upon approval of the NEW WMP will inherently depend on the financial resources available to do so. Forming partnerships with other agencies and resource protection groups (outlined in Table 8.4 in Chapter 8) throughout the watershed will also be crucial to the success of the implementation process due to the benefits of resource-sharing. With the obligations that need to be met in the Phase II storm water management program, funding will need to be allocated from existing budgets, or opportunities for new funding sources will need to be realized. Opportunities for funding sources should be constantly researched throughout the implementation phase.

Funding sources, such as Section 319 or CMI grants that often require matching funds, are available but are often limited to short-term, one time projects. The US EPA reported that over 40% of section 319 funding is typically used to help design and build management approaches to prevent and control nonpoint source pollution from agricultural lands. Some projects may need to be funded through fundraising, citizens, industries, or municipalities in the watershed. Other opportunities for funding could come from the following sources:

- Implementation of a storm water utility fee (incurred by users of the storm water system);
- Calculating user fees based on the amount of impervious cover produced in developments;
- Establishing wetland or tree mitigation banking systems; or
- Charging fees based on the amount of unstabilized soils (per-day, per-acre fee) on exposed land at construction sites.

An excellent clearinghouse of additional resources on funding opportunities is available at:  
<http://www.crowc.org/programs/phase2/funding.html>.

The MDEQ has a “Grants and Loans Catalog” and information on funding sources from the MDEQ is available at:  
[http://www.michigan.gov/deq/0,1607,7-135-3307\\_3515---,00.html](http://www.michigan.gov/deq/0,1607,7-135-3307_3515---,00.html).

The US EPA’s website has additional resource information on funding available at:  
<http://www.epa.gov/owow/funding.html>, and  
<http://www.epa.gov/efinpage/guidbkpdf.htm>.

### **Provide Sufficient Enforcement Capability (BMP 80)**

After ordinances and regulations to address land use planning and nonpoint source pollution prevention measures are adopted, there must be sufficient resources and personnel available to enforce them. Stakeholders have expressed a high degree of concern in regards to lack of enforcement of local regulations. To address these concerns, measures such as additional personnel dedicated to inspection and enforcement, as well as follow-through for administration and payment of fines may be necessary. An option to consider may involve allocating staff devoted to other tasks to take on additional duties as an enforcement officer, as opposed to hiring a dedicated, full-time officer.

### **Implement Institutional Framework for Watershed-Wide Actions (BMP 81)**

In order to ensure watershed management is most effective, actions should be taken to ensure that planning, project, and program opportunities are shared across jurisdictional boundaries to include federal, state, county, and local government involvement. Management of water and natural resources on a watershed-scale can be an overwhelming endeavor and the establishment of a central working group dedicated to watershed issues and implementation of action plans is a highly recommended strategy. This group may consist of continued meetings of the NEW watershed advisory group as a whole, or separate, more detailed working groups may be formed to help direct various components of the NEW WMP. This framework should be established early on in the implementation process of the NEW WMP to ensure a program that is as time and cost effective as possible for all entities involved. This group would also work to evaluate WMP effectiveness over time by compiling the evaluation components of the methods for measuring progress and providing feedback on recommended updates to the WMP every two years, or as needed. See Section 9.1 of Chapter 9 for additional information on possible institutional frameworks that should be considered in the NEW.

## **6.2.8 Other Applicable BMPs**

### **Meet Established Total Maximum Daily Loads (TMDLs) in the NEW (BMP 82)**

At present, there are several TMDLs that need to be developed by the MDEQ and approved by the US EPA. Once the TMDLs are approved, the Phase II permitted agencies and communities will need to implement applicable BMPs to achieve the specific TMDL targets. The TMDL documents will outline which strategies should be taken to achieve the reduced pollutant loadings.

Table 6.1, below outlines the TMDLs to be developed In the NEW (see Section 2.3.1 of Chapter 2 for a more in depth description of TMDLs):

**Table 6.1 Summary of 303(d) Listed Waterbodies in St. Clair County’s Northeastern Watersheds (MDEQ, 2006)**

Pollutant/ Impairment	Waterbody	Miles Impaired	Reach Impaired	Source	TMDL Year
PCBs	Black River	390	St. Clair River confluence upstream to include all tributaries	<ul style="list-style-type: none"> <li>Atmospheric Deposition</li> <li>Historic industrial/ municipal point source discharges</li> <li>Localized contaminated sediments</li> </ul>	2010
	St. Clair River	27	Vicinity of Algonac, Lake St. Clair inlet upstream to Lake Huron outlet at Port Huron		2010
	St. Clair River	27	Same as noted above for a Fish Consumption Advisory		2010
Mercury	Black River	1	Water Street boat launch downstream of RR bridge		2011
Pathogens/ Bacteria ( <i>E. coli</i> )	Black River	1.5	St. Clair River confluence upstream to I-94 in the vicinity of Port Huron	<ul style="list-style-type: none"> <li>CSOs</li> <li>Urban runoff/storm sewers</li> <li>Illicit connections</li> </ul>	2009
	Lake Huron	0.12	Krafft Road Beach in the vicinity of Port Huron		2015
	St. Clair River	27	Vicinity of Algonac, Lake St. Clair inlet upstream to Lake Huron outlet at Port Huron		2009
	St. Clair River	0.5	Chrysler Beach in Marysville		2016

- The only TMDL that is associated with management of storm water runoff will be the pathogen TMDLs, and it is anticipated that all permittees in the NEW will need to implement measures to meet the pathogen TMDL once it has been approved. Many permittees are already implementing measures to minimize impacts from bacteria, including implementation of their IDEP and the elimination of CSO systems in Port Huron.

#### Additional BMP Resources:

##### Various Environmental Model Ordinances from Macomb County:

[http://macombcountymi.gov/planning/Model\\_Envir\\_Ordinances.asp](http://macombcountymi.gov/planning/Model_Envir_Ordinances.asp) (also see Appendix O).

##### US EPA’s National Menu of BMPs for Storm Water Phase II:

Scroll to bottom of page to links for each of the 6 Minimum Measures. Each Minimum Measure link takes you to a page that lists fact sheets for every BMP you can think of. The site contains information on costs, pollutant removal efficiencies, restrictions, maintenance, etc.:

<http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm>.

##### MDEQ’s Guidebook of Best Management Practices for Michigan Watersheds:

[http://www.michigan.gov/deq/0,1607,7-135-3313\\_3682\\_3716-103496--,00.html](http://www.michigan.gov/deq/0,1607,7-135-3313_3682_3716-103496--,00.html).

##### MDEQ’s Index of Individual BMPs:

[http://www.michigan.gov/deq/0,1607,%207-135-3313\\_3682\\_3714-13186--,00.html](http://www.michigan.gov/deq/0,1607,%207-135-3313_3682_3714-13186--,00.html).

**MDOT Approved BMPs:**

**[http://www.michigan.gov/documents/SWMP\\_05\\_MDOT v 4 120609 7.0 Appendix D.pdf](http://www.michigan.gov/documents/SWMP_05_MDOT_v_4_120609_7.0_Appendix_D.pdf)**

**Storm Water Manager's Resource Center:**

This dynamic new site will include user-friendly features such as a searchable storm water library, 10 browsable slide shows, a manual builder, an ordinance selector, more than 50 different fact sheets on virtually every topic necessary for a community to implement Phase I or II storm water requirements, and fully downloadable articles from "The Practice of Watershed Protection". This resource was supported by a grant from the EPA Office of Wastewater Management and can be accessed at: **[www.stormwatercenter.net](http://www.stormwatercenter.net)**.

**Maintenance BMPs for Storm Water Treatment Practices:**

**[http://www.stormwatercenter.net/Manual Builder/Maintenance Manual/introduction.htm](http://www.stormwatercenter.net/Manual_Builder/Maintenance_Manual/introduction.htm)**

**6.3 Estimated Costs and Environmental Benefits of Recommended Best Management Practices that Address the Pollutants and Issues of Concern in St. Clair County's Northeastern Watersheds**

Table 6.2 provides a summary of the estimated costs of each recommended BMP for the NEW. Detailed descriptions of each BMP can be found in the previous sections of this Chapter. Additional details on applicable BMPs, maintenance schedules, and costs can be found on the US EPA's website at: **<http://www.epa.gov/owow/nps/urbanmm/>**.

**Table 6.2 Estimated Costs of Recommended Best Management Practices in St. Clair County’s Northeastern Watersheds**

BMP#	BMP Recommendation	Estimated Cost*
1	Develop and Distribute Outreach Materials on Watershed Awareness and Storm Water Management	\$100/hour for consultant services for materials development. Printing costs estimated at around \$0.50/brochure. See Table 8.2 (in Chap. 8 - Inf. And Ed.) for additional costs broken out by outreach material type.
2	Utilize the “Seven Simple Steps to Clean Water” Campaign Materials and Mass Media Efforts	Brochures: \$0.01-\$0.10/each (member cost). Posters: \$0.50/each (member cost). Tip Cards: \$0.01-\$0.10/each (member cost). Display Panel: \$43.75/each (member cost, includes S&H). Free on loan from the SCCHD. Giveaways: \$.10-\$1.20/each (member cost, not including S&H). Order forms available at: <a href="http://www.semcog.org/OursToProtect/Materials/MaterialsUsageGuidelines.htm">http://www.semcog.org/OursToProtect/Materials/MaterialsUsageGuidelines.htm</a> .
3	Encourage the Use of Generally Accepted Agricultural Management Practices (GAAMPs)	Costs include staff time and mailing. Tasks are: identification of problem, communication with the NRCS and landowner, preparation of packets and mailing and follow up.
4	Encourage Reduced Fertilizer, Pesticide and Herbicide Usage	As part of an operations and maintenance program, staff should be trained on the proper use and disposal of fertilizers on grounds. \$100/hour for training; no additional cost in terms of regular operation and maintenance operations. Free training materials to be developed by SEMCOG. See: <a href="http://www.semcog.org/MunicipalTraining/index.htm">http://www.semcog.org/MunicipalTraining/index.htm</a>
5	Seek Participation from the Public during Earth Fair and River Day	No cost beyond staff time if advertise events through existing means (newsletters, website, posters, newspaper, etc.)
6	Implement Employee Training Programs	\$100/hour for training by consultant. Programs also available through the MDEQ for a nominal fee. Free materials are being developed by SEMCOG. See: <a href="http://www.semcog.org/MunicipalTraining/index.htm">http://www.semcog.org/MunicipalTraining/index.htm</a>
7	Promote St. Clair County’s 24-Hour Water Quality Hotline	Hotline already established through the SCCHD. Promotion may consist of obtaining free posters from the SCCHD.
8	Develop and Distribute Outreach Materials on Low-Impact Design	\$100/hour for consultant services for materials development. Printing costs estimated at around \$0.50/brochure.
9	Encourage the Use of Household Hazardous Waste Disposal and Electronics Recycling Programs	Cost to promote program depends on method of promotion. Newsletter articles are an easy and free means to promote this program administered through the St. Clair County Environmental Services Department. Sample newsletter information is available from the SCCHD.
10	Install Watershed Signage	\$80/sign for materials and printing; \$131/sign for installation by the SCCRC on Township/county roads.
11	Promote the Adopt-a-Stream Program	Brochures may be obtained though the SCCMSU Extension office (MSU Ext) and copied at a nominal fee. The MSU Ext provides all equipment and training free of charge.
12	Promote the Adopt-a-County Road Program	Brochures may be obtained though the SCCRC and copied for a nominal fee. All equipment and instructions provided by the SCCRC at no cost.
13	Provide Information on/Utilize the Soil Testing Program	Soil testing program information may be obtained from the MSU Ext office and copied for a nominal fee. Homeowner/residential test: \$15 (includes full analysis and recommendations)
14	Encourage Participation in the Citizen Planner Program	Participation is \$385 per person for seven core sessions; individual sessions \$75 per person; locally selected topics available for \$45 per person. Group discounts available for four or more registrants of same municipality at \$315 per person for seven core sessions (based on Year 2006 rates).
15	Provide Education on the Identification of Failing On-Site Septic Disposal Systems	Septic system maintenance brochures available from the SCCHD free of charge.

**Table 6.2 Estimated Costs of Recommended Best Management Practices in St. Clair County's Northeastern Watersheds**

BMP#	BMP Recommendation	Estimated Cost*
16	Encourage Reduced Use of Road Salt and Promote Alternative Deicing Chemicals	\$100/hour for review of storage area and recommendations. 8-24 hours for this task dependent on size of facility. Conventional salt costs \$25/ton, alternatives from \$200to \$650/ton. Application rates are assumed to be approximately 200-lbs./lane mile. \$20/lane mile for Calcium Chloride in addition to conventional salt. \$65/lane mile for CMA in addition to conventional salt. <sup>2</sup>
17	Encourage Golf Course Nutrient Management	Staff time and mail costs to prepare and mail letter and brochure or information to Golf Course owner. Agencies such as the United States Golf Association and local MSU-Extension office will have information about golf course certification programs that can be recommended.
18	Perform Storm Drain/Catch Basin Marking	Catch basin markers made of a heavy duty plastic that have been found to last longer than spray painting the curb. They can be purchased for \$1.50-\$2.00/each and placed by volunteer civic groups or DPW staff. Current ordering information for SCC curb markers available through the SCCHD.
19	Seek Input from the Public on Development of Ordinances for Water Quality and Quantity Protection	Staff time to develop notices and advertise events through existing means (newsletters, website, posters, newspaper, etc.)
20	Seek Participation from the Public at NEW Watershed Advisory Group (WAG) Meetings	No cost if advertise events through existing means (newsletters, website, posters, newspaper, etc.)
21	Implement Illicit Discharge Elimination Plan (IDEP)	Costs associated with field surveys of open channels and closed systems to detect illicit connections/discharges: \$2,000/lineal mile of open channel; \$2,800/lineal mile of closed sewer (visual inspection, not TV); \$660/individual building; \$1-\$2/lineal foot for TV inspection. <sup>2</sup>
22	Sanitary Sewer Planning—Manage Lagoon Systems and Package Wastewater Treatment Plants	Costs would be incurred for staff time allotted for permit reviews. Costs would also be associated with program development for the inspection and enforcement of violations of discharge permits from these facilities. Staff time would need to be allotted for this; if consultants were used for the program, costs would be at least \$100/hour.
23	Eliminate Sanitary Sewer Overflow Events	Costs vary with community. Marysville and Marine City have undertaken multi-year projects to address this issue.
24	Eliminate Combined Sewer Overflow Systems	The City of Port Huron is currently in their ninth year of a \$186 million, 15-year project to control its sewage overflows (to date, 75% of the work has been completed to eliminate CSOs).
25	Implement St. Clair County Public Bathing Beach Water Quality Monitoring Program	The program is currently conducted by the SCCHD and funding is provided for the monitoring program through grant and county funds.
26	Study, Develop, Adopt and Enforce an Illegal Dumping Ordinance	\$150/hour for development and/or review. 160-320 hours for this task (may vary widely). \$200/hour for legal review. 80-200 hours for each ordinance (may vary widely). \$500/public meeting (depending on size/volume/quantity) Publishing and distribution costs can vary widely by community. <sup>2</sup>
27	Study, Develop, Adopt and Implement Illicit Discharge/Connection Elimination Ordinance	\$150/hour for development and/or review. 160-320 hours for this task (may vary widely). \$200/hour for legal review. 80-200 hours for each ordinance (may vary widely). \$500/public meeting (depending on size/volume/quantity) Publishing and distribution costs can vary widely by community. <sup>2</sup>
28	Support County-wide Onsite Septic Disposal System (OSDS) Ordinance	\$150/hour for development and/or review. 160-320 hours for this task (may vary widely). \$200/hour for legal review. 80-200 hours for each ordinance (may vary widely). \$500/public meeting (depending on size/volume/quantity)

**Table 6.2 Estimated Costs of Recommended Best Management Practices in St. Clair County's Northeastern Watersheds**

BMP#	BMP Recommendation	Estimated Cost*
		Publishing and distribution costs can vary widely by community. <sup>2</sup>
29	Implement and Enforce the Soil Erosion and Sedimentation Control (SESC) Ordinance and the SESC Program	Plan review: \$100/hour, typically requires a minimum of 4 hours plus 4 hours per acre of site. Geotextile: \$0.80/sq. yd. Straw Erosion Blanket: \$0.50/lin.ft. Wood Fiber Blanket: \$0.55/lin.ft. Silt Sack: \$130/sack Beaver Dam: \$60/sack Monofilament Wrap: \$2.70/sq.yd. Plastic Snow Fence: \$0.80/lin.ft. (including posts) Wood Snow Fence: \$0.80/lin.ft. (including posts) Sediment Log: \$2.50/lin.ft. <sup>2</sup>
30	Study, Develop, Adopt and Implement Storm Water Management Ordinance/Design Standards for Storm Water Management Systems	\$150/hour for development and/or review. 160-320 hours for this task (may vary widely). \$200/hour for legal review. 80-200 hours for each ordinance (may vary widely). \$500/public meeting (depending on size/volume/quantity) Publishing and distribution costs can vary widely by community. <sup>2</sup>
31	Study, Develop and Adopt Development Standards for Water Quality and Quantity Protection	\$100/hour for development. 1000-2000 hours for this task. \$100.00/manual for printing (depending on size/volume/quality). Site Planning Roundtable: \$25,000 to \$40,000. <sup>2</sup>
32	Update Master Plan to Incorporate Watershed Management Plan Goals and Objectives	\$150/hour for development and/or review. 160-320 hours for this task (may vary widely). <sup>2</sup>
33	Study, Develop, Adopt and Implement Aquatic (Riparian) Buffer Ordinance	\$150/hour for development and/or review. 160-320 hours for this task (may vary widely). \$200/hour for legal review. 80-200 hours for each ordinance (may vary widely). \$500/public meeting (depending on size/volume/quantity) Publishing and distribution costs can vary widely by community. <sup>2</sup>
34	Study, Develop, Adopt and Implement Floodplain Management Ordinance	\$150/hour for development and/or review. 160-320 hours for this task (may vary widely). \$200/hour for legal review. 80-200 hours for each ordinance (may vary widely). \$500/public meeting (depending on size/volume/quantity) Publishing and distribution costs can vary widely by community. <sup>2</sup>
35	Study, Develop, Adopt and Implement Wetland Protection Ordinance	\$150/hour for development and/or review. 160-320 hours for this task (may vary widely). \$200/hour for legal review. 80-200 hours for each ordinance (may vary widely). \$500/public meeting (depending on size/volume/quantity) Publishing and distribution costs can vary widely by community. <sup>2</sup>
36	Study, Develop, Adopt and Implement a Woodlands/Tree Preservation Ordinance	\$150/hour for development and/or review. 160-320 hours for this task (may vary widely). \$200/hour for legal review. 80-200 hours for each ordinance (may vary widely). \$500/public meeting (depending on size/volume/quantity) Publishing and distribution costs can vary widely by community. <sup>2</sup>
37	Perform High-Quality Natural Features Inventories throughout the Watershed	Inventories would need to be conducted by a trained professional at a cost of \$100-\$150/hr. Costs would vary depending on the size of the areas inventoried.
38	Incorporate High-Quality Natural Features Inventories into Master Plans, Zoning and other Ordinances	\$150/hour for development and/or review. 160-320 hours for this task (may vary widely). <sup>2</sup>
39	Study, Develop, Adopt and Implement Resource Protection	\$150/hour for development and/or review. 160-320 hours for this task (may vary widely).

**Table 6.2 Estimated Costs of Recommended Best Management Practices in St. Clair County's Northeastern Watersheds**

<b>BMP#</b>	<b>BMP Recommendation</b>	<b>Estimated Cost*</b>
	Overlay District Standards	\$200/hour for legal review. 80-200 hours for each ordinance (may vary widely). \$500/public meeting (depending on size/volume/quantity) Publishing and distribution costs can vary widely by community. <sup>2</sup>
<b>40</b>	Develop/Update Natural Areas Plan	\$150/hour for development and/or review. 160-320 hours for this task (may vary widely). \$200/hour for legal review. 80-200 hours for each ordinance (may vary widely). \$500/public meeting (depending on size/volume/quantity) Publishing and distribution costs can vary widely by community. <sup>2</sup>
<b>41</b>	Perform Stream/Drain Inventories and Water Quality Monitoring throughout the Watershed	\$100/hr consultant fees to perform inventories and water quality monitoring.
<b>42</b>	Identify Areas for Recreation Enhancement	\$150/hour for development and/or review.
<b>43</b>	Develop/Update Recreation Plans	\$150/hour for development and/or review. 160 hours to update or develop Recreation Plan (may vary widely). <sup>2</sup>
<b>44</b>	Implement Greenway Corridor Vision Plans	\$150/hour for development and/or review. Additional costs associated with the construction of infrastructure (walkways, bridges, etc.) and signage.
<b>45</b>	Initiate Hydrologic and Hydraulic Studies	Basin-wide, approximately \$92,000/acre for an in-depth study. <sup>4</sup> Studies focusing on fewer indices or representative stream reaches would be less costly. The Anchor Bay Watershed had an analysis of representative stream reaches done for about \$40,000.
<b>46</b>	Study, Develop and Update Site Plan Review Process to Require Hydrogeological Investigations	\$150/hour for development and/or review. 160-320 hours for this task (may vary widely). \$200/hour for legal review. 80-200 hours for each ordinance (may vary widely). \$500/public meeting (depending on size/volume/quantity) Publishing and distribution costs can vary widely by community. Costs for the actual investigation could vary widely depending on the site but typically are about \$10,000. The cost of the investigation would be incurred by landowner.
<b>47</b>	Encourage Participation in the Purchase of Development Rights Program	State program—no cost to municipalities other than staff time and mailing costs incurred in promotion of the program. Costs may be incurred by the landowner in developing the agreement with the State.
<b>48</b>	Encourage Participation in the Farmland Preservation Program (P.A. 116 Program)	State program—no cost to municipalities other than staff time and mailing costs incurred in promotion of the program. Costs may be incurred by the landowner in developing the agreement with the State.
<b>49</b>	Encourage the Use of Conservation Easements	Work in conjunction with local land conservancies to encourage management and preservation of natural resources through conservation easements. Communities could develop land use planning tools to require conservation easements in certain developments. The costs for planning tool development would be similar to ordinance development (see BMP 50).
<b>50</b>	Study, Develop, Adopt and Implement Agricultural Buffer Zoning Ordinance	\$150/hour for development and/or review. 160-320 hours for this task (may vary widely). \$200/hour for legal review. 80-200 hours for each ordinance (may vary widely). \$500/public meeting (depending on size/volume/quantity) Publishing and distribution costs can vary widely by community. <sup>2</sup>
<b>51</b>	Study, Develop, Adopt and Implement Rural Clustering Ordinance	\$150/hour for development and/or review. 160-320 hours for this task (may vary widely). \$200/hour for legal review. 80-200 hours for each ordinance (may vary widely). \$500/public meeting (depending on size/volume/quantity) Publishing and distribution costs can vary widely by community. <sup>2</sup>
<b>52</b>	Study, Develop, Adopt and Implement Mixed Use Zoning	\$150/hour for development and/or review. 160-320 hours for this task (may vary widely).

**Table 6.2 Estimated Costs of Recommended Best Management Practices in St. Clair County's Northeastern Watersheds**

BMP#	BMP Recommendation	Estimated Cost*
	Ordinance	\$200/hour for legal review. 80-200 hours for each ordinance (may vary widely). \$500/public meeting (depending on size/volume/quantity) Publishing and distribution costs can vary widely by community. <sup>2</sup>
53	Study, Develop, Adopt and Implement Private Roads Ordinance	\$150/hour for development and/or review. 160-320 hours for this task (may vary widely). \$200/hour for legal review. 80-200 hours for each ordinance (may vary widely). \$500/public meeting (depending on size/volume/quantity) Publishing and distribution costs can vary widely by community. <sup>2</sup>
54	Minimize Directly Connected Impervious Areas	The cost of redirecting downspouts to lawn or garden is about \$50/house <sup>4</sup> The costs for other BMPs to reduce directly connected areas are provided in BMP 59.
55	Study, Develop, Adopt and Implement Yard Waste Composting Facility Ordinance	\$150/hour for development and/or review. 160-320 hours for this task (may vary widely). \$200/hour for legal review. 80-200 hours for each ordinance (may vary widely). \$500/public meeting (depending on size/volume/quantity) Publishing and distribution costs can vary widely by community. <sup>2</sup>
56	Prevent and Remove Stream Flow Obstructions	Costs would be associated with maintenance staff time to remove debris or organize volunteer efforts. MDEQ construction permit cost is \$100. Costs may increase if the services of a professional may be needed to evaluate impacts to habitat from woody debris removal, estimated at at least \$100/hour.
57	Study, Develop, Adopt and Implement Hazardous Materials Cleanup Ordinance	\$150/hour for development and/or review. 160-320 hours for this task (may vary widely). \$200/hour for legal review. 80-200 hours for each ordinance (may vary widely). \$500/public meeting (depending on size/volume/quantity) Publishing and distribution costs can vary widely by community. <sup>2</sup>
58	Install and Maintain Sediment Trapping Devices	Design, legal and contingencies are typically 25%-30% of construction costs. Construction— Mobilization: 3%-5% of construction costs; Site Preparation: \$5.00-\$10.00/cubic yard for basin and sediment excavation; \$1.30/lin. foot for silt fence \$60.00/each on average for stone or gravel at inlet; Maintenance: 3%-5% of construction costs. <sup>2</sup>
58	Install and Maintain Catch Basin Inserts	The cost for a single insert is \$800-\$1,400 <sup>7</sup> The cost for maintenance depends on the location of the basin but they typically have to be cleaned monthly and more frequently in high sediment or traffic areas.
58	Install and Maintain Media/Sand and Organic Filters	Construction: \$3.00-\$6.00/cubic foot for media filter; \$5.30/cubic foot for vegetated filter; Maintenance: \$0.36-\$0.72/cubic foot/year. Typical filter size is 10 cubic feet per impervious acre. <sup>2</sup>
58	Install and Maintain Oil/Grit Separators	Cost is moderate to high, approximated at \$20,000 for the unit itself, plus labor and maintenance, approximated at \$900. <sup>13</sup>
58	Install and Maintain Oil and Grease Traps	Construction: \$100/cubic foot. Maintenance: \$10/year/cubic foot. There should be a maximum area of one acre tributary to each device; volume is typically 400 cubic feet per trap device. It may be possible to recover costs from property owners by passing a bylaw or entering into a maintenance agreement.
59	Install and Maintain Grassed Swales	Construction: \$0.30/square foot.

**Table 6.2 Estimated Costs of Recommended Best Management Practices in St. Clair County's Northeastern Watersheds**

BMP#	BMP Recommendation	Estimated Cost*
		Maintenance: \$0.02/square foot. <sup>2</sup>
59	Install and Maintain Vegetated ("Green") Roofs	Extensive: \$8-12/sq.ft. <sup>3</sup> Intensive: \$15-25/sq.ft. <sup>3</sup>
59	Install and Maintain Rain Gardens (Bioinfiltration)	\$3-4/sq.ft. <sup>3</sup>
59	Install and Maintain Pervious Pavements	\$2.00-\$3.00/square foot as opposed to \$0.50-\$1.00/square foot for traditional pavement. Interlocking pavers can cost between \$5.00-\$10.00/square foot. <sup>3</sup>
59	Install Rain Barrels	\$20-150 each <sup>3</sup>
59	Install Dry Wells	\$900-\$1,400 each <sup>5</sup>
60	Install and Maintain Storm Water Retention/Infiltration Basins and other Infiltration Devices	<p>Infiltration Trenches: The construction cost for a relatively large infiltration trench (i.e., 1.8 meters (6 feet) deep and 1.2 meters (4 feet) wide with a 68 cubic meter (2,400 cubic feet) volume) ranges from \$10,000 to \$25,000. A smaller infiltration trench (i.e., 0.9 meters (3 feet) deep and 1.2 meters (4 feet) wide with a 34 cubic meter (1,200 cubic feet) volume) is estimated to cost from \$5,000 to \$10,500. Maintenance costs include buffer strip maintenance and trench inspection and rehabilitation. Maintenance costs for infiltration trenches based on the above examples, annual operation and maintenance costs would average \$1,000 for the large trench and \$500 for the small trench. Typically, annual maintenance costs are approximately 5 to 10 percent of the capital cost. Trench rehabilitation may be required every 5 to 15 years.<sup>14</sup></p> <p>Other Infiltration Devices: Design, legal and contingencies are typically 25%-30% of construction costs. Construction— Mobilization: 3%-5% of construction costs; Site Preparation: \$3,000-\$6,000/acre for clearing; \$2.50-\$6.00/cubic yard for earth excavation; \$3,000-\$7,000/each for inlet/outlet structures; Maintenance costs: Typically 3%-5% of construction costs.<sup>2</sup></p>
60	Install and Maintain Extended Wet Detention Ponds	<p>Design and Permits: 30% of construction cost estimated. Construction: \$160,000/million gallons (MG) for 1 MG pond to \$52,000/MG for 10MG pond, or \$0.50 to \$1.00/cubic foot excluding land purchase. Maintenance: \$10,000/year.<sup>2</sup></p>
60	Perform Wetland Restoration	\$500/acre <sup>6</sup>
60	Install and Maintain Storm Water Retention/Detention Basins	<p>Design and Permits: 30% of construction cost estimated. Construction: \$160,000/million gallons (MG) for 1 MG pond to \$52,000/MG for 10MG pond, or \$0.50 to \$1.00/cubic foot excluding land purchase. Maintenance: \$10,000/year</p>
60	Install and Maintain Wet Detention Ponds (Constructed Wetlands)	<p>Design: \$7,000-\$14,000/acre (permitting, design and contingency). Construction: \$26,000-\$55,000/acre (excluding land purchase—land purchase may be negligible if constructed as part of new development or if incorporated into</p>

**Table 6.2 Estimated Costs of Recommended Best Management Practices in St. Clair County's Northeastern Watersheds**

BMP#	BMP Recommendation	Estimated Cost*
		existing parklands). Maintenance: \$600-\$1,100/acre/year. <sup>2</sup>
61	Utilize In-Stream/Shoreline Habitat Restoration Techniques	<p>Costs are associated with the hourly costs of equipment and operator:            Loader: \$125-150            Excavators: \$150-175            Dozers: \$90-150            Foreman: \$50</p> <p>Specific productivity estimates in hours are provided in the noted reference based on number of laborers needed related to the in-stream habitat technique employed.<sup>3</sup></p> <p>Costs may be offset with the help of volunteers or government agencies to install enhancement structures; installation of structures during low flows will also help to offset costs; the use of heavy equipment should be avoided to produce the least amount of disturbance to the surrounding area. Stream restoration averages \$50,000/km<sup>11</sup></p> <ul style="list-style-type: none"> <li>• Vegetation: \$5-\$20/lineal foot, depending on type and maturity of plant selected<sup>12</sup></li> <li>• Bioengineering: \$30-\$100/lf, depending on method selected and severity of erosion<sup>12</sup></li> <li>• Glacial stone or riprap: \$20-\$40/lf for a shoreline with 8 feet between high and low water levels<sup>12</sup></li> <li>• Concrete, steel, or vinyl piling: \$50-\$200/lf, depending on type of seawall<sup>12</sup></li> </ul>
62	Implement Alternative Drain Practices and Rehabilitation	Depending on project type, costs would be associated with mobilization, design, construction and maintenance as noted above in other applicable BMP costs.
63	Install and Maintain Streambank Stabilization Measures	<p>Construction:            \$1.50-\$3.50/live stake (2 to 3 feet spacing in grid pattern);            \$2.00-\$9.00/joint planting stake (2 to 3 feet spacing in grid pattern);            \$5.00-\$9.00/foot of live fascine (spaced at 3 to 5 feet up the slope);            \$10.00-\$25.00/square foot of live cribwall (typically requires 4 square feet per lineal foot of streambank);            \$25.00-\$35.00/square yard (for plain 8" rip-rap);            \$30.00-\$45.00/square yard (for plain 16" rip-rap);            \$20.00-\$30.00/foot (for 3X1 gabion baskets).<sup>2</sup></p> <p>Vegetative measures can also be installed.</p>
64	Replace Undersized Culverts/Repair Misaligned or Obstructed Culverts	Prices vary depending on size of culvert needed and culvert material type (i.e. concrete, metal, plastic, etc.). Prices could range from a few thousand to hundreds of thousands of dollars.
65	Stabilize Eroding Road and Bridge Surfaces	<p>Construction—            Mobilization: 3%-5% of construction costs;            Site Preparation            \$250/ton average for mulching;            \$2.00-\$4.00/square yard for geotextile fabric;            \$1.50-\$6.00/lb for seeding;            \$2.00-\$3.50/sq. yard for Sodding;            \$30.00/sq. yard for riprap;            Design, legal, and contingencies typically 25% to 30% of construction costs.</p> <p>Maintenance:            3%-5% of construction costs.<sup>2</sup></p>
66	Install and Maintain Gauge Stations	<p>USGS Gauge Station:            For continuous record stream gauge station—            Installation: \$13,000-\$15,000            Annual Operation: \$11,200 (based on 2005 numbers from USGS)</p>

**Table 6.2 Estimated Costs of Recommended Best Management Practices in St. Clair County's Northeastern Watersheds**

BMP#	BMP Recommendation	Estimated Cost*
67	Install and Maintain Native Landscaping	Native landscape installation costs are similar to conventional costs: from \$2,000-4,000/acre. <sup>3</sup> Maintenance costs for native vegetation are lower than conventional due to less fertilization and herbicide/ pesticide needs..
68	Install and Maintain Riparian Buffers	\$1.25/sq. foot for installation. Maintenance costs for invasive species removal, undergrowth removal or sediment removal are minimal. There is little to no cost to preserve existing vegetation. <sup>3</sup>
69	Implement and Maintain No-Mow Buffer Zones	No cost—would incur cost savings due to decreased maintenance needs.
70	Perform Retrofitting of Storm Water Management Facilities	See costs associated with structural and vegetative storm water management BMPs.
71	Perform Curb/Street Sweeping	\$65/curb mile (excluding disposal costs). \$150/curb mile for contractor (including disposal costs). <sup>2</sup>
72	Implement Catch Basin Cleaning Program	Inspection: \$3/catch basin, 10 catch basins per hour; Cleaning: \$10-\$40/catch basin (including disposal in an approved landfill). <sup>2</sup>
73	Utilize Retired Engineer Technical Assistance Program (RETAP) to Identify Improvements to Municipal Housekeeping Practices	Program offered free of charge through MDEQ.
74	Perform Storm Sewer System Maintenance and Drain Cleaning	Sewer/drain jet cleaning: \$79/hour Sewer/drain vactor cleaning: \$96/hour Disposal costs will be reduced if a dewatering/drying area is available. Disposal costs for dry materials range from \$10-20/cubic yard. Vactor trucks range in cost from \$175,000-\$200,000. Contracted sewer cleaning rates range from \$125-\$175 per hour and may or may not include disposal. Approximately 1,000-1,500 feet/day can be cleaned using jet cleaning or vactor equipment. Other sources indicate sewer cleaning to be \$1.00-\$2.00/foot. <sup>2</sup>
75	Manage Public Facilities	Costs of \$100/hour associated with development of management plans pertaining to containment of stored chemicals/possible pollutants and/or stockpiles of sand/gravel/salt. Implementation of plan would be included in daily management activities of current staff.
76	Develop and Implement Procedures for Disposal of Operation and Maintenance Wastes	Costs associated with municipal staff to maintain the structural controls and costs associated with disposal procedures.
77	Maintain Sanitary Sewer System Infrastructure	Costs incurred to implement a sewer management program would include labor, equipment, and materials and services. Estimate from Oakland County Drain Commission office (1996) below: Labor—Inspection: \$24,900; Repair: \$15,810 Equipment—Inspection: \$6,560; Repair: \$12,170; Material and Services—Repair: \$3,190; Approximately 16 manholes could be inspected per day and 2/day could be repaired depending on the extent of repairs needed. References indicate that 1,200feet/day of sewer can be inspected using T.V. inspecting. Contracted sewer inspection costs approximately \$150/hour. <sup>2</sup> Hourly Costs—Manhole inventory and inspection: \$67.00; Sanitary/drain manhole repair: \$67.00; Sewer/drain inspection, T.V.: \$110
78	Develop and Implement Pollution Incident Prevention Plan	Costs of \$100/hour associated with development of management plans pertaining to containment of stored chemicals/possible pollutants and/or stockpiles of sand/gravel/salt. Implementation of plan would be included in daily management activities of current staff.
79	Implement Financial Solutions	Research should be conducted on an on-going basis. Costs incurred would be for

**Table 6.2 Estimated Costs of Recommended Best Management Practices in St. Clair County's Northeastern Watersheds**

BMP#	BMP Recommendation	Estimated Cost*
		staff to research funding options, or if the services were needed for a consultant, estimated costs would be at least \$100/hour.
80	Provide Sufficient Enforcement Capability	Costs would be associated with staff time to perform enforcement of ordinances and site plan reviews.
81	Implement Institutional Framework for Watershed-Wide Actions	Costs would be associated with continued WAG meetings. Consultant fees would be at least \$100/hour to aid with implementation efforts.
82	Meet Established Total Maximum Daily Loads (TMDLs) in the NEW (once developed)	To be determined; TMDLs to be developed in Years: 2009, 2010, 2011, 2015, and 2016

**\*References Key:**

<sup>1</sup>Rouge Program Office, "Planning and Cost Estimating Criteria for Best Management Practices", 2000

<sup>2</sup>Rouge River National Wet Weather Demonstration Project, "Cost Estimating Guidelines for Best Management Practices and Engineered Controls", 1997

<sup>3</sup>American Rivers, "Catching the Rain—A Great Lakes Resource Guide for Natural Stormwater Management", 2004

<sup>4</sup>Mill Creek Subwatershed Management Plan, HRWC, 2004

<sup>5</sup>Accessed at: [www.lgpc.state.nv.us/DrvWell.pdf](http://www.lgpc.state.nv.us/DrvWell.pdf) on 7/15/05

<sup>6</sup>Accessed at: [www.fws.gov/partners/pdfs/MI-needs.pdf](http://www.fws.gov/partners/pdfs/MI-needs.pdf) on 7/15/05

<sup>7</sup>Accessed at: [www.forester.net/ecm\\_0211\\_runoff.html](http://www.forester.net/ecm_0211_runoff.html) on 7/15/05

<sup>8</sup>Accessed at: [www.epa.gov/etv/pdfs/vrvs/09\\_vs\\_kleen.pdf](http://www.epa.gov/etv/pdfs/vrvs/09_vs_kleen.pdf) on 7/15/05

<sup>9</sup>Accessed at: [www.attra.org/attra-pub/covercrop.html#Economics](http://www.attra.org/attra-pub/covercrop.html#Economics) on 7/15/05

<sup>10</sup>Accessed at: [www.detnews.com/2005/livingston/0502/17/B05L-92492.htm](http://www.detnews.com/2005/livingston/0502/17/B05L-92492.htm) on 7/15/05

<sup>11</sup>Accessed at: [www.bccf.com/steelhead/pdf/Cheakamus\\_and\\_Mashiter\\_projects.pdf](http://www.bccf.com/steelhead/pdf/Cheakamus_and_Mashiter_projects.pdf) on 7/27/05