KNOWLEDGE, EFFORTS, AND ASSOCIATED EXPENSES OF COMPLYING WITH
STORMWATER PHASE II REGULATIONS BY COMMUNITY
LEADERS IN SMALL MUNICIPAL STORM SEWER
SYSTEMS (MS4s) OF MISSISSIPPI

By

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In March 2003, many communities in Mississippi fell under National Pollutant Discharge Elimination System (NPDES) regulations and were required to develop Stormwater Pollution Prevention Plans (SWPPPs). This study surveyed those in charge of SWPPPs in Mississippi’s regulated communities to determine the knowledge, efforts, and associated expenses, of complying with Stormwater Phase II regulations as well as what attempts regulated communities made to include urban forestry in their SWPPPs. While results indicated that all respondents were compliant with Stormwater Phase II regulations, regulated communities can improve efforts in several areas to best mitigate stormwater runoff pollution (e.g., public education and urban forestry). Findings will be useful when presented to current and, soon to be, regulated communities in an educational and outreach effort to increase their knowledge levels, reduce incurred costs,
increase the effectiveness of their SWPPP, and enhance their ability to utilize urban and community forests as a stormwater mitigation tool.

Key words: MS4s, Stormwater Phase II Regulations, urban forestry
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CHAPTER I
INTRODUCTION

Background

Water quality is a major natural resource-related issue affecting society in a number of ways. Water is important for consumption, irrigation of agricultural and forest crops, enabling the harvest of flora and fauna from water bodies, and for water-related recreational activities. Stormwater runoff is a major contributor to the impairment of water quality by polluting streams, rivers, groundwater, and eventually large bodies or courses of water (EPA 2002a). As stormwater flows over the urban and rural terrain, sediments and pollutants are picked up and deposited in streams, rivers, and other water bodies. Through laws and regulations, federal (e.g., the Federal Water Pollution Control Act Amendments of 1972, as amended in 1977 and then commonly known as the Clean Water Act), state [e.g., state Best Management Practices (BMPs)], and local governments in the United States have sought to protect water quality and quantities to ensure the public has sufficient quantities of clean and safe water, and healthy communities and ecosystems.

The 2000 National Water Quality Assessment examined 699,946 miles of streams and rivers in the United States, accounting for 19% of streams and rivers in the country (EPA 2002a). Of the 19% assessed, 39% were found to be impaired by pollution (EPA
2002a). In 2000, the Environmental Protection Agency (EPA) reported that urban stormwater runoff polluted and impaired 13% of streams and rivers in the United States. As urban and rural stormwater discharges into receiving water bodies it often causes a variety of impacts leading to flooding, geomorphologic changes, pollution, ecosystem degradation, and impairment of beneficial water uses (Marsalek 2001). In urban areas specifically, stormwater runoff may include sediment, bacteria, toxic chemicals, and other pollutants. Runoff from construction sites in urban areas also increases erosion and results in high sediment loads to streams and rivers. Siltation alters aquatic habitats, suffocates fish eggs and bottom-dwelling organisms, and can interfere with drinking water treatment processes and recreational use of rivers and streams (EPA 2002a). The social and economic implications of these occurrences are extensive, and lead to large demands on both the economy and health system of the U.S.

The concern for controlling stormwater discharges can be traced to the 1972 Clean Water Act (CWA) Section 208 provisions. The 208 provisions evaluated impacts and recommended controls for point and non-point source discharges. In conjunction with the development of hundreds of area-wide water quality management plans, the provisions became known as “208 plans” (Conetta 2000). These plans were completed in the late 1970s and mostly identified the need for further study on the specific impacts of urban runoff and control measures to prevent non-point source impacts. Based on the findings of the 208 plans, a nationwide pilot program known as the Nationwide Urban Runoff Program (NURP) studied 26 locations in greater detail (Conetta 2000). This
intensive study revealed urban runoff was indeed causing significant impacts to water quality and a wide range of controls were suggested to address these impacts. Supplemental studies supported NURP’s findings and, because of these studies, the U.S. Congress amended the Clean Water Act in 1987 to require permitting of stormwater discharges and controls to address adverse impacts of such discharges.

The EPA used a two-phased approach to carry out the Congressional mandate of the 1987 amendment. Stormwater Phase I would primarily involve the submission of a National Pollutant Discharge Elimination System (NPDES) permit application covering industrial discharges, municipal discharges of cities with a population greater than 100,000 by 1993, and, for some construction sites, it would also require permitting by the 1993 deadline (Conetta 2000). Stormwater Phase II would involve the permit submission for all other discharges, which included municipal discharges of smaller towns and discharges of construction sites by 2003. The Stormwater Phase I regulations were in place six years after the 1987 amendment, but it took another 10 years for Phase II to come into effect (Conetta 2000). This delay was attributed to complexities associated with numerous interests and individual needs and constraints (e.g., budget concerns, climate) of thousands of smaller communities Phase II would regulate. In March of 2003, Stormwater Phase II regulations went into rule affecting numerous communities in Mississippi.

March 10, 2007 marked the four-year anniversary whereby Mississippi’s small municipal stormwater sewer systems (MS4s) were required to implement Stormwater
Pollution Prevention Plans (SWPPPs) under Stormwater Phase II regulations (FR 1999). The regulations made an effort to reduce urban stormwater runoff pollution. The effectiveness of SWPPPs depends on many variables including knowledge, efforts, and associated expenses of complying with Stormwater Phase II regulations by communities in the State. Due to the short time period Stormwater Phase II regulations have been in effect, and the fact that the program does not require monitoring of pollutant loads in storm drains, few in-depth research projects have been directed toward their impacts. Most of the literature provides an explanation of various regulations; and the limited research that has been accomplished is simply reporting on implementation practices from case studies. No studies currently deal with the EPA Region IV or Mississippi in regard to Stormwater Phase II regulations.

Therefore, this research project was directed toward determining and documenting the knowledge, efforts, and associated expenses of complying with Stormwater Phase II regulations by community leaders in small MS4s in Mississippi. This will help determine if the knowledge and efforts of communities studied were in compliance with the regulations. Additionally, this information will be used to assist current and future designated MS4 communities in properly and more efficiently complying with Stormwater Phase II regulations and accomplishing their goals in a cost effective and timely manner.
Objective

The primary objective of this research project was to determine and document the knowledge, efforts, and associated expenses of complying with Stormwater Phase II regulations by community leaders in MS4s in Mississippi. It is currently believed that the majority of regulated MS4s can increase their knowledge base and efforts with compliance; however, there is a lack of funding to fully implement the Stormwater Pollution Prevention Plans. Research results will show what efforts are being made and where Mississippi’s MS4 entities stand in compliance and budgeting. Results will then be used in educational and outreach activities to assist current and future designated MS4 communities in properly complying with Stormwater Phase II regulations, thus enabling them to accomplish their goals in a cost effective and timely manner.
CHAPTER II
LITERATURE REVIEW

Stormwater Phase I Regulation

In 1993, Stormwater Phase I regulations went into effect. The ruling required a permit for stormwater discharges for certain industrial activities, construction activities disturbing five or more acres, and cities with a population of 100,000 or greater (CFR 2004). At the time of this study, the City of Jackson, Mississippi was the only Stormwater Phase I entity in the State.

The NPDES permit application required entities to: (1) complete a Notice of Intent (NOI), which is an application giving notice of the intent to discharge stormwater from an industry, construction site, or city (2) create a SWPPP as described by the general permit which details how pollutants may get into stormwater and what BMPs would be implemented to prevent that from occurring, and (3) acquire a map with applicable facility locations highlighted (CFR 2004). Upon completion of requirements a cover letter, Certificate of Coverage, and copy of the existing General Permit would be sent to the applicant (CFR 2004).

Stormwater Phase II Coverage

Stormwater Phase II regulations expanded the stormwater regulation coverage.
No new industrial sites were included, but the new phase included construction sites disturbing one acre or more and all designated areas with a population less than 100,000. A designated area is an urbanized area (UA) that contains an MS4. An MS4 is defined in the Code of Federal Regulations (CFR) as a conveyance or system of conveyances owned by a state, county, parish, city, town, or other entity that discharges into waters of the United States and is designated or used for collecting or conveying stormwater. Small MS4s (less than 100,000 residents) can be designated by the permitting authority in one of three ways (EPA 2000):

1. **Automatic Nationwide Designation** - The Stormwater Phase II final rule requires nationwide coverage of all MS4 entities located within the boundaries of a U.S. Bureau of the Census - defined “urbanized area” (UA) based on the latest decennial census. An urbanized area is a land area comprising one or more places that together have a residential population of at least 50,000 and an overall population of at least 1,000 people per square mile.

2. **Potential Designation by the NPDES Permitting Authority (Required Evaluation)** - A MS4 operator outside of an UA may be designated as a regulated MS4 entity if the NPDES determines that its discharges cause, or have the potential to cause, an adverse impact on water quality. No population contingencies are associated with this ruling.

3. **Potential Designation by the NPDES Permitting Authority (Physically Interconnected)** - The permitting authority is required to designate any small MS4 that contributes substantial pollutant loads of a physically interconnected MS4 regulated by the NPDES stormwater program.

Any operator of a MS4 that falls under the above ruling, unless waived, is considered a designated MS4 entity and must comply with Stormwater Phase II regulations.
**Stormwater Phase II Regulation and Implementation**

Under Stormwater Phase II regulations, owners and operators of MS4s were required to reduce the discharge of stormwater runoff pollutants to the “maximum extent practicable” (MEP), protect water quality, and satisfy appropriate water quality requirements of the CWA (EPA 2000). Implementation of the MEP standard will require the development and implementation of BMPs and achievement of measurable goals to satisfy each of six minimum control measures (EPA 2000). The six minimum control measures are:

1. Public education and outreach on the impacts of stormwater runoff;
2. Public involvement and participation in developing and implementing stormwater control programs;
3. Illicit discharge detection and elimination of line connections into the MS4;
4. Construction site stormwater runoff control on sites greater than one acre;
5. Post-construction stormwater management to reduce pollutants in areas affected by development; and
6. Pollution prevention and good housekeeping within daily operations by the MS4 operators (i.e., municipal workers).

These minimum control measures were extremely flexible and the maximum extent practicable was left as a vague guideline. MEP has not been defined by the EPA, but was intended to be flexible enough to allow for the development of site specific permit conditions based on the best professional judgment of the permit writer (Gentile et al. 2003). Flexibility was also present because MS4s need flexibility to optimize reductions in stormwater pollution on a location-by-location basis, based on BMPs.
implemented to meet specific measurable goals. Not only do hydrology, climate, local receiving waters, and geology play a part in determining specific goals and plans but so does MS4 size, current ability to finance, and capacity to perform operations (MDEQ 2002).

The selection of suitable management strategies depended upon community leaders in charge of MS4s. This made the knowledge and efforts of community leaders key to successful programs. Successful stormwater management to control urban stormwater runoff pollution required an area wide approach combining prevention, reduction, and treatment practices and technologies (Cave and Smullen 2003).

Gentile et al. (2003) studied permit writing for Stormwater Phase I implementation. Their research showed that the most difficult aspect of writing MS4 stormwater permits was in drafting permit language whereby compliance can be easily determined. NPDES permitting authorities must be able to determine compliance of MS4 operators. Gentile et al. went further to state that traditional NPDES wastewater permits used a relatively simple process of verifying wastewater sampling results, while MS4 permits were BMP based; therefore, determining compliance was more difficult. This research was used to help Stormwater Phase II communities write improved permits and increase compliance. An example of permit language that provided more measurable goals follows:
“The Permittee shall inspect those portions of the storm drain system consisting of storm drainpipes 36 inches in diameter or greater, for illicit connections within five years after the permit is adopted.”

The example was specific as to the size of drainpipes to be inspected and the timeframe in which inspections should occur. Specific language allowed NPDES authorities to measure project goals and easily determine compliance while enabling local governments to implement SWPPPs with confidence.

Jones and Gordon (2000) studied different ways to implement stormwater strategies into federal, state, and local policy. Their findings supported regional stormwater management programs as a means of improved regulation that would also lower costs through economies of scale. A regional approach encouraged sharing regulations, costs, and in some cases governing bodies (McKinley et al. 2003). Smaller communities could then adopt close-by regulations already in place contributing to more consistent regulation and planning (Jones and Gordon 2000). The EPA supported these findings, preferably on a watershed basis and especially in the case of communities with limited capabilities. Choosing to work with other government entities as cooperative or referencing parts of each other’s plans can help resolve issues that may arise where multiple regulated jurisdictions exist in the same area. This can potentially avoid duplicative efforts as well as territorial or regulatory disputes (EPA 2000).
Public Education and Outreach

Municipalities were required to implement a public education program to distribute educational materials to the community or conduct equivalent outreach activities (e.g., Web sites, television specials, programs) about the impacts of stormwater discharged on water bodies and the steps the public can take to reduce pollutants in stormwater runoff (Conetta 2000). Programs should be directed toward educating individuals and households about steps they can take to reduce stormwater pollution. These steps should be directed to ensure proper septic system maintenance, ensure proper use and disposal of landscape and garden chemicals including fertilizers and pesticides, protect and restore riparian vegetation, and properly dispose of used motor oil and household hazardous wastes. The end result should lead to a public with a greater understanding of the issues, capable of fund-raising to achieve goals, and better able to comply with regulations to improve water quality.

Control of stormwater pollution was most effectively implemented when the public and various organizations understood stormwater pollution impacts, its sources, and actions they could take to control it (Neiswender and Shepard 2003). According to the EPA, public education and outreach was one of the most important control measures in a SWPPP. An informed and knowledgeable community was crucial to the success of a program, since it helped ensure greater support and compliance with the Stormwater Phase II program (EPA 2000). Educating the public on stormwater pollution, specifically the Stormwater Phase II program, will create much needed awareness and involvement.
Involving the public during the development of stormwater management plans will gain support, increase awareness of stormwater runoff and the problems it causes, and help make it easier to adopt and implement plans once they are finalized (EPA 2002b).

The EPA final rule (EPA 2000) recommended concentrating on three main action areas for successful implementation of public education and outreach. First, partnerships should be formed with currently existing programs in other communities. These partnerships can provide the benefits of pooled resources, reduce costs, and lead to a more consistent and effective outreach program (Worlton and Christensen 2003). Second, communities should use educational materials and strategies provided by federal, state, county, parish, local, and tribal governments when possible instead of developing their own materials. At the same time, communities should incorporate materials and activities that make issues relevant to local situations and strategies (e.g., local areas where residents can discard chemicals and household hazardous wastes). Last, the EPA recommended focusing on reaching diverse audiences. Public education programs should use a mix of appropriate local strategies to sensitively address viewpoints and concerns of a variety of audiences and communities, including minority and disadvantaged communities, as well as children.

Neiswender and Shepard (2003) studied Stormwater Phase II municipalities in the U.S. Midwest. Their research was based on efforts of University Cooperative Extension systems in regard to public education and outreach. Research showed that during education strategy development, outcome based education principles work best. Such
programs were critical to achieving desired results and behavior changes that had a positive impact on stormwater quality.

Regional efforts at establishing public education and outreach programs were examined by Worlton and Christensen (2003). An outreach partnership involving 10 municipalities surrounding Phoenix, Arizona, showed that partnerships can provide the benefits of pooled resources, reduce costs, and result in a more consistent and effective outreach program. The partnership involved representatives from each municipality who came together and developed an organizational model, strategic plan, and a funding mechanism for an outreach program. Stormwater Phase I MS4s shared existing resources with nearby Stormwater Phase II MS4s. Shared materials came at no cost to Stormwater Phase II communities (e.g., BMP pamphlets, storm drain stencil designs). Expenses were also reduced as the costs of developing television and radio spots were shared and the partnership capitalized on group buying power.

**Public Involvement and Participation**

The EPA believed the public could provide valuable input and assistance to regulated, small MS4s municipal stormwater management programs and, therefore, suggested the public be given opportunities to play an active role in both program development and implementation (EPA 2000). An active and involved community was crucial to the success of the stormwater program in this regard because it allowed for broader public support, shorter implementation schedules, broader expertise, and the use of community volunteers as a free resource. Involving the public can also create a
conduit to other programs, further increasing support for stormwater management programs (EPA 2000).

As of 2003, a plan to reach out and recruit volunteers from the public was required to be included in SWPPPs by the EPA (EPA 2000). Municipalities needed to advertise and solicit assistance from all socio-economic groups and entities and were encouraged to be creative in how they implemented their recruitment efforts. The goal was to involve a diverse cross-section of the public who could offer a multitude and diversity of concerns, ideas, and connections during the SWPPP development process. This measure was also intended to involve the creation of a local stormwater management team panel, task force, or advisory committee to assist a given municipality in the development and implementation of the six minimum control measures (Conetta 2000).

To meet the public involvement requirements of the Stormwater Phase II regulations, Franklin, Tennessee carefully chose task force members who represented the diversity of the city’s population, and who could effectively transform the public into stormwater stakeholders. Although the task force has completed its original mission, many members remained active in city stormwater issues (EPA 2002b). BMPs that can be incorporated for public involvement included volunteer water quality monitoring, volunteer speakers who can aid in public education, storm drain stenciling (signs or stenciled notices on storm drains that remind citizens to not pollute storm drains), community clean-ups, and citizen watch groups.
Illicit Discharge Detection and Elimination

Illicit discharge detection and elimination was required for the purpose of reducing the amount of illicit discharges into MS4s. An illicit discharge is any discharge into an MS4 not composed entirely of stormwater, such as septic tank overflows, sanitary connections, and chemical dumping, except for NPDES permitted industrial sources and discharges from fire-fighting activities (EPA 2000). Illicit discharge detection and elimination are important elements of any effective stormwater quality program (Zielinski and Brown 2003). Inappropriate connections to storm drain systems account for significant annual pollutant loads from urban areas (Zielinski and Brown 2003). Recognizing adverse effects of illicit discharges on receiving waters, has led to the final rule requiring an operator of a regulated, small MS4 to develop, implement, and enforce an illicit discharge detection and elimination (IDDE) program. The IDDE program must include (EPA 2000):

- A storm sewer system map, showing the location of all outfalls (i.e., a point of discharge from a storm sewer into natural waters) and names and locations of all waters of the United States that receive discharges from those outfalls;

- Through an ordinance or other regulatory mechanism, a prohibition (to the extent allowable under state, local, or tribal law) on non-stormwater discharges into the MS4, and appropriate enforcement procedures and actions;

- A plan to detect and address non-stormwater discharges and illegal dumping into the MS4;

- Education of public employees, businesses, and general public about hazards associated with illegal discharges and improper waste disposal; and

- Determination of appropriate BMPs and measurable goals for this minimum control measure.
The storm sewer system map, developed by the individual MS4 entity, was meant to demonstrate a basic awareness of the intake and discharge areas of the MS4 as well as prioritize areas for outfall screening or dye testing. The map helps determine the extent of discharged dry weather flows, possible sources of dry weather flows, and particular water bodies these flows may be affecting (EPA 2000). An existing map, such as a topographical map, on which the location of major pipes and outfalls can be clearly presented demonstrated such awareness; however, many affluent towns utilized Geographic Information Systems (GIS) for mapping and informational purposes. Zielinski and Brown (2003) reported that 80% of the small Stormwater Phase I towns surveyed used GIS mapping for their stormwater pollution prevention programs. The convenience and power of a GIS helped track outfalls and record site data.

A well-developed IDDE plan to detect and address illicit discharges was the backbone of this minimum control measure. The plan’s success was dependent upon several factors including the MS4s’ available resources, size of an IDDE program staff, degree and character of discharges, and degree of detail put in ordinances and regulations. As guidance to a well-developed IDDE plan, the EPA offered four steps: locate problem areas, find the source, remove/correct illicit connections, and document actions taken (EPA 2000).

EPA (2000) recommended that priority areas be identified for detailed screening of the system based on the likelihood of illicit connections. Methods that can locate problem areas included public complaints; visual screening; water sampling from
manholes and outfalls during dry weather events; and use of infrared and thermal photography. Once a problem area or discharge was found, additional efforts were usually necessary to determine the problem source (EPA 2000). Methods that can find the source of the illicit discharge included dye testing buildings in problem areas; dye or smoke testing buildings at the time of a sale; employing a certification program showing that buildings have been checked for illicit connections; implementing an inspection program of existing septic systems; and using video to inspect storm sewers.

Once the source was identified, the offending discharger should be notified and directed to correct the problem (EPA 2000). Education efforts and working with the discharger may be effective in resolving the problem before taking legal action. The final step required that all action taken under the plan should be documented (EPA 2000). This illustrates that progress was being made to eliminate illicit connections and discharges. Documented actions should be included in annual reports along with information on number of outfalls screened; any complaints received and corrected; number of discharges and quantities of flow eliminated; and number of dye or smoke tests conducted.

Techniques of illicit discharge detection were examined in Wayne County, Michigan. Tuomari and Thompson (2003) found intensive sampling of outfalls, dye testing, and televising of storm sewers to be effective in detection and elimination of illicit discharges. Zielinski and Brown (2003) reported on a major study on illicit discharges. The project included a survey of 24 Stormwater Phase I municipalities,
representing various geographic and climatic regions in the United States, used to discern the most cost effective and efficient ways to identify and correct illicit discharges. Results were used to educate Stormwater Phase II communities across the United States. Project findings suggested focusing on mapping outfalls and using a well-trained field staff for detection.

**Construction Site Stormwater Runoff Control**

Polluted stormwater runoff from construction sites flows into MS4s and is eventually discharged into streams and rivers. While sediment is not the only pollutant from construction sites, it is the pollutant of greatest concern to regulators. Sediment runoff rates from construction sites are typically 10 to 20 times greater than those of agricultural lands, and 1,000 to 2,000 times greater than those of forest lands (EPA 2000). Construction sites can contribute more sediment in a shorter period of time than would naturally be deposited over several decades in a natural setting. The resulting siltation alters aquatic habitat, suffocates fish eggs and bottom dwelling organisms, and can interfere with drinking water treatment processes and recreational use of water bodies within the United States (EPA 2002a).

Stormwater Phase II regulations seek to minimize sediment and other construction site pollutants from entering streams and rivers. This measure applied to areas greater than one acre and less than five acres (Stormwater Phase I applies to sites greater than five acres) (Conetta 2000). In many cases, small municipalities covered by Stormwater Phase II needed to enact new ordinances or modify existing ones to require control of
construction runoff as a condition of project or site approval (Conetta 2000). The 
Stormwater Phase II final rule has many requirements for MS4s concerning construction 
site runoff controls. Requirements included (EPA 2000):

- An ordinance or other regulatory mechanism requiring the implementation of 
  proper erosion and sediment controls, and controls for other wastes on applicable 
  construction sites;

- Procedures for site plan review of construction plans that consider potential water 
  quality impacts;

- Procedures for site inspection and enforcement of control measures;

- Sanctions to ensure compliance (e.g., established in the ordinance or other 
  regulatory mechanism);

- Established procedures for the receipt and consideration of information submitted 
  by the public; and

- A determination the action of appropriate BMPs and measurable goals for this 
  minimum control measure.

The most important components of the construction site stormwater runoff control 
measure are the review of site plans, by officials in the UA, before site construction 
begins and site inspection during construction to ensure compliance. After the review is 
completed, it is up to the inspectors to enforce penalties and educate construction workers 
on BMPs needed to control or mitigate construction site stormwater runoff.

Many BMPs can be utilized on construction sites (EPA 2000). Some are better 
for certain types of topography and some are suited for either short-term (e.g., silt fences) 
or long-term control (e.g., wet ponds) of runoff and sediment. Suggested BMPs included

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Post-Construction Stormwater Runoff Control

The EPA aimed the post-construction stormwater management measure at actively controlling or treating stormwater resulting from newly developed sites or those that were redeveloped (Conetta 2000). Post-construction stormwater management sites have different needs than sites currently under construction. Structural and non-structural BMPs within this measure were generally geared at long-term maintenance. Other BMPs were targeted toward the reduction of pollutants across an increase in impervious surfaces. Impervious surface areas generally increase after construction. The following elements were required for the minimum control in the post-construction stormwater management measure (EPA 2000):

- Development of strategies that included a combination of structural (e.g., retention ponds) and non-structural (e.g., greenspace preservation) BMPs;
- An ordinance or other regulatory mechanism requiring the implementation of post-construction runoff controls to the extent allowable under state, local, or tribal law;
- Adequate long-term operation and maintenance of controls; and
- A determination of the appropriate BMPs and measurable goals for this minimum control measure.

Many BMPs were recognized as being useful for the post-construction stormwater management measure (EPA 2000). Non-structural BMPs included planning and procedures such as zoning and comprehensive master plans that guide community
development away from sensitive areas. Other non-structural BMPs were site-based controls such as buffer strips, riparian buffers, minimization of site disturbance, and minimization of impervious surfaces. Structural BMPs included storage practices such as catch basins, infiltration practices such as porous pavement, and vegetative practices such as grassy swales.

**Pollution Prevention and Good Housekeeping**

Stormwater Phase II municipalities and MS4 entities now have a responsibility to consider the effect their operation and maintenance activities have on stormwater runoff pollution (EPA 2000). This measure addressed that issue and required the MS4 entity to examine and alter their actions to help ensure a reduction in the amount and type of pollution that: (1) collects on streets, parking lots, open spaces, and storage and vehicle maintenance areas and is discharged into local waterways; and (2) results from actions such as environmentally damaging land development and flood management practices or poor maintenance of storm sewer systems. To prevent the above actions, and avoid pollutant build up, each MS4 operator is required to (EPA 2000):

- Develop and implement an operation and maintenance program with the ultimate goal of preventing or reducing pollutant runoff from municipal operations into the storm sewer system;

- Include employee training on how to incorporate pollution prevention/good housekeeping techniques into municipal operations such as park and open space maintenance, fleet and building maintenance, new construction and land disturbances, and stormwater system maintenance. To minimize the duplication of effort and conserve resources, the MS4 operator can use training materials available from the EPA, their state, tribe, or relevant organizations; and
- Determine appropriate BMPs and measurable goals for this minimum control measure.

Specific actions a municipality can take to reduce stormwater pollutant load include regular street sweeping, ensuring proper waste disposal, and limiting and ensuring proper pesticide use. Many of the recommended practices are most likely utilized by UAs already. These actions and the above requirements should help the Stormwater Phase II entity meet measurement goals.

### Stormwater Phase II Program Implementation Costs

Funding, and the cost of implementing a Stormwater Phase II program, is a major concern to all designated entities. McKinley et al. (2003) stated that in many cases communities were not able to afford the additional financial burden of the permit nor did they have the resources to perform the requirements needed to obtain stormwater permits. Although ways exist to reduce costs for individual municipalities, cost estimates need to first be examined.

Nationally, the average annual cost to regulated entities for the Stormwater Phase II program was estimated to be $297 million (1998 dollars) (EPA 1999). Sources show the breakdown of costs of each program component, but what mattered most to municipalities was the entire program cost per citizen per year. The cost of Stormwater Phase II was widely variable but was expected to be in the range of $3.75 to $6.00 per citizen per year when a given program is fully formed (Reese 2003). The cost estimate by Reese was for a model community with a population of 50,000. The variation of costs...
were due to the character of the MS4, climate and geology, preferences of the permit
writer and specific requirements of the state, character of stream quality and the need for
improvement, and ability of the municipality to share costs with others (Reese 2003).

There were many ways for municipalities to save on program implementation
costs. Reese (2003) showed how municipalities could modify local programs to suit
stormwater program needs. Ways to reduce costs included obtaining free information
from the Internet; partnering with non-profit organizations; acquiring federal, state, and
regional grants; charging special fees to citizens in stormwater utility bills; and sharing
costs with neighboring communities under a regional program. McKinley et al. (2003)
documented cost savings of $1.4 million per year for the Hamilton County, Ohio, study
region and a household cost reduction of 44% per year when a regional approach to
Stormwater Phase II permitting was utilized. Integrated approaches to stormwater
planning could identify opportunities not apparent when separate strategies were
developed. The regional approach resulted in integrated, more sustainable solutions, and
substantial cost savings for local communities (Anderson and Iyaduri 2003).
CHAPTER III
METHODS

Survey Procedures

A survey was developed by research scientists in the Forest and Wildlife Research Center, Mississippi State University (MSU) and subsequently pilot tested with two professionals in water quality and environmental regulation. It was also reviewed by the Mississippi Forestry Commission (MFC). The Mississippi Department of Environmental Quality (MDEQ) helped to determine the individuals within the appropriate entities to be interviewed or surveyed within each UA. Communities to be surveyed included Mississippi municipalities that have been designated by NPDES as Stormwater Phase I or Stormwater Phase II regulated areas. These UAs (n=34) were: Bay St. Louis, Biloxi, Brandon, Clinton, D’Iberville, Flowood, Gautier, Gulfport, Hattiesburg, Horn Lake, Long Beach, Madison, Moss Point, Ocean Springs, Olive Branch, Pascagoula, Pass Christian, Pearl, Petal, Richland, Ridgeland, Southaven, Waveland, DeSoto County, Forrest County, Hancock County, Harrison County, Hinds County, Jackson County, Keesler Air Force Base, Lamar County, Madison County, Rankin County, and the University of Southern Mississippi.

Implementation procedures for the survey were based on the modified Dillman (2000) technique. UAs were contacted by telephone through MDEQ listed NPDES
Stormwater Phase II contacts. Once contact was established, communities were asked to participate in the survey through a personal interview. As previously stated, participants were asked to reply to survey questions during an interview or they could fill the survey out on their own and mail it in. The benefits of the on-site visit were to make the interviewer available to clear up any questions participants may have had about the project or the survey instrument. If a personal interview was denied to the researchers, individuals were given the opportunity to participate in the study by having a survey mailed to them, completing it, and mailing back. All interviewed and mail-out participants were presented with a cover letter, survey, and stamped return envelope (Appendix A).

Participants were contacted by telephone two weeks after the personal interview or survey mail out, if no survey had been returned. The call was to serve as a reminder to complete and mail in the survey and answer any potential questions respondents may have had. In some cases, an extra survey was mailed to participants when needed.

**Survey Questions**

The survey was intended for use as a face-to-face interview instrument; however, in many cases a brief introduction to the project was given and the survey was left with participants who could then mail back their responses. Questions were asked in various formats. The survey used open-ended and close-ended questions, close-ended questions with ordered responses, partially close-ended questions, and scaled questions structures.
The Human Subjects Internal Review Board at Mississippi State University approved the survey and these procedures (#05-303).

The survey developed consisted of eleven sections (Appendix B). Section A of the questionnaire covered community characterization. Section B asked about SWPPP program implementation. Sections C. through H. covered the six minimum control measures of the Stormwater Phase II rule (i.e., public education and outreach, C.; public involvement and participation, D.; illicit discharge detection and elimination, E.; construction site stormwater runoff control, F.; post-construction stormwater management, G.; pollution prevention and good housekeeping, H.). Section I. asked about Urban and Community Forestry. Section J. asked respondents demographic information. The last section, K. provided space for respondents to write in comments or questions concerning any of the relevant issues addressed by the study and the survey.

**Data Analysis**

Survey responses were tabulated and analyzed upon return. Written responses were collated while numerical data was entered into Excel for a descriptive statistical analysis. Averages, medians, and means were calculated where appropriate. Any comparative or test statistics would not have heightened the analysis; but would have detracted from data gathered in the survey questionnaire. Descriptive statistics were adequate for this study and the limited data set.
CHAPTER IV
RESULTS

Three of 37 MDEQ listed UAs were disregarded from the survey process because they were not “communities of people,” but were other entities such as governmental organizations or military land holdings. Fifteen of the remaining 34 UAs did not return surveys, one refused to participate, seven were contacted multiple times and failed to return calls and messages, and seven were interviewed face-to-face, but failed to mail in their return survey. Hurricane Katrina and the aftermath brought hardships to many communities included in the study and contributed to a lack of participation. Nineteen of 34 UAs returned surveys, resulting in a return rate of 56%. The 19 returned surveys were not all answered in full, therefore results and statistics were based on the number of responses per question.

Community Characterization

Fifteen cities, two counties, one military base, and one university responded to the survey. Over 53% of the respondent’s land use was considered urban when urban was defined as areas with high amounts of impervious surfaces including downtown areas, industrial areas, and business districts. More than 15% of the land was considered suburban where suburban was defined as residential areas with moderate amounts of
impervious surfaces. Almost 13% of the land was considered rural where rural was defined as agricultural areas with sparse housing and low amounts of impervious surfaces. Finally, 18.6% was considered undeveloped where undeveloped was defined as areas within a natural state with no impervious surfaces. Average size of the respondent’s community was 60.2 square miles. In 2006, the average population for designated Stormwater Phase II communities was 42,515.

Ten communities reported a total of 430 miles of separate storm sewers to convey stormwater with an average of 43 miles per community. Three communities reported using combined sewers with a total length of 118 miles, with nine communities not using combined sewers at all. Responses to miles of open drainage varied greatly from zero miles to 5,500 miles, with an average of 581 miles and a median of 30 miles for 11 communities. One community reported five miles of conveying stormwater with another type of drainage, but did not specify. Twelve designated communities managed sanitary wastes with individual septic systems, one reported using community septic systems, 10 used community waste water treatment plants, 12 used centralized waste water treatment plants, and one community reported sending their wastes to an adjacent city for management.

Implementation of SWPPP

Four respondents had a SWPPP before Stormwater Phase II regulations went into effect, 14 did not, and one respondent did not know. Since regulations came into effect in March 2003, 19 designated areas had implemented an SWPPP. Thirteen UAs operated
under individual NPDES permits, four operated under a joint permit with other UAs and one respondent did not know what type of permit they operated under.

**Public Education and Outreach**

All respondents included a Public Education and Outreach program in their SWPPP. Seventeen UAs targeted the industrial and commercial sectors for educational and outreach efforts, 19 targeted residential areas, and 15 targeted the government sector. Of the issues addressed by outreach efforts, trash management and disposal of household hazardous wastes were addressed most frequently with average usage ratings of 3.5 and 3.2, respectively (Table 1). Brochures and fact sheets were used most frequently in efforts to address the industrial, commercial, residential, and governmental sectors (Table 2). Web sites, stormwater hotlines, educational material libraries, and television programs, or announcements topped the list of efforts UAs were not currently using but planned to utilize in the future (Table 3).
Table 1. Frequencies of stormwater management issues addressed by public education and outreach program efforts of Mississippi’s urbanized areas (UAs), as reported\(^a\) in 2006.

<table>
<thead>
<tr>
<th>Issues Addressed</th>
<th>N(^b)</th>
<th>Minimal Use = 1</th>
<th>Somewhat Minimal Use = 2</th>
<th>Somewhat Frequent Use = 3</th>
<th>Frequent Use = 4</th>
<th>Median</th>
<th>Average Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Disposal of household hazardous wastes</td>
<td>18</td>
<td>0</td>
<td>2</td>
<td>9</td>
<td>6</td>
<td>3</td>
<td>3.2</td>
</tr>
<tr>
<td>Disposal of used motor oil</td>
<td>18</td>
<td>0</td>
<td>8</td>
<td>2</td>
<td>7</td>
<td>3</td>
<td>2.9</td>
</tr>
<tr>
<td>Use and disposal of pesticides</td>
<td>18</td>
<td>0</td>
<td>8</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>2.8</td>
</tr>
<tr>
<td>Use and disposal of landscape and garden chemicals</td>
<td>18</td>
<td>0</td>
<td>8</td>
<td>6</td>
<td>3</td>
<td>3</td>
<td>2.7</td>
</tr>
<tr>
<td>Disposal of cooking oils and grease</td>
<td>18</td>
<td>2</td>
<td>10</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2.3</td>
</tr>
<tr>
<td>Septic system maintenance</td>
<td>17</td>
<td>4</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>2.3</td>
</tr>
<tr>
<td>Trash management</td>
<td>15</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>9</td>
<td>4</td>
<td>3.5</td>
</tr>
<tr>
<td>Protecting and restoring riparian vegetation</td>
<td>15</td>
<td>1</td>
<td>4</td>
<td>9</td>
<td>1</td>
<td>3</td>
<td>2.7</td>
</tr>
<tr>
<td>Adequate green space</td>
<td>13</td>
<td>1</td>
<td>3</td>
<td>4</td>
<td>5</td>
<td>3</td>
<td>3.0</td>
</tr>
<tr>
<td>Permeable pavements</td>
<td>11</td>
<td>2</td>
<td>2</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>2.8</td>
</tr>
<tr>
<td>Pet waste management</td>
<td>10</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>3</td>
<td>3</td>
<td>2.6</td>
</tr>
<tr>
<td>Other</td>
<td>5</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>4</td>
<td>3.6</td>
</tr>
</tbody>
</table>

\(^a\) Shaded numbers represent the mode response.
\(^b\) Number of UAs requiring usage.
Table 2. Frequencies of stormwater management public education and outreach program efforts by Mississippi’s urbanized areas (UAs) and their usage ratings\(^a\) through 2006.

<table>
<thead>
<tr>
<th>Effort</th>
<th>N(^b)</th>
<th>Minimal Use = 1</th>
<th>Somewhat Minimal Use = 2</th>
<th>Somewhat Frequent Use = 3</th>
<th>Frequent Use = 4</th>
<th>Median Rating</th>
<th>Average Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brochures or fact sheets</td>
<td>18</td>
<td>0</td>
<td>1</td>
<td>10</td>
<td>7</td>
<td>3</td>
<td>3.3</td>
</tr>
<tr>
<td>Storm drain stenciling</td>
<td>17</td>
<td>2</td>
<td>6</td>
<td>2</td>
<td>7</td>
<td>3</td>
<td>2.8</td>
</tr>
<tr>
<td>Web sites</td>
<td>16</td>
<td>0</td>
<td>6</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2.9</td>
</tr>
<tr>
<td>Sponsored speaking engagements</td>
<td>14</td>
<td>3</td>
<td>6</td>
<td>4</td>
<td>2</td>
<td>2</td>
<td>2.3</td>
</tr>
<tr>
<td>Educational programs for school children</td>
<td>13</td>
<td>0</td>
<td>2</td>
<td>5</td>
<td>6</td>
<td>3</td>
<td>3.3</td>
</tr>
<tr>
<td>Advertisement in local print media</td>
<td>12</td>
<td>0</td>
<td>5</td>
<td>5</td>
<td>2</td>
<td>3</td>
<td>2.8</td>
</tr>
<tr>
<td>Educational displays</td>
<td>10</td>
<td>1</td>
<td>5</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>2.6</td>
</tr>
<tr>
<td>Stormwater hotlines to report polluters</td>
<td>10</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2.2</td>
</tr>
<tr>
<td>Radio programs or announcements</td>
<td>10</td>
<td>2</td>
<td>6</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2.1</td>
</tr>
<tr>
<td>Library of educational materials</td>
<td>7</td>
<td>1</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>3</td>
<td>2.4</td>
</tr>
<tr>
<td>Recreational guides</td>
<td>7</td>
<td>3</td>
<td>0</td>
<td>4</td>
<td>0</td>
<td>3</td>
<td>2.1</td>
</tr>
<tr>
<td>Tributary signage</td>
<td>6</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2.5</td>
<td>2.7</td>
</tr>
<tr>
<td>Television programs or announcements</td>
<td>5</td>
<td>2</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1.5</td>
<td>2.0</td>
</tr>
<tr>
<td>Utility bill information stuffers</td>
<td>4</td>
<td>0</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2.6</td>
</tr>
<tr>
<td>Economic incentives for businesses</td>
<td>3</td>
<td>0</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>3</td>
<td>2.7</td>
</tr>
<tr>
<td>Restaurant placemats</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>2.0</td>
</tr>
<tr>
<td>Posters for bus stops</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1.7</td>
</tr>
<tr>
<td>Signs and billboards</td>
<td>3</td>
<td>1</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1.7</td>
</tr>
<tr>
<td>Refrigerator magnets</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1.5</td>
<td>1.5</td>
</tr>
<tr>
<td>Bumper stickers</td>
<td>2</td>
<td>2</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1.0</td>
</tr>
</tbody>
</table>

\(^{a}\) Shaded numbers represent the mode response.

\(^{b}\) Number of UAs requiring usage.
Table 3. Education and outreach efforts respondents in Mississippi’s urbanized areas (UAs) were not currently using in 2006, but planned to utilize in the future.

<table>
<thead>
<tr>
<th>Effort</th>
<th>N</th>
<th>Effort</th>
<th>N</th>
</tr>
</thead>
<tbody>
<tr>
<td>Library of educational materials</td>
<td>5</td>
<td>Tributary signage</td>
<td>3</td>
</tr>
<tr>
<td>Stormwater hotlines to report polluters</td>
<td>5</td>
<td>Advertisement in local print media</td>
<td>2</td>
</tr>
<tr>
<td>Television programs or announcements</td>
<td>5</td>
<td>Brochures or fact sheets</td>
<td>2</td>
</tr>
<tr>
<td>Web sites</td>
<td>5</td>
<td>Recreational guides</td>
<td>2</td>
</tr>
<tr>
<td>Educational displays</td>
<td>4</td>
<td>Bumper stickers</td>
<td>1</td>
</tr>
<tr>
<td>Educational programs for school children</td>
<td>4</td>
<td>Economic incentives for businesses</td>
<td>1</td>
</tr>
<tr>
<td>Radio programs or announcements</td>
<td>4</td>
<td>Refrigerator magnets</td>
<td>1</td>
</tr>
<tr>
<td>Sponsored speaking engagements</td>
<td>4</td>
<td>Signs and billboards</td>
<td>1</td>
</tr>
<tr>
<td>Utility bill information stuffers</td>
<td>4</td>
<td>Posters for bus stops</td>
<td>0</td>
</tr>
<tr>
<td>Storm drain stenciling</td>
<td>3</td>
<td>Restaurant placemats</td>
<td>0</td>
</tr>
</tbody>
</table>

Several respondents verbally stated what they considered the most effective aspects of their public education and outreach programs. Public meetings and education for schools were recurring themes. Their written responses were categorized as:

- Speaking engagements to contractors and the public
- Public meetings
- Public stormwater meetings and residential mail outs
- Quarterly meetings with builders and developers
- Storm drain stenciling Web site
- Education for schools
- Speaking engagements to allow for more dynamic interaction and fluid communication of stormwater management principals. This method was preferred to more static print media and methods.
- Contractor/developer training
- Newspapers which do an excellent job of helping promote cleaner environmental practices. School systems have also been a very useful way of reaching not only children but also their parents.
- Educational programs for school children
Seventeen respondents formed partnerships with existing government or non-governmental programs to carry out their public education and outreach programs. Partnerships included adjacent regulated cities, counties, Mississippi Department of Marine Resources, National Resource Conservation Service, MDEQ, Soil and Water Conservation Districts, schools, and Boy Scouts. Two UAs had not formed partnerships at the time of the survey.

Ten respondents were part of a regional or statewide public education and outreach programs. Eight were not involved in regional or statewide programs at the time of the survey. Seventeen respondents reported total cumulative annual costs of implementing public education and outreach programs of $143,101. Costs ranged from $0 to $60,000 with an average annual cost of $8,418 and a median cost of $2,600 among the UAs. Annual cost savings in public education and outreach programs were reported by partnering with government programs, regional/statewide efforts, and non-governmental organizations. Table 4 shows savings reported on the survey questionnaire.

Table 4. Average annual cost savings to Mississippi’s urbanized areas (UAs) by partnering with government programs, non-governmental programs, and regional/statewide efforts to leverage public education and outreach expenditures (2006 dollars).

<table>
<thead>
<tr>
<th>Partner</th>
<th>N</th>
<th>Total Savings</th>
<th>Average Savings</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>#</td>
<td>$</td>
<td>$</td>
</tr>
<tr>
<td>Government programs</td>
<td>8</td>
<td>38,701.00</td>
<td>4,837.60</td>
</tr>
<tr>
<td>Non-governmental organizations</td>
<td>4</td>
<td>85,000.00</td>
<td>21,250.00</td>
</tr>
<tr>
<td>Regional/statewide efforts</td>
<td>6</td>
<td>7,501.00</td>
<td>1,250.20</td>
</tr>
<tr>
<td>Total and weighted average</td>
<td></td>
<td>131,202.00</td>
<td>7,289.00</td>
</tr>
</tbody>
</table>
Public Involvement and Participation

Table 5 shows total and average annual SWPPP costs savings due to volunteer public involvement and participation. Storm drain stenciling, community clean-up projects, and public meeting projects were most frequently engaged in. Community clean-up projects resulted in the most cost savings. One respondent responded that tributary signage (signs posted reminding citizens to not pollute tributaries and what water bodies the tributaries drain to) was a public involvement and participation program used within their UA but failed to include attributed cost savings.

Table 5. Average annual stormwater management cost savings due to volunteer public involvement and participation in Mississippi’s urbanized areas (UAs) (2006 dollars).

<table>
<thead>
<tr>
<th>Activity</th>
<th>N (^a)</th>
<th>Total Savings</th>
<th>Average Savings (^b)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Storm drain stenciling</td>
<td>14</td>
<td>16,351.00</td>
<td>1486.45</td>
</tr>
<tr>
<td>Community clean-up projects</td>
<td>14</td>
<td>52,299.00</td>
<td>5,229.90</td>
</tr>
<tr>
<td>Public meetings/citizen panels</td>
<td>10</td>
<td>2,999.00</td>
<td>428.43</td>
</tr>
<tr>
<td>Volunteer educators and speakers</td>
<td>6</td>
<td>3,999.00</td>
<td>999.75</td>
</tr>
<tr>
<td>Adopt-a-stream</td>
<td>3</td>
<td>2,000.00</td>
<td>2,000.00</td>
</tr>
<tr>
<td>Urban forestry</td>
<td>2</td>
<td>6,000.00</td>
<td>3,000.00</td>
</tr>
<tr>
<td>Reforestation programs</td>
<td>2</td>
<td>6,200.00</td>
<td>3,100.00</td>
</tr>
<tr>
<td>Water quality monitoring</td>
<td>2</td>
<td>6,000.00</td>
<td>3,000.00</td>
</tr>
<tr>
<td>Adopt-a-storm drain</td>
<td>2</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Beach restoration</td>
<td>1</td>
<td>20,000.00</td>
<td>20,000.00</td>
</tr>
<tr>
<td>Wetland planting programs</td>
<td>1</td>
<td>4,000.00</td>
<td>4,000.00</td>
</tr>
<tr>
<td>Other</td>
<td>1</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Total and weighted average (^c)</td>
<td></td>
<td>119,848.00</td>
<td>2,996.20</td>
</tr>
</tbody>
</table>

\(^a\) Some respondents who used the activity did not enter a dollar amount.
\(^b\) Average savings were calculated using the number of respondents who entered a dollar amount.
\(^c\) Weighted average were calculated using the number of respondents who entered a dollar amount.
Seventeen UAs involved the public in developing and implementing stormwater management programs while two did not. Twelve UAs involved the public in reviewing stormwater management programs; four did not, and one respondent did not know if the public were involved in program reviews. Public volunteers served as citizen representatives on three respondent stormwater management boards. The remaining 16 respondents did not include public volunteers.

The average annual costs of implementing the public involvement and participation minimum control were $9,546 with a median of $1,000. Eleven respondents entered costs estimates ranging from $0 to $60,000. Cost savings to public involvement and participation program implementation through partnering with government, non-government, and regional/statewide programs were shown in Table 6. Cost savings attributed to using minimum controls because of public involvement and participation were shown in Table 7.

Table 6. Average annual stormwater management cost savings to Mississippi’s urbanized areas (UAs) by partnering with government programs, non-governmental programs, and regional/statewide efforts as reported by respondents (2006 dollars).

<table>
<thead>
<tr>
<th>Partner</th>
<th>N</th>
<th>Total</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Government programs</td>
<td>4</td>
<td>15,000.00</td>
<td>3,750.00</td>
</tr>
<tr>
<td>Non-governmental organizations</td>
<td>2</td>
<td>75,000.00</td>
<td>37,500.00</td>
</tr>
<tr>
<td>Regional/statewide efforts</td>
<td>1</td>
<td>0.00</td>
<td>0.00</td>
</tr>
<tr>
<td>Total and weighted average</td>
<td></td>
<td>90,000.00</td>
<td>12,857.14</td>
</tr>
</tbody>
</table>
Table 7. Average annual stormwater management cost savings to Mississippi’s urbanized areas (UAs) from volunteers in stormwater programs for each minimum control as reported by respondents (2006 dollars).

<table>
<thead>
<tr>
<th>Minimum Control</th>
<th>N</th>
<th>Total</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>#</td>
<td>$</td>
<td>$</td>
</tr>
<tr>
<td>Public education and outreach</td>
<td>10</td>
<td>11,500.00</td>
<td>1,150.00</td>
</tr>
<tr>
<td>Illicit discharge detection and elimination</td>
<td>9</td>
<td>21,000.00</td>
<td>2,333.33</td>
</tr>
<tr>
<td>Construction site stormwater runoff control</td>
<td>8</td>
<td>25,600.00</td>
<td>3,250.00</td>
</tr>
<tr>
<td>Post-construction site stormwater runoff control</td>
<td>8</td>
<td>20,500.00</td>
<td>2,562.50</td>
</tr>
<tr>
<td>Public involvement and participation</td>
<td>7</td>
<td>13,700.00</td>
<td>1,957.14</td>
</tr>
<tr>
<td>Pollution prevention/good housekeeping</td>
<td>7</td>
<td>5,500.00</td>
<td>785.71</td>
</tr>
<tr>
<td>Total and weighted average</td>
<td></td>
<td>97,800.00</td>
<td>1,995.91</td>
</tr>
</tbody>
</table>

**Illicit Discharge Detection and Elimination**

Sixteen UAs had an ordinance bylaw, rule, or regulation that specifically prohibited inappropriate discharges from entering a MS4 while one did not and two respondents did not know. Eleven UAs had the legal authority to inspect private properties for illegal discharges while three did not, three respondents did not know, and four UAs could inspect private properties, but only with an administrative warrant. Several respondents described the enforcement procedures and actions used in illicit discharge detection and elimination. Written comments included:

- Building official’s inspections
- Complaint-based enforcement
- $100/day fine
- Inspections conducted as needed or as follow up to problem. Violators cited fines issued
- Testing of outfall effluent, writing citations to housing residents threatening removal
- Notify in writing, give time to correct, re-inspect, issue citation if needed
- Written violation (2), issue ticket (3) in municipal court
• Authority is granted by ordinance and general police powers although most private property inspections are precipitated by complaints. Statue violations area misdemeanor and punishable by fine or jail time or both.
• Fines, penalty, stop work order
• Code enforcement office regularly checks construction sites for proper restraints on discharge
• We call MS Health Dept to investigate problems such as failing septic tanks.
• City ordinance

Seventeen UAs had developed a storm sewer system map as part of their SWPPP. Two UAs had not started mapping at the time of the survey. Thirteen UAs with storm sewer system maps used GIS as their mapping tool, while eight reported using computer-aided design (CAD), and three used a paper mapping system. Field surveys were conducted in 11 UAs to verify mapping. Six UAs did not verify, and one respondent did not know, if field surveys were used or not.

Storm sewer system maps included many elements. Storm sewers were included in 16 UAs, combined sewers in one, sanitary sewers in 13, outfalls in 14, and land use in eight UA mapping systems. Twelve respondents stated all outfalls and names of all waters that received discharges from those outfalls within their UA were included on the storm sewer system map. Three UAs did not include outfalls and names of waters while two respondents did not know if their maps did or not.

In efforts to eliminate illicit discharges UAs incorporate many procedures into their SWPPPs. Fourteen UA SWPPPs contained procedures for locating priority areas likely to have illicit discharges, 11 had procedures to trace the source of an illicit discharge, nine had procedures for removing an illicit discharge, and eight had procedures...
for an IDDE program evaluation and assessment. Eight respondents entered cost estimates of IDDEs. Costs ranged from $0 to $20,000. The estimated annual cost of an UA implementing an IDDE minimum control was $9,671 with a median of $8,600.

**Construction Site Stormwater Runoff Control**

At the time of the survey, 18 UAs had an ordinance, bylaw, rule, or regulation that specifically prohibited inappropriate discharges from construction sites entering a MS4 while one did not. Seventeen UAs had the legal authority to inspect private properties during construction for illegal discharges while one did not, and one UA could inspect private properties, but only with an administrative warrant. Several respondents described enforcement procedures and actions used in construction site stormwater runoff control. Written descriptions included:

- Building official actions
- Building Permit/Stormwater Permit
- Periodic inspections during construction process, plat and plans approval by city
- Certified letter informing of noncompliance/no action $100/day
- Weekly inspections, contact builder/developer, issue citations, levy fines
- Contractor is notified in person of deficiency and this is brought to the contracting officer for punitive measures as needed
- Warning, stop work order
- They are required to follow their site plan which shows erosion controls or risk being issued a stop work order
- Inspections and enforcement are carried out by the municipal code office
- Fines, stop work, penalties
- Notice of violation, stop work orders, fines/jail time
- City Ordinance
- Small fine, more importantly the delaying approval and/or inspections due to non-compliance
Eighteen UAs had procedures for site plan reviews before construction begins and site inspection and enforcement control measures to deter infractions. Two UAs had site inspectors who worked solely on stormwater inspections, while 16 UAs combined the inspector’s position with other inspection work such as building inspections. Seventeen UAs had an organized way to receive information or questions submitted by the public regarding construction sites and follow-up on information by inspecting sites in question.

Table 8 reported on BMPs recommended in SWPPPs to contractors and how frequently each BMP was used within the UA. Silt fences, rip-rap outlet protection, temporary seeding, permanent seeding, and straw bale barriers were among the most recommended BMPs. Rip-rap outlet protection, construction entrances/exits, and detention ponds had the highest usage rating. The construction site runoff control cost UAs an average of $17,500 annually to implement. Fifteen respondents entered costs estimates, which ranged from $0 to $63,000. The median cost to UAs was $15,000.
Table 8. Construction site Best Management Practices (BMPs) recommended to contractors, by stormwater management plans, and their usage rating\textsuperscript{a} from respondents in Mississippi during 2006.

<table>
<thead>
<tr>
<th>BMPs</th>
<th>N\textsuperscript{b}</th>
<th>Minimal Use = 1</th>
<th>Somewhat Minimal Use = 2</th>
<th>Somewhat Frequent Use = 3</th>
<th>Frequent Use = 4</th>
<th>Median</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Silt fences</td>
<td>19</td>
<td>1</td>
<td>1</td>
<td>13</td>
<td>4</td>
<td>3.6</td>
<td></td>
</tr>
<tr>
<td>Riprap outlet protection</td>
<td>18</td>
<td>0</td>
<td>0</td>
<td>3</td>
<td>12</td>
<td>4</td>
<td>3.8</td>
</tr>
<tr>
<td>Temporary seeding</td>
<td>18</td>
<td>1</td>
<td>0</td>
<td>4</td>
<td>10</td>
<td>4</td>
<td>3.5</td>
</tr>
<tr>
<td>Permanent seeding</td>
<td>17</td>
<td>5</td>
<td>2</td>
<td>8</td>
<td>4</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>Straw bale barriers</td>
<td>17</td>
<td>5</td>
<td>3</td>
<td>8</td>
<td>3.5</td>
<td>3.2</td>
<td></td>
</tr>
<tr>
<td>Detention pond</td>
<td>16</td>
<td>0</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>4</td>
</tr>
<tr>
<td>Vegetated swales</td>
<td>16</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>9</td>
<td>4</td>
<td>3.6</td>
</tr>
<tr>
<td>Sod stabilization</td>
<td>16</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>4</td>
<td>3</td>
<td>2.9</td>
</tr>
<tr>
<td>Tree preservation</td>
<td>16</td>
<td>3</td>
<td>3</td>
<td>2</td>
<td>6</td>
<td>3</td>
<td>2.8</td>
</tr>
<tr>
<td>Erosion control blankets</td>
<td>16</td>
<td>4</td>
<td>6</td>
<td>2</td>
<td>2</td>
<td>2</td>
<td>2.1</td>
</tr>
<tr>
<td>Retention pond</td>
<td>15</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>9</td>
<td>4</td>
<td>3.5</td>
</tr>
<tr>
<td>Storm drain inlet protection</td>
<td>15</td>
<td>2</td>
<td>2</td>
<td>1</td>
<td>8</td>
<td>4</td>
<td>3.2</td>
</tr>
<tr>
<td>Vegetative buffer zones</td>
<td>15</td>
<td>0</td>
<td>5</td>
<td>2</td>
<td>6</td>
<td>3</td>
<td>3.1</td>
</tr>
<tr>
<td>Sediment basins</td>
<td>15</td>
<td>1</td>
<td>3</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>3.0</td>
</tr>
<tr>
<td>Tree plantings</td>
<td>15</td>
<td>2</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>2.8</td>
</tr>
<tr>
<td>Construction entrances/exits</td>
<td>14</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>10</td>
<td>4</td>
<td>3.8</td>
</tr>
<tr>
<td>Greenspace preservation</td>
<td>14</td>
<td>0</td>
<td>5</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>2.8</td>
</tr>
<tr>
<td>Check dams</td>
<td>14</td>
<td>3</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>2</td>
<td>2.3</td>
</tr>
<tr>
<td>Mulching</td>
<td>13</td>
<td>1</td>
<td>2</td>
<td>5</td>
<td>3</td>
<td>3</td>
<td>2.9</td>
</tr>
<tr>
<td>Velocity dissipation</td>
<td>12</td>
<td>1</td>
<td>6</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2.3</td>
</tr>
<tr>
<td>Diversion</td>
<td>10</td>
<td>2</td>
<td>5</td>
<td>1</td>
<td>1</td>
<td>2</td>
<td>2.1</td>
</tr>
<tr>
<td>Surface roughening</td>
<td>9</td>
<td>2</td>
<td>3</td>
<td>3</td>
<td>0</td>
<td>2</td>
<td>2.1</td>
</tr>
<tr>
<td>Tillage, with lime and fertilizer</td>
<td>8</td>
<td>2</td>
<td>0</td>
<td>5</td>
<td>0</td>
<td>3</td>
<td>2.4</td>
</tr>
<tr>
<td>Natural depressions</td>
<td>8</td>
<td>2</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>1.8</td>
</tr>
<tr>
<td>Exfiltration devices</td>
<td>8</td>
<td>2</td>
<td>4</td>
<td>0</td>
<td>0</td>
<td>2</td>
<td>1.7</td>
</tr>
<tr>
<td>Slope breaks</td>
<td>7</td>
<td>1</td>
<td>1</td>
<td>3</td>
<td>1</td>
<td>3</td>
<td>2.7</td>
</tr>
<tr>
<td>Slope drains</td>
<td>7</td>
<td>1</td>
<td>0</td>
<td>3</td>
<td>0</td>
<td>3</td>
<td>2.5</td>
</tr>
<tr>
<td>Constructed wetlands</td>
<td>6</td>
<td>3</td>
<td>1</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>1.8</td>
</tr>
<tr>
<td>Level spreaders</td>
<td>3</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>0</td>
<td>1.5</td>
<td>1.5</td>
</tr>
</tbody>
</table>

\textsuperscript{a} Shaded numbers represent the mode response.

\textsuperscript{b} Number of UAs requiring usage.
Post-construction Site Stormwater Control

At the time of the survey, 18 UAs had an ordinance bylaw, rule, or regulation that specifically prohibits inappropriate discharges from post-construction sites entering a MS4 while one did not. Thirteen UAs had the legal authority to inspect private properties after construction for illegal discharges while three did not, and three did not know.

Several respondents described enforcement procedures and actions used in construction site stormwater runoff control. Descriptions included:

- Building official
- Periodic inspections; approval of final plan
- >1 acre pre-construction/post-construction runoff
- Sites are monitored on warranty inspections and deficiencies sent to contractor for repair
- Warning, time for correction, issue citation
- Only through complaint driven circumstances and with the property owners permission
- We have not reached this point in the Phase II program
- City ordinance

Table 9 listed BMPs required for post-construction sites and their frequency of use. Detention ponds, retention ponds, and vegetated swales were required the most. Retention ponds, detention ponds, and tree plantings had the highest usage ratings. The post-construction site runoff control cost UAs an average of $10,500 annually to implement. Thirteen respondents entered costs estimates, which ranged from $0 to $45,000, with a median of $8,333.
Table 9. Best management practices (BMPs) required for post construction sites by Mississippi urbanized areas (UAs) and their usage ratings\textsuperscript{a} during 2006.

<table>
<thead>
<tr>
<th>BMPs</th>
<th>N\textsuperscript{b}</th>
<th>Minimal Use = 1</th>
<th>Somewhat Minimal Use = 2</th>
<th>Somewhat Frequent Use = 3</th>
<th>Frequent Use = 4</th>
<th>Median</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detention pond</td>
<td>17</td>
<td>0</td>
<td>2</td>
<td>2</td>
<td>7</td>
<td>4</td>
<td>3.5</td>
</tr>
<tr>
<td>Retention pond</td>
<td>13</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>4</td>
<td>3.6</td>
</tr>
<tr>
<td>Vegetated swales</td>
<td>13</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>5</td>
<td>4</td>
<td>3.1</td>
</tr>
<tr>
<td>Tree plantings</td>
<td>11</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>3</td>
<td>2.5</td>
<td>3.2</td>
</tr>
<tr>
<td>Velocity dissipation devices</td>
<td>9</td>
<td>2</td>
<td>4</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>1.9</td>
</tr>
<tr>
<td>Natural depressions</td>
<td>5</td>
<td>1</td>
<td>2</td>
<td>3</td>
<td>0</td>
<td>2.5</td>
<td>2.0</td>
</tr>
<tr>
<td>Exfiltration devices</td>
<td>4</td>
<td>1</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>2</td>
<td>2.0</td>
</tr>
<tr>
<td>Constructed wetlands</td>
<td>4</td>
<td>2</td>
<td>1</td>
<td>1</td>
<td>0</td>
<td>1.5</td>
<td>1.8</td>
</tr>
</tbody>
</table>

\textsuperscript{a} Shaded numbers represent the mode response.
\textsuperscript{b} Number of UAs requiring usage.

**Pollution Prevention Good Housekeeping**

Eighteen UAs had programs in their SWPPP to reduce pollutant runoff for municipal operations. The prevention program included, in part, educating municipal employees on several proper maintenance procedures. Seventeen UAs covered park and open space maintenance, 18 covered fleet/motor vehicle maintenance, 14 covered building maintenance, and 10 covered roadway and bridge maintenance.

BMPs were also required in pollution prevention/good housekeeping of municipal operations. Table 10 reported on the BMPs some UAs included and the frequency that stormwater leaders believed they were being used. Auto maintenance, illegal dumping control, storm drain stenciling, and landscape and lawn care were used by the most frequently used BMPs. Alternate discharge options for chlorinated water, roadway and
bridge maintenance, and landscape and lawn care were used most frequently. The average annual cost of implementing the pollution prevention/good housekeeping minimum control was $27,286. Fourteen respondents estimated the costs ranging from $0 to $250,000. The median value was $6,667.

Table 10. Best management practices (BMPs) utilized in pollution prevention/good housekeeping of Mississippi’s urbanized areas (UAs) municipal operations and their usage ratings\(^a\) during 2006.

<table>
<thead>
<tr>
<th>BMP</th>
<th>N(^b)</th>
<th>Minimal Use = 1</th>
<th>Somewhat Minimal Use = 2</th>
<th>Somewhat Frequent Use = 3</th>
<th>Frequent Use = 4</th>
<th>Median</th>
<th>Average</th>
</tr>
</thead>
<tbody>
<tr>
<td>Automobile maintenance</td>
<td>17</td>
<td>1</td>
<td>0</td>
<td>7</td>
<td>8</td>
<td>3.5</td>
<td>3.4</td>
</tr>
<tr>
<td>Illegal dumping control</td>
<td>17</td>
<td>1</td>
<td>1</td>
<td>4</td>
<td>10</td>
<td>4</td>
<td>3.4</td>
</tr>
<tr>
<td>Landscaping and lawn care</td>
<td>16</td>
<td>0</td>
<td>1</td>
<td>7</td>
<td>6</td>
<td>3</td>
<td>3.4</td>
</tr>
<tr>
<td>Parking lot and street cleaning</td>
<td>16</td>
<td>0</td>
<td>6</td>
<td>3</td>
<td>6</td>
<td>3</td>
<td>3.0</td>
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<tr>
<td>Storm drain stenciling</td>
<td>16</td>
<td>0</td>
<td>7</td>
<td>4</td>
<td>3</td>
<td>2</td>
<td>2.7</td>
</tr>
<tr>
<td>Roadway and bridged maintenance</td>
<td>14</td>
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<td>0</td>
<td>7</td>
<td>6</td>
<td>3</td>
<td>3.5</td>
</tr>
<tr>
<td>Vehicle washing</td>
<td>14</td>
<td>2</td>
<td>5</td>
<td>2</td>
<td>4</td>
<td>2</td>
<td>2.6</td>
</tr>
<tr>
<td>Pest control</td>
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<td>1</td>
<td>2</td>
<td>5</td>
<td>3.5</td>
<td>3.0</td>
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<tr>
<td>Alternative discharge options for chlorinated water</td>
<td>7</td>
<td>0</td>
<td>1</td>
<td>1</td>
<td>5</td>
<td>4</td>
<td>3.6</td>
</tr>
<tr>
<td>Septic system controls</td>
<td>6</td>
<td>1</td>
<td>2</td>
<td>1</td>
<td>2</td>
<td>2.5</td>
<td>2.7</td>
</tr>
<tr>
<td>Pet waste collection</td>
<td>5</td>
<td>2</td>
<td>0</td>
<td>2</td>
<td>1</td>
<td>3</td>
<td>2.4</td>
</tr>
</tbody>
</table>

\(^a\) Shaded numbers represent the mode response.

\(^b\) Number of UAs requiring usage.

Urban and Community Forestry

Three of 19 UAs surveyed used (or stormwater leaders believed were being used) urban and community forestry to reduce the quantity of stormwater discharges and
improve stormwater runoff quality. Nine communities used tree ordinances and nine used landscape laws to encourage/enforce stormwater pollutant prevention, while eight UAs did not, and two did not know at the time of the survey.

Respondents were asked to estimate stormwater control cost savings due to urban and community forestry. Three respondents estimated cost savings to be $0. One estimated $1,000 per year. Respondents were then asked to estimate how much the UA would save annually due to stormwater control if the urban forest was at its full potential. Two respondents estimated $0 and one estimated $10,000 saved annually.

Sixteen of 19 respondents would like a workshop on how to use the Mississippi Urban and Community Forestry Management Manual (Husak and Grado 2005). Two did not want a workshop and one was undecided at the time they were surveyed. In addition to cost saving information, respondents were asked what urban forestry services they were willing to pay for with city funds shown in Table 11. No respondents were willing to pay for compliance inspection for vendor work. Respondents wrote in the following statements concerning willingness to pay for other urban forestry services:

- I am not sure how this would benefit city.
- Interested in what is available
- Any that are free?

In addition to services respondents were willing to pay for, respondents stated needing stormwater separators, money and additional staff to help with urban forestry and stormwater control.
Table 11. Urban forestry services Mississippi urbanized areas (UAs) were willing to pay for when queried in 2006.

<table>
<thead>
<tr>
<th>Services</th>
<th>Number of Respondents Willing to Pay</th>
</tr>
</thead>
<tbody>
<tr>
<td>Street tree inventory</td>
<td>5</td>
</tr>
<tr>
<td>Site inspection for compliance with ordinance requirements and planning codes</td>
<td>4</td>
</tr>
<tr>
<td>Establishment of tree nurseries</td>
<td>3</td>
</tr>
<tr>
<td>Other urban forestry workshops</td>
<td>3</td>
</tr>
<tr>
<td>Pre-construction planning for saving trees on construction sites</td>
<td>3</td>
</tr>
<tr>
<td>Hazard tree evaluation</td>
<td>1</td>
</tr>
<tr>
<td>Compliance inspection for vendor work</td>
<td>0</td>
</tr>
</tbody>
</table>
CHAPTER V
DISCUSSION

Results from this study indicated that all 19 respondents were compliant in that they had developed and begun implementing a SWPPP by March 2003. At the time of the survey not all UAs had fully implemented all six minimum controls. There were two reasons UAs had not fully implemented their SWPPPs. The first was that UAs simply had not gotten that far in the Stormwater Phase II program. For example, in respect to enforcement procedures for the IDDE minimum control one respondent wrote “we have not reached that point in our Stormwater Phase II program.” The second reason was due to natural disaster. Several coast communities had to put stormwater management efforts on hold to pursue Hurricane Katrina recovery efforts and redevelopment activities. Mississippi’s UAs have until March 2008 to fully implement their SWPPPs and, at the time of this study, they were well on their way to meeting that requirement at the time of the survey.

SWPPPs costs to UAs varied greatly and were not as high as expected. With the exception of the construction site stormwater minimum control, average annual costs for each minimum control was below $10,000, making the cost per resident minimal. While the IDDE minimum control was expected to incur the highest cost among the six minimum controls, due to time and money involved in mapping outfalls and checking for
illicit discharges, respondent estimates ranked construction site runoff control as the most costly minimum control. It was assumed that IDDE cost would remain in house, while construction site runoff costs would be passed on to consumers. Site plan review and construction site inspection may have had higher costs than expected.

McKinley et al. (2003) found that regional partnerships can reduce costs by 44% by utilizing the power of economies of scale and reducing the effort to complete tasks, as Stormwater Phase II efforts are not repeated in every UA and resources can be shared. None of Mississippi’s UAs were part of a regional NPDES permit. Some respondents did report cost savings from regional/statewide efforts for individual minimum control measures such as public outreach and education and public involvement and participation, but the majority of cost savings to Mississippi UAs came from partnering with non-governmental organizations and programs (e.g., Department of Marine Resources, Boy Scouts of America). Several respondents listed adjacent cities and counties as partners, but these partnerships did not result in sizable cost savings compared to a regional/statewide NPDES permit. In general, Mississippi UAs were missing an opportunity to reduce their program costs by not engaging in more partnerships and forming regional NPDES permits.

The NPDES Stormwater Phase II Program provides no financial assistance for local governments to implement the necessary requirements (White and Boswell 2005). Therefore, the sole source of funding for implementation is the UA budget. If Stormwater Phase II programs prove to be too much of a strain on already tight UA
budgets, a stormwater utility bill could be used to reduce costs. A survey by Nowak et al. (1990) in Milwaukee, Wisconsin, showed that more than half the citizens surveyed were willing to pay $50 or more per household per year for programs to protect and restore local lakes and streams from non-point source pollution, in which urban stormwater runoff is a major component, within a time frame of eight to 10 years.

Respondent UAs in this study used a variety of tools to educate the public on stormwater runoff issues. Most of the educational efforts utilized brochures and fact sheets, educational programs for school children, Web sites, and storm drain stenciling and advertisements in local print media. Although speaking engagements were not utilized as often as the previously mentioned tools, several respondents listed public meetings along with newspaper advertisements and educational programs for school children as the most effective method of education. Two of the five respondents that listed some form of public meeting as the most effective aspect of public education and outreach noted that the meetings included contractors. While it is important to educate contractors, contractor participation may not be the best measure for overall public education and outreach success. Contractors have a vested interest in learning about Stormwater Phase II Regulations and represent a small portion of residents. The majority of citizens will not have such a vested interest and must be reached and educated for stormwater mitigation efforts to be successful.

According to Nowak et al. (1990) television news reports, newspaper articles, and community newsletters were cited as the best way to get the public to take notice of water
resource issues in Milwaukee. Only 6% of the respondents in Nowak’s study said they were “very likely” to attend meetings or workshops on water education and about 55% said they were “not likely to attend.” While this and Nowak’s study both list newspaper articles/advertisements in local print media as one of the better methods of education, there were major differences in the use and effectiveness of television and public meetings as educational tools. In this study, television programs or ads received a low usage rating and were not mentioned as one of the most effective educational tools. The two studies’ differing views on public meetings may be attributed to positive feedback from contractors who have a vested interest in attending stormwater management meetings in Mississippi’s UAs, therefore, giving stormwater leaders a sense of accomplishment and effectiveness. While meetings may be effective in educating contractors, stormwater leaders should check to see if the general public is attending and if public meetings are effective in their education efforts. In the future, television programs and announcements should be utilized more in Mississippi’s UAs to reach the general public.

A major component of the SWPPP was developing a IDDE map. Stormwater Phase II regulations require a storm sewer system map, showing the location of all outfalls and the names and location of all waters of the United States that receive discharges from those outfalls (EPA 2000). Seventeen UAs had started an IDDE map at the time of the survey, but several had not yet mapped all outfalls or named all the waters of the United States that receive discharges from those outfalls. No requirements were
made as to what type of mapping system to use. Respondents reported using GIS, CAD, and paper mapping for IDDE maps. Storm sewer system mapping is an area where McKinley et al. (2003) stated that a regional approach can be of great benefit to UAs. Smaller UAs, who lack resources for mapping, could partner with larger UAs with GIS/GPS resources thus reducing time and costs on mapping projects.

Legal authority and enforcement procedures are the backbone of the IDDE, construction-site runoff control, and post-construction site runoff control minimum controls. Almost all UAs had some ordinance, bylaw, rule, or regulation that prohibited illicit discharges in each of the minimum controls and had the authority to inspect them on private property. Respondents listed various methods to handle infractions such as fines for illicit discharges, weekly inspections of construction sites, stop work orders, and jail time. Not all UAs included stop work orders and jail time in their enforcement procedures. Brown et al. (2004) stated that potential enforcement tools can range from warnings to criminal prosecution and that the choice of enforcement tools should be based on volume and type of discharge, its impact on water quality, and whether it was intentional or accidental. When interviewing respondents, more than one stated stop work orders were the most effective tool in construction site stormwater runoff control. UAs should make sure to include a wide range of enforcement tools from citations to jail time so appropriate and effective actions can be taken against violators.

Stormwater leaders who responded to this study’s survey did not appear to have knowledge of the value of urban and community forestry in general or in the context of
stormwater management. Grado et al. (2006) had similar findings stating a sizeable number of Mississippi officials might have a very low or nonexistent level of awareness of urban and community forestry and little familiarity with associated water quality benefits. It was not surprising that most respondents did not offer estimates on urban forest values, because few urban forestry benefit/cost analyses have been performed in Mississippi communities (Jones and Grado 2005). Most UAs reported tree plantings and tree preservation as BMPs recommended to construction workers in their SWPPP. Both received a usage rating of 2.8 in construction site-stormwater runoff control while tree planting received a higher rating of 3.2 in post-construction site stormwater. While these ratings were not low they do show that UAs have opportunities to include more tree planting and tree preservation (i.e., urban forestry) into their SWPPPs. Even though most respondents reported tree planting and tree preservation being used as BMPs, only 3 of the 19 respondents used (or believed were being used) urban and community forestry to mitigate stormwater runoff. There is an obvious disconnect among respondents between using trees as BMPs and using urban and community forestry as a stormwater mitigation tool. Stormwater leaders need training and education on urban and community forestry to make the connection.

Respondents did recognize and need for training on urban and community forestry. Sixteen of the 19 respondents requested a workshop on how to be trained to use the Mississippi Urban and Community Forestry Management Manual (Husak and Grado 2005). As these workshops are implemented, the information in the manual will show
stormwater leaders how to get the most out of their urban and community forest’s stormwater mitigating benefits by managing the urban forest and incorporating more urban forest issues into stormwater management.
The 2006 Survey of Mississippi’s Stormwater Community Leaders produced several findings that need to be taken under consideration by current and future regulated UAs. While respondents provided cost estimates, in the future more in-depth research, such as evaluating accounting and expenditure ledgers is needed to determine Stormwater Phase II Program expenditures for Mississippi’s regulated UAs. Current and future UAs should examine a regional approach to SWPPPs and stormwater utility bills as means of reducing costs incurred on the community budget. UAs should concentrate educational efforts on television programs/announcements and newspaper articles for the general public, educational programs for school children, and meetings/training sessions for construction workers. Finally, stormwater leaders should take advantage of manuals and programs to learn more about urban and community forestry’s role in mitigating stormwater runoff.

After the 2010 U.S. Census Bureau data is released, it is assumed more Mississippi communities will fall under Stormwater Phase II Regulations due to increasing population densities. Newly regulated UAs should take advantage of this study and others for planning and implementation purposes that will ultimately lead to reduced costs and streamlined SWPPPs thus avoiding confusion while achieving
pollution reduction. Finally, agencies and organizations can use the information and results presented in this study, in an outreach effort, to educate UAs on pending stormwater changes and aid newly regulated UAs in effective program implementation. It is estimated that an additional 16 UAs after 2010 that will fall under the Stormwater Phase II regulations, making these efforts ever more important.
LITERATURE CITED


APPENDIX A

SURVEY COVER LETTER
May 4, 2006

Dear Community Leader,

We are requesting your help. Please take 45 minutes of your time to complete the questionnaire titled “2006 Survey of Mississippi Stormwater Community Leaders.” The primary purpose of this research is to identify the knowledge, efforts, and associated expenses of complying with Stormwater Phase II Regulations by community leaders in small municipal storm sewer systems (MS4s) in Mississippi. This survey could impact the methods and costs accrued to current and future MS4s in handling stormwater regulations. Other purposes include identifying community needs and issues relative to urban forestry and community leaders’ awareness of urban forestry programs. In addition, this research will identify areas that require additional research, stormwater/urban forestry programs already in place in communities and the success of those programs, and funding programs that have been used by communities to implement stormwater/urban forestry programs.

It is important that each questionnaire be completed and returned so results will accurately represent the status and opinions voiced by Mississippi’s communities. If you choose to fill out the questionnaire, please know that your participation is voluntary, you may stop at any time, and you do not have to answer any questions. The study results will be invaluable for developing education and outreach programs. For example, all Mississippi communities will potentially benefit from this research because the results will be used to assist the current and future MS4s regulated by the Stormwater Phase II ruling.

I appreciate your willingness to take part in this study. If you should have any questions or need help filling out the survey, please contact me at (662) 325-2792 or by e-mail at sgrado@cfr.msstate.edu or write me at Department of Forestry, Box 9681, Mississippi State, MS 39762-9681. You may also contact Mr. Britt A. Hubbard at (662) 312-1994 at Mississippi State University or by e-mail at bah19@msstate.edu. Thank you for your assistance with this study.

I ask that you turn in your questionnaire at the end of the interview or return your questionnaire in the enclosed self-addressed, postage-paid envelope before May 18, 2006.

Sincerely,

Stephen C. Grado
Professor of Forestry
APPENDIX B

SURVEY QUESTIONNAIRE
2006 Survey of Mississippi Stormwater Community Leaders

Conducted by the Department of Forestry Forest and Wildlife Research Center Mississippi State University
A. Community Characterization

1. What is the form of government in your urbanized area (UA)/jurisdiction?

   City _____  County _____  Township _____  Other _____

   If other, describe: __________________________________________

2. What is the approximate percentage of each of the following land uses in your UA (all categories should sum to 100%)?

   Urban _____  Sub-urban _____  Rural _____  Undeveloped _____

3. What is the approximate area of your UA? _______ square miles

4. What is the population of your UA? _______

5. Estimate the total length in miles each stormwater conveyance system present in your UA with respect to overall system length:

   Separate storm sewers _______ miles
   Combined sewers _______ miles
   Open drainage _______ miles
   Other _______ miles

   If other, describe and provide mileage:

   ___________________________________________________________________

6. How does your community manage sanitary wastes (check all that apply)?

   Individual septic systems _____
   Community septic systems _____
   Community wastewater treatment plants (WWTP) _____
   Centralized WWTP _____
   Other _____

   If other, describe:

   ___________________________________________________________________

B. Implementation

1. Before Stormwater Phase II Regulations, did your small municipal separate storm sewer system (MS4) have a stormwater pollution prevention plan (SWPPP)?

   Yes _____  No _____  Don’t Know _____
2. Has a SWPPP been implemented in your UA since the Stormwater Phase II Regulations came into effect in March of 2003?

Yes_____ No_____ Don’t Know _____

If no, does your designated UA plan on creating and implementing a SWPPP in the future?

Yes_____ No_____ Don’t Know _____

3. Which type of National Pollutant Discharge and Elimination System (NPDES) permit does your MS4 operate under?

Individual _____ Joint (co-permittee) (modified individual) _____ Regional _____

C. Public Education and Outreach

1. Does your SWPPP include a Public Education and Outreach program (if no or don’t know, go to Question D.1.)?

Yes _____ No_____ Don’t Know_____

2. Which sectors are targeted in your Public Education and Outreach program (check all that apply)?

Industrial _____ Residential _____ Commercial _____ Government _____

3. Which issues does your current outreach and education efforts address (check all that apply and rate 1 to 4 where 1=addressed minimally and 4=addressed frequently)?

<table>
<thead>
<tr>
<th>Efforts Check</th>
<th>Rating</th>
<th>Efforts Check</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Septic system maintenance</td>
<td></td>
<td>Use and disposal of pesticides</td>
<td></td>
</tr>
<tr>
<td>Use and disposal of landscape and garden chemicals</td>
<td></td>
<td>Protecting and restoring riparian vegetation</td>
<td></td>
</tr>
<tr>
<td>Disposal of cooking oils and grease</td>
<td></td>
<td>Disposal of household hazardous wastes</td>
<td></td>
</tr>
<tr>
<td>Disposal of used motor oil</td>
<td></td>
<td>Adequate greenspace</td>
<td></td>
</tr>
<tr>
<td>Permeable pavements</td>
<td></td>
<td>Trash management</td>
<td></td>
</tr>
<tr>
<td>Pet waste management</td>
<td></td>
<td>Other:</td>
<td></td>
</tr>
</tbody>
</table>

If other issues, describe:

_____________________________________________________________________________________

63
4. Which education and outreach efforts does your SWPPP utilize (check all that apply and rate 1 to 4 where 1=utilized minimally and 4=utilized frequently)?

<table>
<thead>
<tr>
<th>Efforts</th>
<th>Check</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Brochures or fact sheets</td>
<td></td>
<td>Advertisement in local print media</td>
</tr>
<tr>
<td>Web sites</td>
<td></td>
<td>Bumper stickers</td>
</tr>
<tr>
<td>Refrigerator magnets</td>
<td></td>
<td>Posters for bus stops</td>
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<tr>
<td>Restaurant placemats</td>
<td></td>
<td>Educational displays</td>
</tr>
<tr>
<td>Storm drain stenciling</td>
<td></td>
<td>Signs and billboards</td>
</tr>
<tr>
<td>Stormwater hotlines to report polluters</td>
<td></td>
<td>Educational programs for school children</td>
</tr>
<tr>
<td>Utility bill information stuffers</td>
<td></td>
<td>Library of educational materials</td>
</tr>
<tr>
<td>Recreational guides to educate golfers, campers, fishermen</td>
<td></td>
<td>Tributary signage to increase public awareness of the watershed network</td>
</tr>
<tr>
<td>Sponsored speaking engagements</td>
<td></td>
<td>Economic incentives for businesses</td>
</tr>
<tr>
<td>Radio programs or announcements</td>
<td></td>
<td>Television programs or announcements</td>
</tr>
</tbody>
</table>

5. Which education and outreach efforts does your SWPPP plan to use in the future that are not currently being utilized (check all that apply)?

<table>
<thead>
<tr>
<th>Efforts</th>
<th>Check</th>
<th>Efforts</th>
<th>Check</th>
</tr>
</thead>
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<tr>
<td>Sponsored speaking engagements</td>
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<td>Economic incentives for businesses</td>
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<tr>
<td>Radio programs or announcements</td>
<td></td>
<td>Television programs or announcements</td>
<td></td>
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</tbody>
</table>

6. Describe what you consider the most effective aspects of your Public Education and Outreach program.
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
7. Has your SWPPP formed partnerships with existing government or non-governmental programs to carry out the Public Education and Outreach program?

   Yes_____  No_____  Don’t Know_____  

If yes, list government program partners:
______________________________________________________________________________________
______________________________________________________________________________________

If yes, list non-governmental program partners:
______________________________________________________________________________________
______________________________________________________________________________________

8. Is your Public Education and Outreach program part of a regional or statewide Public Education and Outreach program?

   Yes_____  No_____  Don’t Know_____  

9. What is the estimated annual cost of implementing the Public Education and Outreach minimum control measure in your UA?

   $________ per year  

10. Estimate annual cost savings to your SWPPP to curb Public Education and Outreach program costs, if any, by partnering with:

    Government programs $________ Non-governmental organizations $________
    Regional/statewide efforts $________

D. Public Involvement and Participation

1. Which SWPPP activities do public volunteers participate in within your MS4 (check all that apply and calculate annual dollars per activity based on man hours of volunteer work)?

<table>
<thead>
<tr>
<th>Activities</th>
<th>Check</th>
<th>$/year</th>
<th>Activities</th>
<th>Check</th>
<th>$/year</th>
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<tr>
<td>Storm drain stenciling</td>
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<td></td>
<td>Adopt-a-stream</td>
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<td></td>
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<tr>
<td>Community clean-up projects</td>
<td></td>
<td></td>
<td>Beach restoration</td>
<td></td>
<td></td>
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<tr>
<td>Volunteer educators and speakers</td>
<td></td>
<td></td>
<td>Volunteer water quality monitoring</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Adopt-a-storm drain</td>
<td></td>
<td></td>
<td>Public meetings/citizen panels</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reforestation programs</td>
<td></td>
<td></td>
<td>Wetland planting programs</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Urban forestry</td>
<td></td>
<td></td>
<td>Other:</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

If other activities, describe:
______________________________________________________________________________________
______________________________________________________________________________________
2. Does your SWPPP involve the public in developing stormwater management programs?
   Yes_____    No_____    Don’t Know_____

3. Does your SWPPP involve the public in implementing stormwater management programs?
   Yes_____    No_____    Don’t Know_____

4. Does your SWPPP involve the public in reviewing stormwater management programs?
   Yes_____    No_____    Don’t Know_____

5. Do public volunteers serve as citizen representatives on your local stormwater management panel/board?
   Yes_____    No_____    Don’t Know_____

6. What is the approximate annual cost of implementing the Public Involvement and Participation minimum control measure in your jurisdiction?
   $__________ per year

7. Estimate annual cost savings to your SWPPP to curb Public Involvement and Participation program costs, if any, of partnering with:
   Government programs $__________
   Non-governmental organizations $__________
   Regional/statewide efforts $__________

8. Estimate annual cost savings to your SWPPP, if any, from using volunteers in your stormwater program for each minimum control?
   Public Education and Outreach $__________ per year
   Public Involvement and Participation $__________ per year
   Illicit Discharge Detection and Elimination $__________ per year
   Construction Site Stormwater Runoff Control $__________ per year
   Post-Construction Site Stormwater Runoff Control $__________ per year
   Pollution Prevention/Good Housekeeping $__________ per year

E. Illicit Discharge Detection and Elimination (IDDE)

1. Does your UA have an ordinance, bylaw, rule, or regulation that specifically prohibits inappropriate discharges, in general, from entering MS4s?
   Yes_____    No_____    Don’t Know_____

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2. Does your UA have the legal authority to inspect private properties for illegal discharges?
   
   Yes_____    No_____    Don’t Know_____ 
   
   Yes, with administrative search warrant _____

3. Describe the enforcement procedures and actions used by your UA for this minimum control measure:
   
   _______________________________________________________________________________________
   _______________________________________________________________________________________
   _______________________________________________________________________________________
   _______________________________________________________________________________________

4. Has your UA developed a storm sewer system map (if no or don’t know, go to Question F.1.)?
   
   Yes_____    No_____    Don’t Know_____ 

5. Indicate the type of mapping system used (check all that apply):
   
   GIS _____    Paper _____
   CAD _____    Other _____
   
   If other, describe:
   
   _______________________________________________________________________________________
   _______________________________________________________________________________________

6. Have field surveys been conducted to verify your mapping?
   
   Yes_____    No_____    Don’t Know_____ 

7. Indicate which system elements are being mapped (check all that apply):
   
   Storm sewers _____    Outfalls _____
   Combined sewers _____    Land use _____
   Sanitary sewers _____

8. Does the mapping system include locations of all outfalls within the MS4?
   
   Yes_____    No_____    Don’t Know_____ 

9. Does your mapping system include names of all waters in the United States that receive discharges from those outfalls?
   
   Yes_____    No_____    Don’t Know_____
10. Does your MS4 SWPPP contain procedures for the following (check all that apply):

- Locating priority areas likely to have illicit discharges
- Tracing the source of an illicit discharge
- Removing the discharge source
- IDDE program evaluation and assessment

11. What is the estimated annual cost of implementing the IDDE minimum control measure in your UA?

$___________ per year

F. Construction Site Stormwater Runoff Control

1. Does your UA have an ordinance, bylaw, rule, or regulation that specifically prohibits inappropriate discharges, from construction sites, from entering MS4s?

Yes_____ No_____ Don’t Know_____

2. Does your UA have the authority to inspect private properties during construction?

Yes_____ No_____ Don’t Know_____  
Yes, with administrative search warrant _____

3. Describe the enforcement procedures and actions used by your UA for this minimum control measure:
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________
_____________________________________________________________________________________

4. Does your SWPPP have procedures for site plan reviews before construction begins?

Yes_____ No_____ Don’t Know_____  

5a. Does your SWPPP have procedures for site inspection and enforcement control measures to deter infractions?

Yes_____ No_____ Don’t Know_____  

If yes, does your site inspector work solely on stormwater inspections or is the position combined with other inspection work such as building inspecting?

Solely_____ Combined_____
6. Does your SWPPP have an organized way to receive information or questions submitted by the public regarding construction site stormwater control?

Yes_____ No_____ Don’t Know_____  

If yes, does your MS4 follow up on the information by inspecting construction sites?

Yes_____ No_____ Don’t Know_____  

7. Does your SWPPP have a list of Best Management Practices (BMPs) best suited for your area, that it recommends contractors use on their construction site? (check all that apply and rate 1 to 4 where 1=utilized minimally and 4=utilized often)

Yes_____ No_____ Don’t Know_____  

<table>
<thead>
<tr>
<th>Structural BMPs Check</th>
<th>Rating</th>
<th>Structural BMPs Check</th>
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<tbody>
<tr>
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<td>Silt fences</td>
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<tr>
<td>Straw bale barriers</td>
<td></td>
<td>Storm drain inlet protection</td>
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<tr>
<td>Sediment basins</td>
<td></td>
<td>Slope drains</td>
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<tr>
<td>Slope breaks</td>
<td></td>
<td>Riprap outlet protection</td>
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<tr>
<td>Check dams</td>
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<td>Construction entrances/exits</td>
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<td>Level spreaders</td>
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<td>Detention pond</td>
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<tr>
<td>Retention pond</td>
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<td>Constructed wetlands</td>
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<td>Exfiltration devices</td>
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<td>Tree plantings</td>
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<td>Non-Structural BMPs Check</td>
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<tr>
<td>Vegetative buffer zones</td>
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<tr>
<td>Greenspace preservation</td>
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<td>Temporary seeding</td>
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<tr>
<td>Mulching</td>
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<td>Erosion control blankets</td>
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</tr>
<tr>
<td>Surface roughening</td>
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<td>Tree preservation</td>
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</tr>
</tbody>
</table>

8. Estimate the annual cost of implementing the Construction Stormwater Runoff Control minimum control measure in your UA.

$________ per year

G. Post-Construction Stormwater Runoff Control

1. Does your UA have an ordinance, bylaw, rule, or regulation that specifically prohibits inappropriate discharges, from post-construction sites, from entering MS4s?

Yes_____ No_____ Don’t Know_____
2. Does your UA have the authority to inspect private properties after construction?

   Yes_____   No_____   Don’t Know_____

   Yes, with administrative search warrant _____

3. Describe enforcement procedures and actions used by your UA for this minimum control measure:

   ______________________________________________________________________
   ______________________________________________________________________
   ______________________________________________________________________

4. Does your MS4 have or require certain BMPs for post-construction sites (if yes, check which are utilized and rate 1 to 4 where 1=utilized minimally and 4=utilized frequently)?

   Yes_____ No_____ Don’t Know_____

<table>
<thead>
<tr>
<th>BMPs</th>
<th>Check</th>
<th>Rating</th>
<th>BMPs</th>
<th>Check</th>
<th>Rating</th>
</tr>
</thead>
<tbody>
<tr>
<td>Detention pond</td>
<td></td>
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<td>Retention pond</td>
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<tr>
<td>Constructed wetlands</td>
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<td></td>
<td>Vegetated swales</td>
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<td>Natural depressions</td>
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<td></td>
<td>Velocity dissipation devices</td>
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<td>Exfiltration devices</td>
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<td></td>
<td>Tree plantings</td>
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</table>

5. What is the approximate overall cost of implementing the Post-Construction Stormwater Runoff Control minimum control measure in your UA?

   $___________

**H. Pollution Prevention/Good Housekeeping**

1. Does your SWPPP include a program to reduce pollutant runoff from municipal operations into storm sewer systems (if no or don’t know, go to Question 1.1.)?

   Yes_____ No_____ Don’t Know_____

2. Does your SWPPP include education of municipal employees on proper maintenance procedures (check all that apply)?

   Park and open space maintenance  _____
   Fleet/motor vehicle maintenance  _____
   Building maintenance             _____
   Storm sewer system maintenance   _____
   Roadway and bridge maintenance   _____
3. Which BMPs do your MS4 practice for pollution prevention/good housekeeping of municipal operations (check all that apply and rate 1 to 4 where 1=utilized minimally and 4=utilized frequently)?

<table>
<thead>
<tr>
<th>BMP</th>
<th>Check</th>
<th>Rating</th>
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<tbody>
<tr>
<td>Pet waste collection</td>
<td></td>
<td></td>
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<tr>
<td>Vehicle washing</td>
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<td>Landscaping and lawn care</td>
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<td>Alternative discharge options for chlorinated water</td>
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<tr>
<td>Septic system controls</td>
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<tr>
<td>Parking lot and street cleaning</td>
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<tr>
<td>Automobile maintenance</td>
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<tr>
<td>Illegal dumping control</td>
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<tr>
<td>Pest control</td>
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<tr>
<td>Roadway and bridged maintenance</td>
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<tr>
<td>Storm drain stenciling</td>
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<tr>
<td>Other</td>
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</tbody>
</table>

If other BMPs, describe:
_____________________________________________________________________________________

4. Estimate annual costs of implementing the Pollution Prevention/Good Housekeeping minimum control measure in your UA?

$__________ per year

I. Urban and Community Forestry

1. Does your community use urban or community forestry to reduce the quantity of stormwater discharges and improve the quality of stormwater runoff?

   Yes____   No____   Don’t Know____

2. Does your community use tree ordinances to encourage/enforce stormwater pollution prevention?

   Yes____   No____   Don’t Know____

3. Does your community use landscape laws to encourage/enforce stormwater pollution prevention?

   Yes____   No____   Don’t Know____

4. How much money do you estimate has been saved annually on stormwater control due to your community’s urban forest?

   $__________ per year

5. How much money could your community save annually on stormwater control if the urban forest was at its full potential?

   $__________ per year
6. Would you like a workshop to be trained on how to use the Mississippi Urban and Community Forestry Management Manual?

   Yes_____     No_____     Don’t Know_____

7. Which of the following urban forestry services would you be willing to pay for (check all that apply)?

   Hazard tree evaluation  _____
   Compliance inspection for vendor work  _____
   Site inspections for compliance with ordinance requirements and planning codes  _____
   Preconstruction planning for saving trees on construction sites  _____
   Establishment of tree nurseries  _____
   Street tree inventory  _____
   Other urban forestry workshops  _____

   If other, describe:
   ____________________________________________________________________________________

8. What additional products or services do you need concerning urban forestry and stormwater control?
   ____________________________________________________________________________________
   ____________________________________________________________________________________
   ____________________________________________________________________________________

J. Respondent Information

1. What position do you hold on the stormwater board?  _______________

2. What agency/business employs you?  _______________

3. How many years have you worked for this agency/business?  _______________

K. Other Comments – Please use this space to address related issues not covered on this survey.
   ____________________________________________________________________________________
   ____________________________________________________________________________________
   ____________________________________________________________________________________
   ____________________________________________________________________________________
   ____________________________________________________________________________________

Your contribution of time to this study is greatly appreciated. Please return your completed questionnaire in the postage paid business reply envelope as soon as possible. Thank You.