Urban Subwatershed Restoration Manual Series

9

Municipal Pollution Prevention/ Good Housekeeping Practices

Version 1.0

September 2008

CENTER FOR WATERSHED PROTECTION

Manual 9

This publication was developed under EPA Assistance Agreement Number CP832764-01-0 awarded by the U.S. Environmental Protection Agency. EPA reviewed the document and had an opportunity to provide comments. However, final decisions on content were made by the recipient. The views expressed in this document are solely those of the Center for Watershed Protection and EPA does not endorse any products or commercial services mentioned in this publication.

Urban Subwatershed Restoration Manual No. 9

MUNICIPAL POLLUTION PREVENTION/GOOD HOUSEKEEPING PRACTICES

Version 1.0

Prepared by:

Michael Novotney and Rebecca Winer
Center for Watershed Protection
8390 Main Street, 2nd Floor
Ellicott City, MD 21043
www.cwp.org
www.stormwatercenter.net

Prepared for:
Office of Wastewater Management
U.S. Environmental Protection Agency
Washington, D.C.

September 2008

Copyright© 2008 by the Center for Watershed Protection
Material may be quoted provided credit is given.
Printed in the United States of America on recycled paper.

Foreword

Until relatively recently, most communities have had little reason to consider the stormwater pollution generated by their own municipal operations. Over the last decade, this reality has begun to change, as the National Pollution Discharge Elimination System (NPDES) has spurred communities across the country to begin developing comprehensive pollution prevention/good housekeeping programs. Although the concepts behind municipal pollution prevention/good housekeeping are relatively easy to understand, many communities have found the process of developing a pollution prevention/good housekeeping program to be both confusing and intimidating.

Although several guidance documents have been written about the source control practices that can be used to address the individual pollution-generating activities (e.g., building maintenance, waste handling and disposal) that a community may conduct, few have focused on the development of comprehensive pollution prevention/good housekeeping programs. To help fill this void, the Center has developed this manual, which outlines our most recent ideas on how municipal pollution prevention/good housekeeping practices can be used to address local water quality issues and watershed restoration goals and objectives.

The manual presents a framework for planning and developing comprehensive and effective pollution prevention/good housekeeping programs. It is intended primarily for use by smaller NPDES Phase II communities and other unregulated communities interested in protecting and restoring local water resources. However, other entities regulated under Phase II of the NPDES program (e.g., departments of transportation, military installations, school districts), as well as communities regulated under Phase I of the program will also find it useful.

As the development of comprehensive pollution prevention/good housekeeping programs is a relatively new concept, we fully expect that the information contained in this manual will be revised and adjusted over time, particularly as we refine, test and expand our approach to municipal pollution prevention/good housekeeping and collect new information from readers like you. As you read the manual and begin to develop or revise you pollution prevention/good housekeeping program, please let us know what has or hasn't worked in your community.

Center staff that contributed to the development of this manual include Karen Cappiella, Greg Hoffmann, Neely Law, Rachel Streusand and Tiffany Wright. Special thanks are extended to our reviewers, including participants at our Stormwater Institute held last fall outside of Toledo, Ohio; Tom Schueler, Coordinator of the Chesapeake Stormwater Network; Rebecca Winer-Skonovd, Senior Scientist with Larry Walker and Associates (Davis, CA); and Karen Cappiella, whose comments and insights on earlier drafts of this manual greatly improved its organization and utility.

Thanks are also due to our EPA project officer, Bryan Rittenhouse, for his support during the two years it took to produce this manual and our Urban Stormwater Retrofit Practices manual

under a cooperative agreement with US EPA Office of Wastewater Management (CP-83276401).

In closing, I hope that this manual helps our readers understand the important role that municipal pollution prevention/good housekeeping can have in protecting and restoring our urban watersheds. Benjamin Franklin may well have been speaking about the relationship between pollution prevention, good housekeeping and the health of our aquatic resources when he said: “an ounce of prevention is worth a pound of cure.”

Sincerely,

Michael Novotney
Center for Watershed Protection

About the Restoration Manual Series

Over the last four years, the Center for Watershed Protection has produced a series of 11 manuals that describes the techniques to restore small urban watersheds. The entire series of manuals was written to organize the enormous amount of information needed to restore small urban watersheds into a format that can easily be accessed by watershed groups, municipal staff, environmental consultants and other users. The contents of the manuals are organized as follows:

Manual 1: An Integrated Framework to Restore Small Urban Watersheds

The first manual, published in 2004, introduces the basic concepts and techniques of urban watershed restoration, and sets forth the overall framework we use to evaluate subwatershed restoration potential. The manual emphasizes how past subwatershed alterations must be understood in order to set realistic expectations for future restoration. Toward this end, the manual presents a simple subwatershed classification system to define expected stream impacts and restoration potential. Next, the manual defines seven broad groups of restoration practices, and describes where to look in the subwatershed to implement them. The manual concludes by presenting a condensed summary of a planning approach to craft effective subwatershed restoration plans.

Manual 2: Methods to Develop Restoration Plans for Small Urban Watersheds

The second manual was published in 2005 and contains detailed guidance on how to put together an effective plan to restore urban subwatersheds. The manual outlines a practical, step-by-step approach to develop, adopt and implement a subwatershed plan in your community. Within each step, the manual describes 32 different desktop analysis, field assessment, and stakeholder involvement methods used to make critical restoration management decisions.

Manual 3: Urban Stormwater Retrofit Practices

This manual, published in 2007, focuses on stormwater retrofit practices that can capture and treat stormwater runoff before it is delivered to the stream. The manual describes both off-site storage and on-site retrofit techniques that can be used to remove stormwater pollutants, minimize channel erosion, and help restore stream hydrology. Guidance on choosing the best locations in a subwatershed for retrofitting is provided in a series of 13 profile sheets. The manual then presents a method to assess retrofit potential at the subwatershed level, including methods to conduct a retrofit inventory, assess candidate sites, screen for priority projects, and evaluate their expected cumulative benefit. The manual concludes by offering tips on retrofit design, permitting, construction, and maintenance considerations.

Manual 4: Urban Stream Repair Practices

The fourth manual was published in 2005 and concentrates on practices used to enhance the appearance, stability, structure, or function of urban streams. The manual offers guidance on three broad approaches to urban stream repair – stream cleanups, simple repairs, and more sophisticated comprehensive repair applications. The manual emphasizes the powerful and relentless forces at work in urban streams, which must always be carefully evaluated in design. Next, the manual presents guidance on how to set

appropriate restoration goals for your stream, and how to choose the best combination of stream repair practices to meet them.

The manual also outlines methods to assess stream repair potential at the subwatershed level, including basic stream reach analysis, more detailed project investigations, and priority screenings. The manual concludes by offering practical advice to help design, permit, construct and maintain stream repair practices in a series of more than 30 profile sheets.

Manual 5: Riparian Management Practices

This manual was originally envisioned to provide guidance on how to restore the quality of forests and wetlands in the stream corridor, though it was never officially completed. The Center completed several manuals from 2005 to 2007 that fully address this topic including the three parts of the *Urban Watershed Forestry Manual* and the six *Wetlands and Watersheds* articles produced for USDA and U.S. EPA, respectively.

Manual 6: Discharge Prevention Practices

The sixth manual covers practices used to prevent the entry of sewage and other pollutant discharges into the stream from pipes and spills. The manual describes a variety of techniques to find, fix and prevent these discharges that can be caused by illicit sewage connections, illicit business connections, failing sewage lines, or industrial/transport spills. The manual also briefly presents desktop and field methods to assess the severity of illicit discharge problems in your subwatershed. Lastly, the manual profiles different "forensic" methods to detect and fix illicit discharges. The Center never completed the full manual, but a major portion of the topic is covered in a 2004 manual entitled *Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments* (Brown *et al.*, 2004)

Manual 7: Watershed Forestry Practices

The seventh manual reviews subwatershed practices that can improve the quality of upland pervious areas, which include techniques to improve conditions, revegetate pervious areas, and restore natural area remnants. When broadly applied, these techniques can improve the capacity of these lands to absorb rainfall and sustain healthy plant growth. This manual also outlines methods to assess the potential for these techniques at both the site and subwatershed scale. This manual was published under separate cover as the *Urban Watershed Forestry Manuals*.

Manual 8: Pollution Source Control Practices

Pollution source control practices reduce or prevent pollution from residential neighborhoods or stormwater hotspots. Thus, the topic of the eighth manual is a wide range of stewardship and pollution prevention practices that can be employed in subwatersheds. The manual presents several methods to assess subwatershed pollution sources in order to develop and target education and/or enforcement efforts that can prevent or reduce polluting behaviors and operations. The manual outlines more than 100 different "carrot" and "stick" options that can be used for this purpose. Lastly, the manual presents profile sheets that describe 21 specific stewardship practices for residential neighborhoods, and 15 pollution prevention techniques for control of stormwater hotspots.

Manual 9: Municipal Pollution Prevention/Good Housekeeping Practices

The ninth manual, published in 2008, focuses on how municipal operations can directly support subwatershed restoration efforts. The manual contains a municipal operations analysis to help local stormwater managers target the municipal operations and activities that can improve water quality. The 10 areas include municipal hotspots, municipal construction, road maintenance, street sweeping, storm drain cleanouts, stormwater hotlines, landscaping and park maintenance, residential stewardship, stormwater maintenance, and employee training. The manual presents guidance on how municipalities can modify these 10 programs to promote subwatershed restoration goals. It presents a series of profile sheets that recommends specific techniques to implement effective municipal programs.

Manual 10: The Unified Stream Assessment (USA): A User's Manual

The Unified Stream Assessment (USA) is a rapid technique to locate and evaluate problems and restoration opportunities within the urban stream corridor. The tenth manual is a user's guide that describes how to perform the USA, and interpret the data collected to determine the stream corridor restoration potential for your subwatershed.

Manual 11: The Unified Subwatershed and Site Reconnaissance (USSR): A User's Manual

The last manual examines pollution sources and restoration potential within upland areas of urban subwatersheds. The manual provides detailed guidance on how to perform each of its four components: the Neighborhood Source Assessment (NSA), Hotspot Site Investigation (HSI), Pervious Area Assessment (PAA) and the analysis of Streets and Storm Drains (SSD). Together, these rapid surveys help identify upland restoration projects and source control to consider when devising subwatershed restoration plans.

Table of Contents

Foreword i

About the Manual Series iii

Introduction 1

Chapter 1: Basics of Municipal Pollution Prevention/Good Housekeeping Programs 4
1.1 Reasons for Developing Municipal Pollution Prevention/Good Housekeeping Programs 5
1.2 Ten Major Municipal Operations 6

Chapter 2: Developing a Municipal Pollution Prevention/Good Housekeeping Program 10
2.2 Maintaining Pollution Prevention/Good Housekeeping Programs Over Time 18
2.3 Scoping the Level of Effort Required to Develop a Pollution Prevention/Good Housekeeping Program 18

Chapter 3: The Municipal Operations Analysis (MOA) 22
3.1 How to Complete the MOA 22
3.2 Scoring the MOA 33

Chapter 4: Municipal Operation Profile Sheets 36

MO-1 Hotspot Facility Management 37
MO-2 Construction Project Management 51
MO-3 Street Repair and Maintenance 63
MO-4 Street Sweeping 73
MO-5 Storm Drain Maintenance 83
MO-6 Stormwater Hotline Response 93
MO-7 Park and Landscape Maintenance 105
MO-8 Residential Stewardship 115
MO-9 Stormwater Management Practice Maintenance 125
MO-10 Employee Training 135

References 146

Introduction

All communities conduct activities that influence water quality. Some activities, such as hotspot facility management, construction project management and street repair and maintenance can negatively impact water quality, while others, such as street sweeping, storm drain maintenance and employee training, can help improve it. By reducing the influence of the operations that negatively impact water quality and increasing the influence those that help improve it, a municipal pollution prevention/good housekeeping practices can help control and reduce stormwater pollution and address local subwatershed restoration goals and objectives.

Since the nature, scope and distribution of municipal operations vary greatly from one community to the next, there is no "one size fits all" approach to pollution prevention/good housekeeping. Every community needs to develop its own pollution prevention/good housekeeping program. To assist communities with this seemingly daunting task, the Center has developed this manual, which is the ninth in the Urban Subwatershed Restoration Manual series.

This manual provides "how to" guidance on developing effective municipal pollution prevention/good housekeeping programs. It is intended primarily for use by smaller communities regulated under Phase II of the NPDES stormwater program, as well as other small, unregulated communities that are interested in protecting and restoring local water resources. Other entities that must develop pollution prevention/good housekeeping programs (e.g., departments of transportation, military installations, school districts) and communities regulated under Phase I of the NPDES stormwater program will also find the guidance useful.

Chapter 1: Basics of Municipal Pollution Prevention/Good Housekeeping Programs

The first chapter explores the basics of municipal pollution prevention/good housekeeping and the reasons for developing a municipal pollution prevention/good housekeeping program. The chapter introduces the 10 major municipal operations than can influence water quality and identifies the stormwater pollutants commonly associated with each of these operations.

Chapter 2: Developing a Municipal Pollution Prevention/Good Housekeeping Program

This chapter offers a seven-step process that can be used to plan and implement an effective municipal pollution prevention/good housekeeping program. The chapter provides guidance on identifying municipal operations that have the greatest influence on water quality and on developing the municipal practices and programs needed to help improve those operations. The chapter concludes with a discussion about setting measurable goals and scoping the level of effort needed to develop an effective program.

Chapter 3: The Municipal Operations Analysis (MOA)

This chapter presents the Municipal Operations Analysis (MOA), which is a simple desktop assessment that identifies the municipal operations that have the greatest influence on water quality. While technically not a field assessment, the MOA may require visits to a number of offices and publicly owned and/or -operated facilities to gather the information needed to complete the analysis. The results of the MOA can be used to help focus pollution prevention/good housekeeping efforts on the municipal operations that need the most improvement within a community.

Chapter 4: Municipal Operation Profile Sheets

The last chapter contains profile sheets that describe methods for investigating and improving each of the 10 major municipal operations. Each profile sheet explains how the operation influences water quality and which practices can be used to improve the operation. The profile sheets also provide references and links to useful web resources.

Chapter 1: Basics of Municipal Pollution Prevention/Good Housekeeping Programs

Every day, municipal employees engage in a variety of activities that influence water quality. Some activities, such as hotspot facility management, construction project management and street repair and maintenance can negatively impact water quality, while others, such as street sweeping, storm drain maintenance and employee training, can help improve it. Whether a pollution prevention/good housekeeping program is designed to reduce the influence of activities that negatively impact water quality (Figure 1), or increase the influence of activities that help improve it (Figure 2), it should be carefully designed to address local water quality issues and subwatershed restoration goals and objectives.

Municipal Construction Site with No Erosion or Sediment Controls

Road Salt Box Placed Next to Storm Drain

Uncovered Storage Barrels at Municipal Public Works Yard

Figure 1: Municipal activities that can negatively impact water quality

Oil Recycling Storage Tanks

Source: Fort Worth, TX

Pet Waste Pick-Up Station

Municipal Xeriscaping Demonstration Area

Figure 2: Municipal activities that can improve water quality

Although all communities conduct some activities that influence water quality, the nature, scope and distribution of those activities vary greatly from one community to the next. Some communities may be responsible for maintaining dozens of stormwater hotspot facilities, hundreds of miles of streets and storm drains and thousands of inlets and catch basins and may

need to develop complex pollution prevention/good housekeeping programs. Others may be responsible for managing a single hotspot facility, a few miles of streets and storm drains and a handful of inlets and catch basins and may need to develop relatively simple programs. Consequently, each community needs to develop its own unique pollution prevention/good housekeeping program.

This chapter explores the basics of municipal pollution prevention/good housekeeping programs and discusses the reasons for developing municipal pollution prevention/good housekeeping programs in the first place. It also describes the 10 major groups of municipal operations that can influence water quality and identifies the stormwater pollutants commonly associated with each of these operations.

1.1 Reasons for Developing Municipal Pollution Prevention/Good Housekeeping Programs

Until relatively recently, most communities did not have pollution prevention/good housekeeping programs designed to control and reduce the amount of stormwater pollution generated by their own operations. This trend is changing as communities strive to comply with the National Pollution Discharge Elimination System (NPDES) stormwater program, which requires communities to develop practices and programs to control and reduce the amount of stormwater pollution that is discharged into their municipal storm drain systems. The minimum control measures associated with the NPDES stormwater program are summarized in Table 1.

Table 1: NPDES Stormwater Program: What It Means

	Phase I Communities	Phase II Communities
Who is covered?	Complex designation, but primarily communities that have a separated storm drain system with a population of more than 100,000.	Very complex designation that includes most communities with a population of more than 50,000 and a population density greater than 1,000 people/square mile. States must also assess whether communities from 10,000 to 50,000 should be covered, based on certain criteria.
Permit status	The first permits were issued in the early 1990s. Extensive permit applications and annual reports. Permit cycle: 5 to 7 years.	Most general permits were issued in December 2002. Simpler application and reporting requirements. Permit cycle: 5 years.
What is required?	• Storm water quality monitoring • Mapping of storm drain network • Outfall screening • Removal of illicit discharges • Source identification • Structural and source control measures to reduce pollutants • Erosion/sediment control program • Demonstration of legal authority to control storm water discharges • Fiscal analysis	Control storm water to the maximum extent practical, using six minimum management measures: • Public education/outreach • Public participation/involvement • Illicit discharge detection and elimination • Construction site runoff control • Post-construction runoff control • Pollution prevention/good housekeeping

Table 1: NPDES Stormwater Program: What It Means		
	Phase I Communities	Phase II Communities
The skinny	Requires creation of programs, and monitoring but does not set firm benchmarks for program performance. Extremely uneven administration by both permitting agencies and municipalities to date. Ranges from paper programs to highly innovative and expansive programs, depending on degree of local and/or state leadership.	Requires creation of programs but does not set firm benchmarks for performance. Stronger emphasis on public education, involvement and pollution prevention than Phase I. No monitoring required. While the minimum control measures do not explicitly call for a watershed approach, they certainly are a strong regulatory driver to improve restoration programs for smaller communities.
Want more information? Phase II communities can consult http://cfpub.epa.gov/npdes/stormwater/swfinal.cfm. A summary of the Phase I program can be found in U.S. EPA. 1996. Overview of the Storm Water Program. EPA833-R-96-008. Available online: http://www.epa.gov/npdes/pubs/owm0195.pdf		

The key implication of the NPDES stormwater program is that communities and, in particular, smaller communities regulated under Phase II of the program, now have a legal responsibility to develop pollution prevention/good housekeeping programs to control and reduce stormwater pollution generated by their own operations. According to the regulations, the operator of a regulated Municipal Separate Storm Sewer (MS4) community must develop a program to:

- Prevent or reduce the amount of stormwater pollution generated by municipal operations and conveyed into receiving waters
- Train employees on how to incorporate pollution prevention/good housekeeping techniques into municipal operations
- Identify appropriate best management practices and measurable goals for preventing or reducing the amount of stormwater pollution generated by municipal operations

This manual provides guidance on developing a pollution prevention/good housekeeping program that will meet the requirements of the NPDES MS4 permit program. It is intended primarily for communities regulated under Phase II of the program, as well as other small, unregulated communities that are interested in protecting and restoring local water resources. However, other entities that must develop pollution prevention/good housekeeping programs (e.g. transportation departments, military installations, school districts), as well as communities regulated under Phase I of the NPDES MS4 permit program, will also find it useful.

1.2 Ten Major Municipal Operations

Pollution prevention/good housekeeping involves identifying the municipal operations that may influence water quality within a community and improving them to better support local subwatershed restoration goals and objectives. As many as 10 different municipal operations should be systematically evaluated to determine where improvements can be made, including:

- Hotspot facility management
- Construction project management
- Street repair and maintenance
- Street sweeping
- Storm drain maintenance
- Stormwater hotline response

- Park and landscape maintenance
- Residential stewardship
- Stormwater management practice maintenance
- Employee training

These operations, described in more detail below, can generate or reduce a variety of stormwater pollutants, including sediment, nutrients, metals, hydrocarbons, pesticides, chlorides and trash, as outlined in Table 2.

Table 2: Stormwater Pollutants Associated with the 10 Major Municipal Operations

Municipal Operation	Sediment	Nutrients	Metals	Hydro-carbons	Toxins	Others
Hotspot Facility Management	●	●	●	●	●	Trash, Organic Matter, Pesticides, Chlorine
Construction Project Management	●	◉	○	◉	◉	Trash
Street Repair and Maintenance	●	◉	◉	●	◉	Trash
Street Sweeping	●	○	◉	◉	○	Trash, Organic Matter
Storm Drain Maintenance	◉	○	○	○	○	Trash, Organic Matter
Stormwater Hotline Response	●	○	○	●	●	Bacteria
Park and Landscape Maintenance	◉	●	○	○	◉	Pesticides
Residential Stewardship	○	●	○	◉	◉	Pesticides
Stormwater Management Practice Maintenance	◉	◉	◉	○	○	Bacteria
Employee Training	●	●	●	●	●	Chloride, Trash

Key
● = frequently associated with operation
◉ = infrequently associated with operation
○ = rarely associated with operation

Hotspot Facility Management - Municipal stormwater hotspot facilities are publicly owned or -operated facilities that produce higher levels of stormwater pollutants and/or present a higher potential risk for spills, leaks or illicit discharges. Although the nature and distribution of publicly owned or -operated hotspot facilities is different in every community, quite a few hotspot facilities usually exist. They include the many municipal facilities that that handle solid waste, wastewater, road and vehicle maintenance and yard waste. Common municipal hotspots include:

- Composting facilities
- Fleet storage and school bus depots
- Landfills/solid waste facilities
- Local streets and storm drains
- Maintenance depots
- Pesticide use in rights-of-way
- Public golf courses
- Public schools
- Public works yards
- Solid waste facilities
- Wastewater treatment plants

Municipal stormwater hotspots can generate the full range of stormwater pollutants, including nutrients, hydrocarbons, metals, chlorides, pesticides, bacteria and trash.

Construction Project Management - A community may engage in any number of capital improvement, development and redevelopment projects, which can generate a wide range of stormwater pollutants, including sediment, nutrients, hydrocarbons, pesticides, trash and construction debris. Common municipal development and redevelopment projects include:

- Public buildings (e.g. schools, libraries, police and fire departments)
- Public golf courses
- Public works facilities
- Road construction and widening
- Utility construction and repair
- Water and wastewater treatment facilities

Street Repair and Maintenance - Regular municipal street repair and maintenance activities, such as pavement marking, repair, patching, resurfacing and surface sealing, can generate a range of stormwater pollutants, including metals, chlorides, hydrocarbons (e.g. benzene, toluene, ethylbenzene, xylene), sediment and trash. If not properly managed, these activities can negatively impact water quality and the health of local aquatic resources.

Street Sweeping - Pollutants from atmospheric deposition and vehicle emissions accumulate on public streets and roadways in between storm events. In many communities, these pollutants remain on public streets and roadways until they are washed into the storm drain system by stormwater runoff. Some communities use street sweeping to remove some of these pollutants and prevent them from being conveyed into the storm drain system. Although street sweeping has historically been more effective at removing large-sized particles, new technologies are emerging that will remove smaller, fine-grained particles. These new technologies will make street sweeping an even more attractive option for communities looking to protect and restore local aquatic resources.

Storm Drain Maintenance - Municipal storm drain systems are designed to quickly and efficiently collect and convey stormwater runoff to streams and other receiving waters. Typical municipal storm drain maintenance activities, such as catch basin, inlet and storm drain cleanouts, are designed to remove trash and debris from the storm drain system to prevent blockages, backups and localized flooding. Although not commonly thought of as a way to prevent or reduce stormwater pollution, regular storm drain maintenance activities can reduce the amount of pollution that is conveyed into local aquatic resources during storm events. This is particularly true in urbanized areas, where the amount of trash and debris that accumulates in the municipal storm drain system can be significant.

Stormwater Hotline Response - Spills, leaks, sanitary sewer overflows and illicit discharges can introduce a range of stormwater pollutants into the storm drain system. Most of the time, municipal staff will not be able to prevent these events from happening, so prompt response to them is the best, and sometimes only, way to prevent them from negatively impacting local water resources. Stormwater hotlines can be used to help communities determine when and where

these events occur. By properly responding to reports of these events, a community can reduce the amount of pollution that is conveyed into the municipal storm drain system.

Park and Landscape Maintenance - When all publicly-owned parks, schools, golf courses, easements and other open spaces are considered, a community may find that it owns as much as 10 percent of the land within its own municipal boundaries. It is not uncommon for a significant percentage of this publicly owned land to be covered with turf, which is often managed with regular mowing, fertilization, pesticide application and supplemental irrigation. These and other regular park and landscape maintenance activities can generate a range of stormwater pollutants, including sediment, nutrients, hydrocarbons, pesticides, herbicides and organic debris, particularly on sites with compacted soils.

Residential Stewardship - Residents engage in many behaviors and activities that can influence water quality. Behaviors such as over-fertilizing, oil dumping, littering and excessive pesticide use can negatively impact water quality, while behaviors such as tree planting, disconnecting rooftops and picking up pet waste can help improve water quality. To help reduce the amount of pollution that is conveyed into streams and other local aquatic resources, communities can develop residential stewardship programs that discourage negative behaviors and encourage positive ones. These stewardship programs are often supplemented with education and outreach events, financial incentives and in-kind services.

Stormwater Management Practice Maintenance - Stormwater management practices are engineered facilities designed to treat or otherwise manage post-construction stormwater runoff and mitigate the negative impacts of land development. These practices, which include extended detention ponds, wet ponds, stormwater wetlands, bioretention areas, swales, filtration practices and infiltration practices, can be used to manage stormwater quantity and quality. Although communities may not be responsible for the siting, design and construction of these practices, they are often responsible, at least in part, for their regular maintenance and upkeep. If not properly maintained, stormwater management practices can lose much of their ability to treat stormwater runoff.

Employee Training - Employee training is an important component of any municipal pollution prevention/good housekeeping program. In order for municipal pollution prevention/good housekeeping programs to achieve success, employees must be trained on how to incorporate pollution prevention/good housekeeping practices into their everyday activities. Employee training and education can also help increase the effectiveness of other subwatershed protection and restoration programs (e.g. illicit discharge detection and elimination).

Developing an effective pollution prevention/good housekeeping program involves determining which of these operations are conducted within your community and designing a program that will increase or reduce their influence, depending on whether they have a positive or negative impact on water quality. The remainder of this manual provides practical guidance for completing these tasks.

Chapter 2: Developing a Municipal Pollution Prevention/Good Housekeeping Program

Although pollution prevention/good housekeeping programs rely primarily on behavioral changes and non-structural pollution prevention practices to control and reduce pollution, they should be treated like any of the other restoration practices used to improve the conditions of urban subwatersheds. They should be carefully designed, effectively targeted and continuously maintained. Although this may appear to be a daunting task, it is not as difficult as it seems. With careful planning and implementation, every community can develop a pollution prevention/good housekeeping program that effectively addresses local water quality issues and subwatershed restoration goals and objectives.

To assist communities in developing effective pollution prevention/good housekeeping programs, the Center has developed the program planning and development process presented in this chapter. The process can be used to help define the focus of local pollution prevention/good housekeeping efforts and systematically improve existing municipal operations. It evaluates local municipal operations, water quality issues and subwatershed restoration goals and objectives to answer nine basic questions:

1. What **municipal operations** are conducted within the community?

2. What **stormwater pollutants** are associated with the operations?

3. Who is responsible for **managing** each of the operations?

4. What is the primary **pollutant of concern** in the subwatershed?

5. Which of the operations has the **greatest influence** on water quality and should be the focus of the community's pollution prevention/good housekeeping efforts?

6. What specific **pollution prevention/good housekeeping practices** should be implemented to improve the operations?

7. How much will the pollution prevention/good housekeeping practices **cost**?

8. Who will be responsible for **implementing** the pollution prevention/good housekeeping practices?

9. How will **progress** made in pollution prevention/good housekeeping be evaluated?

To be sure, answering many of the questions listed above requires careful analysis and some professional judgment. Still, the questions provide a good framework to organize your thinking about municipal pollution prevention/good housekeeping and ways to control and reduce the amount of stormwater pollution conveyed into streams and other aquatic resources through the municipal storm drain system. The remainder of this chapter outlines the seven-step planning and development process, which can be used to systematically answer the questions listed above. The process is straightforward, cost-effective and can be used to develop pollution prevention/good housekeeping programs in communities both large and small.

2.1 Developing a Pollution Prevention/Good Housekeeping Program

Developing an effective pollution prevention/good housekeeping program involves identifying the municipal operations that are conducted in your community, determining which of them has the greatest influence on water quality and designing a strategy that will either reduce or increase their influence, depending on whether they have a positive or negative impact on water quality. The seven-step program planning and development process outlined in this chapter can be used to complete these tasks and develop a local pollution prevention/good housekeeping program. The process, which is depicted in Figure 3, is described in more detail below.

Step 1: Identify Existing Municipal Operations

Since the nature, scope and distribution of municipal operations varies greatly from one community to the next, the process of developing a municipal pollution prevention/good housekeeping program begins with identifying the municipal operations that are currently conducted in your community:

- Construction project management
- Employee training
- Hotspot facility management
- Park and landscape maintenance
- Residential stewardship
- Storm drain maintenance
- Stormwater hotline response
- Stormwater management practice maintenance
- Street repair and maintenance
- Street sweeping

The product of this step is a short list of the municipal operations conducted in the community.

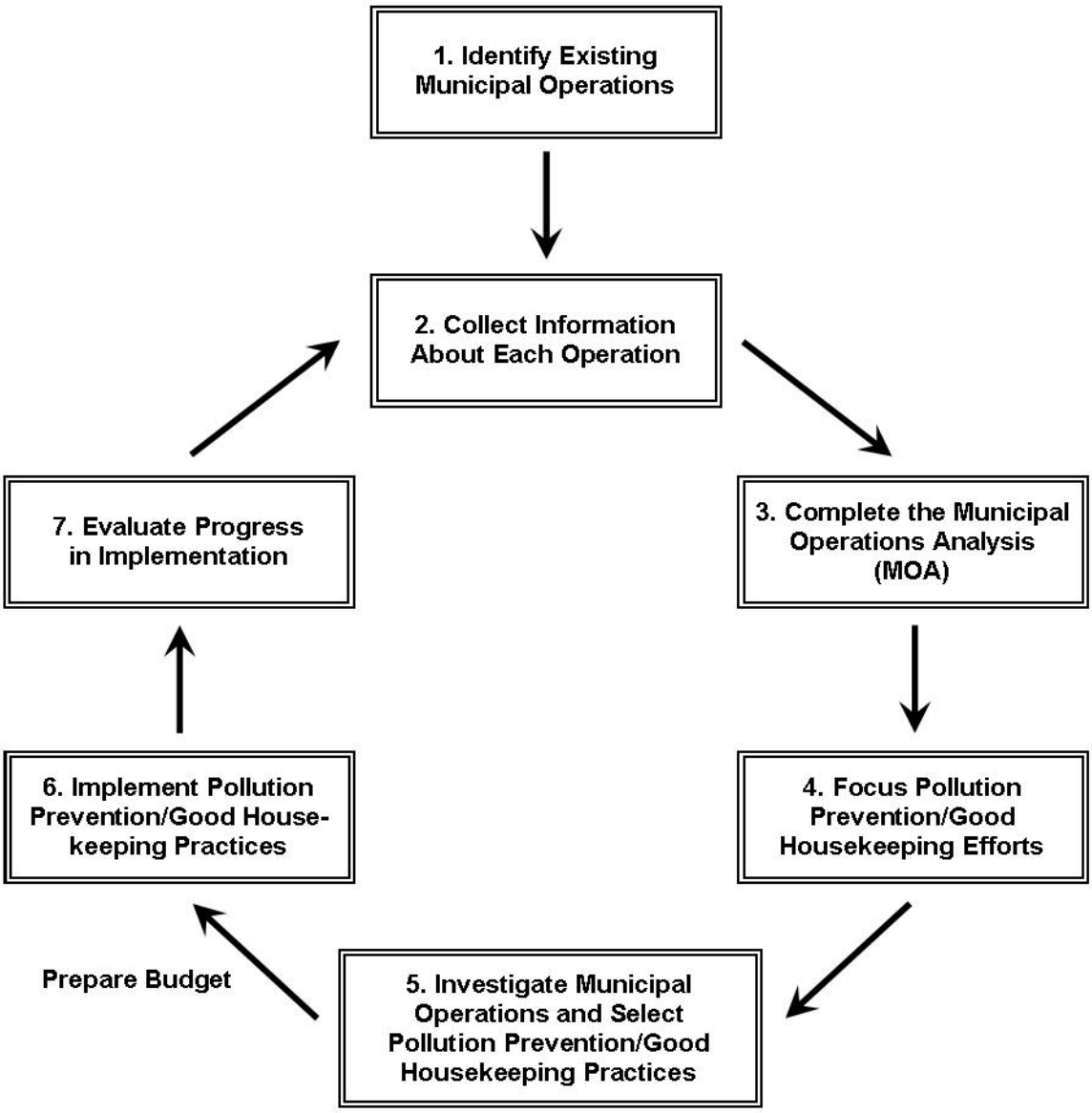

Figure 3: Developing a pollution prevention good housekeeping program

Step 2: Collect Information About Each Operation

Once you've identified the particular municipal operations that are conducted within your community, the next step is to collect some basic information about them. The information that should be collected about each operation varies according to the nature of the operation. Because hotspot facility management involves specific pollution-generating activities, the information that should be collected about hotspot facility management is different than the information that should be collected about the other municipal operations, which typically involve more general pollution-generating activities that occur at a variety of locations throughout a community.

Hotspot Facility Management - Basic information to collect about each municipal stormwater hotspot where hotspot facility management takes place in your community includes:

- Facility name
- Street address
- Watershed and subwatershed address
- Geospatial coordinates (e.g. latitude, longitude)
- Facility type
- Facility manager name
- Facility manager contact information
- Site plans, if available
- Aerial photography, if available

It should be noted that some publicly owned or -operated stormwater hotspot facilities might be classified as *regulated* stormwater hotspots and, as such, are subject to additional federal or state regulations. Additional information on regulated stormwater hotspots can be found in Manual 8.

Other Municipal Operations - Basic information to collect about the other municipal operations conducted in your community includes:

- Operation name
- List of watersheds and subwatersheds where operation occurs
- Map showing where operation occurs
- Operation manager name
- Operation manager contact information

As you identify the particular municipal operations that are conducted in your community and collect some basic information about them, you should begin communicating with the individuals who manage or oversee each of operations. This is an ideal time to inform these individuals about the community's pollution prevention/good housekeeping efforts and the purpose of the community's municipal pollution prevention/good housekeeping program. If they are not already aware of the link between their operation and stormwater pollution, it is also a good time to educate them about the influence that their operations or facilities can have on water quality. It is also a good time to begin building a relationship with them, because you will need to coordinate with them to develop and implement an effective municipal pollution prevention/good housekeeping program.

The product of this step is a simple database or binder that contains all of the information that you collect about the municipal operations conducted in your community. Summary sheets for each of the operations can be created and included in the database or binder.

Step 3: Complete the Municipal Operations Analysis (MOA)

Given limited resources, it is unlikely that you will immediately be able to further investigate and improve all of the municipal operations that are conducted in your community. Therefore, it is important to focus your pollution prevention/good housekeeping efforts, at least initially, on the

operations that have the greatest influence on water quality. This can be accomplished by completing the Municipal Operations Analysis (MOA), which is provided in Chapter 3.

The MOA is a simple desktop assessment that uses readily available information to help you identify the municipal operations that have the greatest influence on water quality in your community. In most cases, completing the MOA will require additional input from the individuals who manage or oversee each of operations as well as visits to various municipal offices and facilities to gather the information needed to complete the analysis. The results of the MOA can be used to help focus your initial pollution prevention/good housekeeping efforts on a manageable number of operations and help craft a meaningful local pollution prevention/good housekeeping strategy.

Step 4: Focus Pollution Prevention/Good Housekeeping Efforts

Once you've completed the MOA, the next step is to select the operation(s) that will become the primary focus of your initial pollution prevention/good housekeeping efforts. The outcome of this step is a prioritized list of the municipal operations in the order in which they will be further investigated and improved. This list, known as the prioritized municipal operations list, can be used to guide your current and future pollution prevention/good housekeeping efforts. The operations at the top of the prioritized municipal operations list should be those that you will address first, while those at the bottom should be those that you will address over time.

When developing your prioritized municipal operations list, it is important to consider not only the results of the MOA, but also any local pollutants of concern. For example, if sediment is a local pollutant of concern, you may want to focus your initial pollution prevention/good housekeeping efforts on municipal operations that can generate high sediment loads, such as construction project management and street sweeping. A different group of municipal operations should be targeted if nutrients are the primary pollutant of concern, including park and landscape maintenance and residential stewardship. Still a different group of municipal operations should be investigated if hydrocarbons and toxins are the pollutants of concern, including hotspot facility management and stormwater hotline response. Table 2 can be used to link municipal operations with particular pollutants of concern.

Step 5: Investigate Municipal Operations and Select Pollution Prevention/Good Housekeeping Practices

Once you've developed your prioritized municipal operations list, the next step is to further investigate each operation to determine how it influences whether water quality can be either increased or reduced. The profile sheets presented in Chapter 4 (Table 3) provide guidance on conducting these follow-up investigations. Your follow-up investigations should begin with the municipal operation that is on top of your prioritized municipal operations list.

Each profile sheet provides information on investigating one of the 10 major municipal operations and on identifying the pollution prevention/good housekeeping practices that can be used to improve each operation. The profile sheets also contain information about the level of

effort required to complete the follow-up investigations as well as links to useful resources that can be used to gather additional information about each operation.

Table 3: Municipal Operation Profile Sheets	
Municipal Operation	**Profile Sheet**
Hotspot Facility Management	MO-1
Construction Project Management	MO-2
Street Repair and Maintenance	MO-3
Street Sweeping	MO-4
Storm Drain Maintenance	MO-5
Stormwater Hotline Response	MO-6
Park and Landscape Maintenance	MO-7
Residential Stewardship	MO-8
Stormwater Management Practice Maintenance	MO-9
Employee Training	MO-10

The basic approach to completing the follow-up investigations is to use a combination of desktop and field assessments to identify the pollution-generating activities associated with each of the operations. With these pollution-generating activities defined, you will be able to prescribe specific pollution prevention/good housekeeping practices to improve each of the operations. A summary of the pollution-generating activities commonly associated with each of the 10 major municipal operations and the stormwater pollutants associated with those activities is presented in Table 4. Note that multiple pollution-generating activities and stormwater pollutants may be associated with a single municipal operation.

Table 4: Pollution Generating Activities and Stormwater Pollutants Associated with Municipal Operations

Pollution Generating Activity	Stormwater Pollutants					
	Sediment	**Nutrients**	**Metals**	**Hydro-carbons**	**Toxins**	**Others**
Hotspot Facility Management						
Vehicle Repair	○	○	●	●	●	
Vehicle Fueling	×	○	●	●	●	
Vehicle Washing	●	●	◉	◉	●	
Vehicle Storage	○	×	◉	●	○	Trash
Outdoor Loading	●	◉	◉	○	○	Organic Matter
Outdoor Storage	●	◉	◉	◉	◉	
Waste Management	○	◉	◉	◉	●	Trash
Building Repair	●	○	◉	◉	◉	
Building Maintenance	●	×	●	○	◉	
Parking Lot Maintenance	●	○	◉	●	◉	
Turf Management	◉	●	×	×	●	Pesticides
Landscaping	○	●	×	×	●	Pesticides
Swimming Pool Discharges	×	×	×	×	×	Chlorine
Construction Project Management						
Construction	●	○	○	◉	◉	Trash

Table 4: Pollution Generating Activities and Stormwater Pollutants Associated with Municipal Operations

Pollution Generating Activity	Stormwater Pollutants					
	Sediment	Nutrients	Metals	Hydro-carbons	Toxins	Others
Street Repair and Maintenance						
Street Maintenance	◉	×	◉	●	◉	Trash
Bridge Maintenance	○	×	◉	●	◉	Trash
Right-of-Way Maintenance	◉	●	×	×	●	Pesticides
Winter Operations	●	×	○	○	○	Chloride
Street Sweeping						
Street Sweeping	●	○	◉	◉	○	Trash, Organic Matter
Storm Drain Maintenance						
Maintenance of Inlet and Outlet Structures	◉	○	○	○	○	Trash, Organic Matter
Maintenance of Storm Drain System	◉	○	○	○	○	Trash, Organic Matter
Stormwater Hotline Response						
Controlling Spills	×	○	×	●	●	
Controlling Illicit Discharges	◉	○	○	●	●	Bacteria
Controlling Illegal Dumping	○	○	○	●	●	Trash, Organic Matter
Park and Landscape Maintenance						
Turf Management	◉	●	×	×	●	Pesticides
Landscaping	○	●	×	×	●	Pesticides
Landscape Waste Management	○	○	×	×	×	Organic Matter
Residential Stewardship						
Storm Drain Stenciling	×	×	○	◉	◉	Trash, Organic Matter
Waste Collection and Recycling	×	×	◉	○	◉	Trash
Hazardous Waste Collection	×	○	◉	●	●	Trash
Leaf and Landscape Waste Collection	○	×	×	×	×	Organic Matter
Stormwater Management Practice Maintenance						
Stormwater Management Practice Maintenance	◉	◉	◉	○	○	Bacteria
Employee Training						
Employee Training	●	●	●	●	●	Chloride, Trash

Key
× = not associated with operation
● = frequently associated with operation
◉ = infrequently associated with operation
○ = rarely associated with operation

The product of each follow-up investigation should be a brief implementation plan that summarizes the results of the investigation and the specific pollution-generating activities that are associated with each operation. Included in each implementation plan should be a summary of the pollution prevention/good housekeeping practices that will be used to address each of the pollution-generating activities and a schedule that indicates when the practices will be implemented. The contents of each implementation plan should be developed in cooperation with the individuals responsible for managing or overseeing each of operations.

A key element of each implementation plan is an estimate of the budget required to implement the recommended pollution prevention/good housekeeping practices. Although providing detailed cost information about all of the pollution prevention/good housekeeping practices that can be used to improve municipal operations is beyond the scope of this manual, there are some useful resources that can be used to gather this information, including Manual 8 and U.S. EPA's *National Menu of Stormwater Management Best Management Practices*, which is available online at: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm.

Step 6: Implement Pollution Prevention/Good Housekeeping Practices

Once a municipal operation has been investigated and assessed, the next step in the process is implementing the prescribed pollution prevention/good housekeeping practices. Although it may be tempting to hand the responsibility for implementation over to the individuals who manage or oversee each of the municipal operations, it is important to work with these individuals during the implementation phase to get the recommended improvements "in the ground." Simple techniques that can be used to do this include providing additional education and information about the prescribed pollution prevention/good housekeeping practices and providing assistance in securing funding for the recommended improvements.

Step 7: Evaluate Progress in Implementation

The last step in the process involves evaluating the progress made in implementing the prescribed pollution prevention/good housekeeping practices. Surveys and other evaluation tools will be needed to evaluate progress in implementation and track success in addressing local water quality issues and subwatershed restoration goals and objectives. Several different kinds of monitoring can be used to evaluate pollution prevention/good housekeeping programs, including:

- *Implementation surveys* - what pollution prevention/good housekeeping practices have been implemented and what improvements still need to be made?
- *Program effort* - counts of the number of municipal operations assessed, implementation plans created and pollution prevention/good housekeeping practices implemented.
- *Employee awareness surveys* - are municipal employees aware of the community's pollution prevention/good housekeeping efforts and have they changed the way that they conduct their day-to-day activities?
- *Water quality surveys* - have measurable improvements in water quality occurred as a result of municipal pollution prevention/good housekeeping efforts?

Communities regulated under Phase II of the NPDES MS4 permit program are required to evaluate their pollution prevention/good housekeeping programs on a regular, typically annual, basis. These communities need to develop measurable performance goals that identify the activities that they will complete during the development of their pollution prevention/good housekeeping programs. They also need to develop some implementation milestones that identify the dates when the measurable performance goals will be attained. Additional information about setting measurable goals and implementation milestones is provided in Section 2.3.

2.2 Maintaining Pollution Prevention/Good Housekeeping Programs Over Time

By their very nature, communities are quite dynamic. People move in and out, businesses come and go, neighborhoods are developed and redeveloped and municipal operations are introduced and expanded. As a result, municipal pollution prevention/good housekeeping programs must continually evolve. They should be regularly evaluated and revised to respond to changes that occur within the community. Municipal pollution prevention/good housekeeping programs should never be considered to be a one-shot deal, but should be considered "living" programs, which must be maintained, updated and enhanced over time.

2.3 Scoping the Level of Effort Required to Develop a Pollution Prevention/Good Housekeeping Program

The level of effort required to develop a municipal pollution prevention/good housekeeping program varies greatly from one community to the next. It depends on the nature, scope and distribution of the municipal operations that are conducted within the community and the number and type of pollution prevention/good housekeeping practices that are needed to improve the way that those operations are conducted. Decent planning-level estimates of the level of effort necessary to develop a municipal pollution prevention/good housekeeping program can be derived using the two-step approach described below.

Step 1: Develop Program Goals and Implementation Milestones

The first step in scoping the level of effort required to develop a municipal pollution prevention/good housekeeping program is to develop some measurable performance goals and implementation milestones. Measurable performance goals can be either *output-based* or *outcome-based*, as described below.

Outcome-Based Goals - Outcome-based goals focus on the positive results of pollution prevention/good housekeeping efforts, such as reducing pollutant loads or improving water quality. Although outcome-based goals are a great way to measure the positive impacts that local pollution prevention/good housekeeping efforts are having on local water resources, they can be difficult to measure and achieve. Ultimately, however, all communities should develop some *outcome-based* measurable goals pollution designed to address local water quality issues and subwatershed restoration goals and objectives.

Output-Based Goals - Output-based goals focus on the activities that are used to achieve the positive outcomes described above. They can be thought of as checklist items that used to track success in completing the activities necessary to develop a municipal pollution prevention/good housekeeping program, such as inspecting municipal operations and implementing pollution prevention/good housekeeping practices. Output-based goals can be used to evaluate basic program effectiveness, but cannot be used to measure how effectively local water quality issues and subwatershed restoration goals and objectives are being addressed.

The success of a community's pollution prevention/good housekeeping program is most effectively gauged through a combination of *outcome-based* and *output-based* goals. Although *outcome-based* goals may take a long time to achieve and may be difficult to measure, all communities should try to craft a handful of *outcome-based* goals that are challenging, yet achievable. Including these goals will help ensure that the pollution prevention/good housekeeping program is having a positive impact on local aquatic resources.

Since measurable performance goals are so important to evaluating and improving municipal pollution prevention/good housekeeping efforts over time, a community should spend some time crafting appropriate goals and implementation milestones as it begins developing its program. It is important that the selected measurable performance goals and implementation milestones be realistic, consistent with the resources (e.g. staff time, staff availability, technical resources) available to the community and in tune with local water quality issues and subwatershed restoration goals and objectives. Some example measurable goals and implementation milestones are presented in Table 5.

Table 5: Measurable Goals and Implementation Milestones for a Pollution Prevention/Good Housekeeping Program

Example Measurable Goals	Timeframe	Priority
Goals related to program startup		
Designate an individual to lead local pollution prevention/good housekeeping efforts	Immediately at program startup	●
Identify and collect basic information about existing municipal operations	Complete shortly after program startup; update regularly after that	●
Compile a simple database or binder that contains basic information about existing municipal operations		●
Develop a digital (e.g. GIS) or hard copy map showing the location of all municipal hotspot facilities and the locations/areas where other municipal operations occur		⦿
Educate the individuals who manage or oversee each of operations about the community's pollution prevention/good housekeeping efforts	Complete shortly after program startup; expand and enhance as needed	⦿
Conduct the Municipal Operations Analysis (MOA)	Year 1; repeat once every five years	●
Prioritize local pollution prevention/good housekeeping efforts based on the results of the MOA and other factors, such as local pollutants of concern		●
Develop a plan (e.g. schedule and budget) for further investigating and improving each municipal operation	Year 1 and each year after that	●
Secure funding and resources to match projected schedule and budget		●

Table 5: Measurable Goals and Implementation Milestones for a Pollution Prevention/Good Housekeeping Program		
Example Measurable Goals	**Timeframe**	**Priority**
Goals related to preventing or reducing stormwater pollution		
Further investigate each municipal operation to identify the pollution-generating activities associated with each operation, beginning with the operation on top of the prioritized municipal operations list	Begin in Year 1; complete by the end of Year 5	●
Prescribe pollution prevention/good housekeeping practices to address specific pollution-generating activities associated with each municipal operation		●
Develop implementation plans that summarize the results of each investigation and describe the pollution prevention/good housekeeping practices that will be used to address the pollution-generating activities associated with each municipal operation		●
Develop implementation milestones and a budget for each implementation plan		●
Further investigate the municipal operation that is at the top of the prioritized municipal operations list to identify the pollution-generating activities associated with it	Year 1	⦿
Prescribe pollution prevention/good housekeeping practices to address specific pollution-generating activities associated with the priority operation		⦿
Develop an implementation plan that summarizes the results of the investigation and describes the pollution prevention/good housekeeping practices that will be used to address the pollution-generating activities associated with the priority operation		⦿
Secure funding and resources to implement pollution prevention/good housekeeping practices described in implementation plans	Begin in Year 1; continuously and regularly after that	●
Implement prescribed pollution prevention/good housekeeping practices	Begin in Year 2	●
Goals related to program evaluation		
Develop measurable performance goals and implementation milestones	Complete shortly after program startup; update regularly after that	●
Estimate level of effort required to meet measurable goals and implementation milestones	Complete shortly after program startup	⦿
Evaluate progress in meeting output-based measurable goals and implementation milestones; adjust program as necessary	End of Year 1 and each year after that	●
Evaluate progress in implementing prescribed pollution prevention/good housekeeping practices	End of Year 1 and each year after that	●
Evaluate effectiveness of program in addressing local water quality concerns and subwatershed restoration goals and objectives (outcome-based goals); adjust program as necessary	End of Year 1 and each year after that	⦿
Key ● = Essential ⦿ = Optional but Recommended		

Communities regulated under Phase II of the NPDES MS4 permit program are required to develop measurable performance goals and implementation milestones that can be used to evaluate their pollution prevention/good housekeeping programs. These communities are provided with a considerable amount of flexibility in developing these goals and milestones, as long as they are defined in a way that can be used to gauge program effectiveness (U.S. EPA, 2000). Communities regulated by the NPDES MS4 permit program can use the information presented in Table 5 as a starting point for developing their own measurable performance goals and implementation milestones, but should adapt or change them to match available resources and address local water quality concerns and local subwatershed restoration goals and objectives.

Step 2: Estimate the Level of Effort Required to Meet Measurable Goals

Once a community has developed its measurable performance goals and implementation milestones, the next step is to estimate the level of effort required to achieve them. This provides a "reality check" on the measurable goals and implementation milestones that were initially developed for the program and allows a community to estimate the staff effort and budget needed to develop and implement a pollution prevention/good housekeeping program.

Basic guidance on scoping the level of effort required to complete the seven-step planning process outlined in this chapter is provided in Table 6. Communities can use this information to estimate the level of effort required to meet their own measurable goals and implementation milestones. If the required level of effort exceeds the amount of available resources (e.g. staff time, staff availability), a community may choose to revise its implementation milestones or may seek to add additional staff or program funding.

Table 6: Scoping the Level of Effort Required to Complete the Planning Process

Step	Staff Hours
Step 1: Identify Existing Municipal Operations	4-8
Step 2: Collect Information About Each Operation	20-40
Step 3: Complete the Municipal Operations Analysis (MOA)	80-120
Step 4: Focus Pollution Prevention/Good Housekeeping Efforts	4-8
Step 5: Investigate Municipal Operations and Select Pollution Prevention/Good Housekeeping Practices[1]	
MO-1: Hotspot Facility Management	120-240
MO-2: Construction Project Management	80-160
MO-3: Street Repair and Maintenance	60-120
MO-4: Street Sweeping	80-200
MO-5: Storm Drain Maintenance	80-200
MO-6: Stormwater Hotline Response	80-160
MO-7: Park and Landscape Maintenance	120-240
MO-8: Residential Stewardship	80-200
MO-9: Stormwater Management Practice Maintenance	120-240
MO-10: Employee Training	80-160
Step 6: Implement Pollution Prevention/Good Housekeeping Practices	Varies[2]
Step 7: Evaluate Progress in Implementation	20-40/evaluation

Notes
1: Additional guidance on scoping the level of effort required to investigate individual municipal operations is contained in the profile sheets presented in Chapter 4.
2: Varies according to the extent and type of improvements required.

Chapter 3: The Municipal Operations Analysis (MOA)

Given limited resources, it is unlikely that even the smallest community, which may be responsible for managing only a single hotspot facility, a few miles of streets and storm drains and a handful of inlets and catch basins, will be immediately able to investigate and improve all of its municipal operations. Therefore, it is important to focus your initial pollution prevention/good housekeeping efforts on the operations that have the greatest influence on water quality in your community. This can be accomplished by completing the Municipal Operations Analysis (MOA).

The MOA is relatively simple "self-assessment" that uses readily available information to help you identify the municipal operations that have the greatest influence on water quality in your community. Ideally, the individual leading the local pollution prevention/good housekeeping effort will complete the assessment. However, the assessment can also be completed by city or town managers, planning or public works directors and staff, and consultants working on behalf of the community. In most cases, completing the MOA will require input from other municipal staff and visits to other municipal offices or publicly owned and/or -operated facilities. The results of the MOA can help focus pollution prevention/good housekeeping efforts on the municipal operations that need the most improvement or that can provide the greatest water quality benefit.

3.1 How to Complete the MOA

Once you have completed step two, collecting basic information about all of the municipal operations conducted within the community, you are ready to complete the MOA. The MOA is divided into 10 sections, with one section devoted to each of the municipal operations:

- Hotspot facility management (MO-1)
- Construction project management (MO-2)
- Street repair and maintenance (MO-3)
- Street sweeping (MO-4)
- Storm drain maintenance (MO-5)
- Stormwater hotline response (MO-6)
- Park and landscape maintenance (MO-7)
- Residential stewardship (MO-8)
- Stormwater management practice maintenance (MO-9)
- Employee training (MO-10)

Each section of the MOA asks questions about the nature, scope and distribution of the municipal operations conducted in your community. A total of 77 questions are provided. Each of the questions is tied to a particular program benchmark or pollution prevention/good

housekeeping practice that can be put in place to improve the way that a municipal operation is conducted.
With the information that you have already collected about the municipal operations conducted in your community in hand, you can complete the MOA by carrying out the following steps:

1. Identify the municipal operations that are currently conducted in your community. You will be completing only those sections of the analysis.

2. Go to each section of the analysis and answer the questions provided. Each of the questions requires a yes or no response or a specific numeric input. If your answers do not agree with the stated program benchmarks and pollution prevention/good housekeeping practices, points are subtracted from the total score. In other cases, the questions can be answered using the basic information that has already been collected about the municipal operations conducted within your community. In most cases, however, answering the questions may require input from other municipal staff or visits to other municipal offices or publicly owned and/or -operated facilities.

3. As you complete each section of the analysis, you are asked to subtotal your score. These subtotals will help you identify the municipal operations that need the most improvement within your community.

4. Calculate your total score. To do this, add the subtotals from each section (you will end up with a negative number) and then add 100, which is the maximum possible score that a community can receive. A community's total score provides a general indication of the level of effort needed to create a pollution prevention/good housekeeping program. As a general rule, if a community's score is under 80, a significant level of effort will typically be needed to develop a program that addresses local water quality issues and subwatershed restoration goals and objectives.

Once you have completed the MOA, go back and review your responses and the subtotals in each section of the analysis. Determine if there are a few specific operations that need significant work or if there are a number of operations that need only minor improvement. This review is important in focusing your pollution prevention/good housekeeping efforts, which is Step 4 in the seven-step process of developing a pollution prevention/good housekeeping program. The outcome of Step 4 is a prioritized list of the municipal operations in the order in which they will be further investigated and improved. This list, known as the prioritized municipal operations list, can be used to guide your current and future pollution prevention/good housekeeping efforts. The operations at the top of the prioritized municipal operations list should be those that you will address first, while those at the bottom should be those that you will address over time.

1. Hotspot Facility Management

Are there any publicly owned or -operated stormwater hotspot facilities located within your community? YES/NO
*If your answer is **YES**, complete the rest of this section*

How many of the following municipal stormwater hotspot facilities are located within your community?

Public Works Yards _____

*If you have **one or more** public works yards, subtract **1** point ⇨* ☐

Vehicle Storage and Maintenance Yards _____
Equipment Storage and Maintenance Yards _____
Materials Storage Yards _____
Wastewater and Water Treatment Facilities _____
Landfills _____
Solid Waste Handling and Transfer Facilities _____
Hazardous Waste Handling and Transfer Facilities _____
Composing Facilities _____
Public Golf Courses _____
Public Swimming Pools _____
Public Buildings _____

In total, how many municipal stormwater hotspot facilities are located within your community? _____

*If you have **10 or more** hotspot facilities, subtract **1** point ⇨* ☐

Has a simple database that contains basic information about all of the municipal stormwater hotspot facilities located within your community been created? YES/NO
*If your answer is **NO**, subtract **1** point ⇨* ☐

Has a map that shows the locations of all municipal hotspot facilities been created? YES/NO
*If your answer is **NO**, subtract **1** point ⇨* ☐

Have on-site investigations been conducted to identify specific pollution-generating activities and pollution source areas at each municipal stormwater hotspot facility? YES/NO
*If your answer is **NO**, subtract **2** points ⇨* ☐

Have pollution prevention plans that identify the pollution prevention/good housekeeping practices (both existing and proposed) used to address specific pollution-generating activities and pollution source areas been created for each municipal hotspot facility? *If your answer is **NO**, subtract **3** points ⇨*	YES/NO ☐
Have pollution prevention/good housekeeping practices been implemented and are they effectively controlling and reducing stormwater pollution at municipal hotspot facilities? *If your answer is **NO**, subtract **2** points ⇨*	YES/NO ☐
Is regular stormwater pollution prevention training and education provided to employees working at each of the municipal hotspot facilities? *If your answer is **NO**, subtract **1** point ⇨*	YES/NO ☐
Subtotal Hotspot Facility Management *(-12 points possible)*	☐

2. Construction Project Management

Does your community fund or otherwise contribute to capital improvement, development or redevelopment projects? *If your answer is **YES**, complete the rest of this section*	YES/NO
How many capital improvement, development and redevelopment does your community fund in an average year? *If you answered **five or more**, subtract **1** point ⇨*	☐
Has your community drafted and adopted a local erosion and sediment control ordinance? *If your answer is **NO**, subtract **2** points ⇨*	YES/NO ☐
Are the 10 critical elements of erosion and sediment control plans, as outlined below, required by the local erosion and sediment control ordinance?	
Minimize clearing	YES/NO
Protect waterways and stabilize drainageways	YES/NO
Phase construction	YES/NO
Rapid soil stabilization	YES/NO
Protect steep slopes	YES/NO
Perimeter controls	YES/NO
Employ advanced settling devices	YES/NO
Certified contractors implement plan	YES/NO
Assess erosion and sediment control practices after storms	YES/NO

*If you answered **NO** to any of the above, subtract **1** point ⇨* ☐

Has your community drafted and adopted a local stormwater management ordinance? YES/NO
*If your answer is **NO**, subtract **2** points ⇨* ☐

Are municipally funded capital improvement, development and redevelopment projects subject to the requirements of the local erosion and sediment control and stormwater management ordinances? YES/NO
*If your answer is **NO**, subtract **2** points ⇨* ☐

Are municipally funded capital improvement, development and redevelopment projects subject to local plan review and site inspection procedures? YES/NO
*If your answer is **NO**, subtract **2** points ⇨* ☐

Are erosion and sediment control and stormwater management (e.g. past performance, certification) considered during the contractor selection process for municipally funded capital improvement, development and redevelopment projects? YES/NO
*If your answer is **NO**, subtract **1** point ⇨* ☐

Are innovative site design and stormwater management practices that conserve natural areas and reduce impervious cover and stormwater runoff volumes required or encouraged on municipally funded capital improvement, development and redevelopment projects? YES/NO
*If your answer is **NO**, subtract **1** point ⇨* ☐

Subtotal Construction Project Management
(-12 points possible) ☐

3. Street Repair and Maintenance

Does your community fund street repair and maintenance projects? YES/NO
*If your answer is **YES**, complete the rest of this section*

What types of street repair and maintenance projects are community-funded?

Paving YES/NO
Resurfacing YES/NO
Pothole Repair YES/NO
Snow Removal YES/NO
Deicing and Anti-Icing Operations (application of sand, salt and other deicing materials) YES/NO
Mowing (within the right-of-way) YES/NO

Herbicide and Pesticide Application (within the right-of-way) YES/NO
Fertilizer Application (within the right-of-way) YES/NO

Are there procedures in place that help prevent paving materials and other potential stormwater pollutants (e.g. salt, pesticides, fertilizers) from entering the municipal storm drain system? YES/NO
*If your answer is **NO**, subtract **3** points* ⇨ ☐

Are paving and resurfacing operations conducted during dry weather? YES/NO
*If your answer is **NO**, subtract **2** points* ⇨ ☐

Are sand, salt and other roadway deicers properly covered and stored to prevent them from being picked up and conveyed into the storm drain system during storm events? YES/NO
*If your answer is **NO**, subtract **2** points* ⇨ ☐

Are there procedures in place to help ensure that herbicides, pesticides and fertilizers are properly used within the right-of-way? YES/NO
*If your answer is **NO**, subtract **2** points* ⇨ ☐

Does your community provide regular stormwater pollution prevention training and education to employees and contractors involved with street repair and maintenance activities? YES/NO
*If your answer is **NO**, subtract **1** point* ⇨ ☐

Subtotal Street Repair and Maintenance ☐
(-10 points possible)

4. Street Sweeping

Does your community have an established street sweeping program? YES/NO
*If your answer is **YES**, complete the rest of this section*
*If your answer is **NO**, subtract **5** points* ⇨ ☐

Estimate the approximate percentage (%) of public streets and roadways that are swept at least once a month: _____

Which of the following pollutants are targeted by your community's street sweeping program?
Sediment YES/NO
Trash and Debris YES/NO
Leaves and Organic Matter YES/NO
Nutrients YES/NO
Other:_____ YES/NO
*If you answered **NO** to all of the above, subtract **2** points* ⇨ ☐

Does your community schedule leaf pickup and subsequent street sweeping in the fall to pick up leaves and other organic matter? YES/NO
*If your answer is **NO**, subtract **2** points* ⇨

Does your community schedule street sweeping in the early spring to pick up sand, salt and other street deicing materials? YES/NO
*If your answer is **NO,** subtract **2** points* ⇨

Does your community use street sweeping equipment (e.g. regenerative-air sweepers, vacuum-assist sweepers) that is capable of picking up a wide range of sediment particles? YES/NO
*If your answer is **NO,** subtract **2** points* ⇨

Does your community provide regular stormwater pollution prevention training and education to employees and contractors involved with street sweeping activities? YES/NO
*If your answer is **NO**, subtract **2** point* ⇨

Subtotal Street Sweeping
(-10 points possible)

5. Storm Drain Maintenance

Are catch basin, inlet, and/or storm drain cleanouts conducted? YES/NO
*If your answer is **YES**, complete the rest of this section*
*If your answer is **NO**, subtract **5** points* ⇨

Estimate the approximate percentage (%) of catch basin, inlet and/or storm drain cleanouts that occur:

In response to complaints and drainage problems
As part of a regularly scheduled cleanout program

*If more cleanouts occur "**in response to complaints and drainage problems"** than **"as part of a regularly scheduled cleanout program"**, subtract **3** points* ⇨

Does your community have a map that shows the locations of all of its catch basins, inlet and storm drains? YES/NO
*If your answer is **NO,** subtract **1** point* ⇨

Does your community have a database or other tracking system in place to track when and where storm drain maintenance occurs? YES/NO
*If your answer is **NO,** subtract **2** points* ⇨

Are procedures for disposing of materials collected during catch basin, inlet and/or storm drain cleanouts in place? YES/NO
*If your answer is **NO,** subtract **1** point* ⇨

Does your community provide regular stormwater pollution prevention training and education to employees and contractors involved with storm drain maintenance activities? YES/NO
*If your answer is **NO,** subtract **1** point* ⇨

Subtotal Storm Drain Maintenance
(-8 points possible)

6. Stormwater Hotline Response

Does your community have a stormwater hotline that residents can use to report spills, leaks, sanitary sewer overflows, illicit discharges and other water quality problems? YES/NO
*If your answer is **YES**, complete the rest of this section*
*If your answer is **NO**, subtract **10** points* ⇨

Does your community have procedures in place for tracking and documenting hotline reports? YES/NO
*If your answer is **NO**, subtract **2** points* ⇨

What types of water quality problems have previously been reported through the local stormwater hotline?

Spills	YES/NO
Illicit Discharges	YES/NO
Combined Sewer Overflows	YES/NO
Sanitary Sewer Overflows	YES/NO
Poor In-Stream Water Quality	YES/NO
Poorly Maintained Construction Sites	YES/NO
Other: _____	YES/NO

Is there a map that shows the locations of previously reported spills, leaks, sanitary sewer overflows, illicit discharges, or other water quality problems? YES/NO
*If your answer is **NO**, subtract **1** point* ⇨

Does your community regularly advertise the phone number, email address and/or website address that it uses as a stormwater hotline? YES/NO
*If your answer is **NO**, subtract **1** point* ⇨

Has your community developed a simple contact database that identifies the local agencies and departments responsible for responding to various YES/NO

hotline reports?
*If your answer is **NO**, subtract **2** points* ⇨ [ ]

Have all of the local agencies and departments responsible for responding to various hotline reports created standard response plans that outline containment and clean up, safety and waste disposal procedures? YES/NO
*If your answer is **NO**, subtract **4** points* ⇨ [ ]

Does your community provide regular stormwater pollution prevention training and education to employees and contractors involved with hotline response activities? YES/NO
*If your answer is **NO**, subtract **1** point* ⇨ [ ]

Subtotal Stormwater Hotline Response
(-10 points possible) [ ]

7. Park and Landscape Maintenance

Are there any publicly owned properties greater than one acre in size located within your community? YES/NO
*If your answer is **YES**, complete the rest of this section*

Approximately how many of the following publicly owned properties greater than one acre in size are located within your community?

Public Parks _____
Public Schools _____
Public Golf Courses _____
Public Buildings (e.g. municipal buildings, police and fire departments) _____
Open Space/Conservation Areas _____

Estimate the approximate percentage (%) of publicly-owned land in your community: _____

*If your answer is ≥ **5%**, subtract **3** points* ⇨ [ ]

Have on-site investigations been conducted on these properties to identify subwatershed restoration opportunities (e.g. pollution prevention, reforestation)? YES/NO
*If your answer is **NO**, subtract **2** points* ⇨ [ ]

Has your community developed an integrated pest management plan that will help ensure that pesticides are used only as a last resort? YES/NO
*If your answer is **NO**, subtract **1** point* ⇨ [ ]

Are there procedures in place to help ensure that herbicides, pesticides and fertilizers are properly used on publicly owned properties? *If your answer is **NO**, subtract **1** point ⇨*	YES/NO
Does your community use native and naturalized landscaping guidance and plant lists when working on publicly owned properties? *If your answer is **NO**, subtract **1** point ⇨*	YES/NO
Are irrigation systems carefully designed to help conserve potable water and provide only the water that plants need to survive? *If your answer is **NO**, subtract **1** point ⇨*	YES/NO
Does your community provide regular stormwater pollution prevention training and education to employees and contractors involved with park and landscape maintenance activities? *If your answer is **NO**, subtract **1** point ⇨*	YES/NO
Subtotal Park and Landscape Maintenance *(-10 points possible)*	

8. Residential Stewardship

Has your community developed any residential stewardship programs to help encourage positive behaviors and discourage negative ones? *If your answer is **YES**, complete the rest of this section* *If your answer is **NO**, subtract **10** points ⇨*	YES/NO
Does your community have an active storm drain stenciling program? *If your answer is **NO**, subtract **1** point ⇨*	YES/NO
Does your community offer curbside pickup of used automotive fluids and other hazardous household wastes? *If your answer is **NO**, subtract **1** point ⇨*	YES/NO
Does your community collect used automotive fluids and other hazardous household wastes at conveniently located collection centers? *If your answer is **NO**, subtract **1** point ⇨*	YES/NO
Does your community offer free soil testing services to residents to help them determine fertilizing and other lawn care needs? *If your answer is **NO**, subtract **1** point ⇨*	YES/NO

Does your community encourage downspout disconnection through the distribution of rain barrels and/or the provision of incentives for simple downspout disconnection, rain barrels or rain gardens? YES/NO
*If your answer is **NO**, subtract **2** points* ⇨ [ ]

Does your community encourage tree planting and watershed forestry through the distribution of trees and/or the provision of incentives (e.g. coupons at local nursery)? YES/NO
*If your answer is **NO**, subtract **1** point* ⇨ [ ]

Does your community regularly advertise its residential stewardship programs? YES/NO
*If your answer is **NO**, subtract **2** points* ⇨ [ ]

Does your community provide regular stormwater pollution prevention training and education to employees and contractors involved with its residential stewardship programs? YES/NO
*If your answer is **NO**, subtract **1** point* ⇨ [ ]

Subtotal Residential Stewardship [ ]
(-10 points possible)

9. Stormwater Management Practice Maintenance

Is your community responsible for the regular upkeep and maintenance of permanent stormwater management practices, including those located on publicly owned lands? YES/NO
*If your answer is **YES**, complete the rest of this section*

Are homeowners associations and/or individual property owners also responsible for the regular upkeep and maintenance of permanent stormwater management practices in your community? YES/NO
*If your answer is **YES**, please answer the following question*

Has your community developed a database or other tracking system that identifies the homeowners associations and/or individual property owners responsible for the regular upkeep and maintenance of permanent stormwater management practices in your community? YES/NO
*If your answer is **NO**, subtract **1** point* ⇨ [ ]

What types of permanent stormwater management practices is your community currently responsible for maintaining?
Detention/Extended Detention Ponds YES/NO
Wet Ponds YES/NO
Stormwater Wetlands YES/NO

Bioretention Areas	YES/NO
Filtration Practices	YES/NO
Infiltration Practices	YES/NO
Swales	YES/NO
Proprietary Devices	YES/NO

Is there a map that shows the locations of all of the permanent stormwater management practices that your community is responsible for maintaining? YES/NO
*If your answer is **NO**, subtract **1** point* ⇨ ____

Has your community established an inspection and maintenance program under which permanent stormwater management practices are periodically inspected and maintained? YES/NO
*If your answer is **NO**, subtract **4** points* ⇨ ____

Does your community have procedures in place for tracking and documenting maintenance activities? YES/NO
*If your answer is **NO**, subtract **1** point* ⇨ ____

Does your community have a dedicated funding source, such as an operating budget or stormwater user fee program, for its stormwater management practice maintenance activities? YES/NO
*If your answer is **NO**, subtract **2** points* ⇨ ____

Does your community provide regular stormwater pollution prevention training and education to employees and contractors involved with stormwater management practice inspection and maintenance activities? YES/NO
*If your answer is **NO**, subtract **1** point* ⇨ ____

Subtotal Stormwater Management Practice Maintenance
(-10 points possible) ____

10. Employee Training

Does your community provide regular stormwater pollution prevention training and education to municipal employees and contractors? YES/NO
*If your answer is **YES**, complete the rest of this section*
*If your answer is **NO**, subtract **10** points* ⇨ ____

Review the work that you have completed so far and record the subtotals for each municipal operation below:

Hotspot Facility Management	
Construction Project Management	
Street Repair and Maintenance	

Street Sweeping	
Storm Drain Maintenance	
Stormwater Hotline Response	
Park and Landscape Maintenance	
Residential Stewardship	
Stormwater Management Practice Maintenance	

Identify the municipal operation that received the lowest score: _____

For the operation that received the lowest score, does your community have a simple contact database that identifies all of the employees and contractors involved with that operation?	YES/NO
*If your answer is **NO**, subtract **2** points ⇨*	
Does your community provide regular stormwater pollution prevention training and education to these employees?	YES/NO
*If your answer is **NO**, subtract **4** points ⇨*	
Based on the results of employee awareness surveys, have the community's existing training and education programs increased employees' overall awareness about the link between municipal operations and stormwater quality?	YES/NO
*If your answer is **NO**, subtract **2** points ⇨*	
Subtotal Employee Training *(-8 points possible)*	

3.2 Scoring the MOA

To determine your total score, simply add the subtotals from each section above (you should end up with a negative number) and add 100, which is the maximum possible score that a community can receive.

Subtotal Hotspot Facility Management (-12 points possible)	
Subtotal Construction Project Management (-12 points possible)	
Subtotal Street Repair Maintenance (-10 points possible)	
Subtotal Street Sweeping (-10 points possible)	
Subtotal Storm Drain Maintenance (-8 points possible)	
Subtotal Stormwater Hotline Response (-10 points possible)	
Subtotal Park and Landscape Maintenance (-10 points possible)	
Subtotal Residential Stewardship (-10 points possible)	
Subtotal Stormwater Management Practice Maintenance (-10 points possible)	

Subtotal Employee Training (-8 points possible)		
Subtotal All Municipal Operations		
Available Points	+	100
Total Score		

The following table will help you estimate the level of effort needed to create an effective pollution prevention/good housekeeping program in your community:

Score	
90 - 100	Congratulations! Your community already has many of the elements of an effective pollution prevention/good housekeeping program in place. Focus on combining these elements and creating a well-organized municipal pollution prevention/good housekeeping program.
80 - 89	Your community has a number of the elements of a pollution prevention/good housekeeping program in place, but could use some tweaking in some areas. Revisit the analysis to determine where these improvements are needed
70 - 79	Significant opportunities exist to improve your community's pollution prevention efforts. Begin by focusing on the municipal operations that need the most improvement in your community.
60 - 69	Current pollution prevention/good housekeeping efforts are inadequate and it is likely that your existing municipal operations are negatively impacting local aquatic resources. A significant effort should be made to improve local pollution prevention/good housekeeping efforts.
Less than 60	Your community's municipal operations are negatively impacting local aquatic resources. A serious effort is needed to improve local pollution prevention/good housekeeping efforts.

Chapter 4: Municipal Operation Profile Sheets

This chapter contains profile sheets describing methods that can be used to investigate and improve each of the 10 major municipal operations. Each profile sheet explains, in clear terms, how the municipal operations influence water quality and outlines the steps that should be completed to identify the pollution-generating activities and pollution source areas associated with each operation. The profile sheets also provide information about the pollution prevention/good housekeeping practices that can be used to improve each of the operations and references and links to useful web resources. The municipal operations profiled in this chapter include:

Profile Sheet **Page**

MO-1 Hotspot Facility Management 37
MO-2 Construction Project Management 51
MO-3 Street Repair and Maintenance 63
MO-4 Street Sweeping 73
MO-5 Storm Drain Maintenance 83
MO-6 Stormwater Hotline Response 93
MO-7 Park and Landscape Maintenance 105
MO-8 Residential Stewardship 115
MO-9 Stormwater Management Practice Maintenance 125
MO-10 Employee Training 135

MO-1	Municipal Operations	
	HOTSPOT FACILITY MANAGEMENT	

Description

Municipal stormwater hotspot facilities are publicly owned or -operated facilities that produce higher levels of stormwater pollutants and/or present a higher potential risk for spills, leaks or illicit discharges. Common municipal hotspot facilities, illustrated in Figure 1 include the many municipal facilities that handle solid waste, wastewater, road and vehicle maintenance, and yard waste, such as:

- Composting Facilities
- Equipment Storage and Maintenance Yards
- Hazardous Waste Disposal Facilities
- Hazardous Waste Handling and Transfer Facilities
- Incinerators
- Landfills
- Materials Storage Yards
- Public Buildings (e.g. Schools, Libraries, Police and Fire Departments)
- Public Golf Courses
- Public Swimming Pools
- Public Works Yards
- Solid Waste Handling and Transfer Facilities
- Vehicle Storage and Maintenance Yards
- Water and Wastewater Treatment Facilities

If not carefully managed, the activities conducted at municipal hotspot facilities can generate a wide variety of stormwater pollutants, including nutrients, hydrocarbons, metals, chlorides, pesticides, bacteria and trash. A summary of the pollution-generating activities typically conducted at municipal stormwater hotspot facilities and the pollutants associated with those activities are presented in Tables 1 and 2 below.

Of the common municipal hotspot facilities listed above, public works yards are often one of the most severe (Figure 1). A number of stormwater pollutants are often stored or handled at these facilities and they should be one of the first hotspot facilities to be investigated during the development of a municipal pollution prevention/good housekeeping program.

Figure 1: Public works yards are typically some of the most severe stormwater hotspot facilities in a community.

Table 1: Pollution Generating Activities Associated with Municipal Hotspot Facilities	
Municipal Hotspot Facility	**Pollution Generating Activities**
Public Works Yards	Vehicle Maintenance and Repair, Vehicle Fueling, Vehicle Washing, Vehicle Storage, Outdoor Loading and Unloading, Outdoor Storage, Dumpster/Waste Management, Building Repair, Building Maintenance, Parking Lot Maintenance, Turf Management, Landscaping
Vehicle Storage and Maintenance Yards	Vehicle Maintenance and Repair, Vehicle Fueling, Vehicle Washing, Vehicle Storage, Outdoor Loading and Unloading, Outdoor Storage, Dumpster/Waste Management, Parking Lot Maintenance
Equipment Storage and Maintenance Yards	
Materials Storage Yards	Outdoor Loading and Unloading, Outdoor Storage, Dumpster/Waste Management, Parking Lot Maintenance
Water and Wastewater Treatment Facilities	Vehicle Storage, Outdoor Loading and Unloading, Outdoor Storage, Dumpster/Waste Management, Building Repair, Building Maintenance, Parking Lot Maintenance, Turf Management, Landscaping
Landfills	Vehicle Fueling, Vehicle Storage, Outdoor Loading and Unloading, Outdoor Storage, Dumpster/Waste Management
Incinerators	
Solid Waste Handling and Transfer Facilities	

Table 1: Pollution Generating Activities Associated with Municipal Hotspot Facilities	
Municipal Hotspot Facility	**Pollution Generating Activities**
Hazardous Waste Handling and Transfer Facilities	Vehicle Fueling, Vehicle Storage, Outdoor Loading and Unloading, Outdoor Storage, Dumpster/Waste Management
Hazardous Waste Disposal Facilities	
Composting Facilities	Vehicle Storage, Outdoor Loading and Unloading, Outdoor Storage, Dumpster/Waste Management
Public Buildings	Outdoor Loading and Unloading, Outdoor Storage, Dumpster/Waste Management, Building Repair, Building Maintenance, Parking Lot Maintenance, Turf Management, Landscaping
Public Golf Courses	Vehicle Maintenance and Repair, Vehicle Fueling, Vehicle Washing, Vehicle Storage, Outdoor Loading and Unloading, Outdoor Storage, Dumpster/Waste Management, Building Repair, Building Maintenance, Parking Lot Maintenance, Turf Management, Landscaping
Public Swimming Pools	Building Repair, Building Maintenance, Parking Lot Maintenance, Swimming Pool Discharges

Table 2: Stormwater Pollutants Associated with Activities Conducted at Stormwater Hotspot Facilities						
Hotspot Operation or Activity	**Sediment**	**Nutrients**	**Metals**	**Hydro-carbons**	**Toxins**	**Others**
Vehicle Repair	○	○	●	●	●	
Vehicle Fueling	×	○	●	●	●	
Vehicle Washing	●	●	◉	◉	●	
Vehicle Storage	○	×	◉	●	○	Trash
Outdoor Loading	●	◉	◉	○	○	Organic Matter
Outdoor Storage	●	◉	◉	◉	◉	
Waste Management	○	◉	◉	◉	●	Trash
Building Repair	●	○	◉	◉	◉	
Building Maintenance	●	×	●	○	◉	
Parking Lot Maintenance	●	○	◉	●	◉	
Turf Management	◉	●	×	×	●	Pesticides
Landscaping	○	●	×	×	●	Pesticides
Swimming Pool Discharges	×	×	×	×	×	Chlorine

Key
× = not a pollutant source
○ = minor pollutant contribution
◉ = moderate pollutant contribution
● = major pollutant contribution

Investigating and Improving the Operation

Improving the way that municipal stormwater hotspot facilities are managed in your community can reduce the amount of stormwater pollution that is conveyed into local aquatic resources. It requires you to examine your existing facilities and identify the pollution prevention/good housekeeping practices that can be used to reduce the amount of stormwater pollution that they

create. This can be accomplished within the context of the seven-step program planning and development process, as described below.

Step 1: Identify Existing Municipal Operations

Recall that the first step in the process is to identify the municipal operations that are conducted within your community. In terms of hotspot facility management, this means determining whether or not your community manages any publicly owned or -operated stormwater hotspot facilities. If it does, the next step in the process is to collect some basic information about each of those facilities. If not, you should begin investigating the other municipal operations that are conducted within your community

Step 2: Collect Information About Each Operation

Once you have determined that your community is responsible for managing one or more publicly owned or -operated stormwater hotspot facilities, the next step in the process is to collect some basic information about each of those facilities. Basic information to collect about each municipal stormwater hotspot facility includes:

- Facility name
- Street address
- Watershed and subwatershed address
- Geospatial coordinates (e.g. latitude, longitude)
- Facility type
- Facility manager name
- Facility manager contact information
- Site plans, if available
- Aerial photography, if available

All of this information should be compiled and added to the simple database or binder that contains the information about all of the municipal operations conducted in your community. Summary sheets for each of the facilities can be created and added to the database or binder. Although not necessary, it is also helpful to create a map showing the location of each municipal hotspot facility.

As you identify the municipal hotspot facilities that are located within your community and collect some basic information about them, you should also be communicating with the individuals who manage or oversee each of facilities. This is an ideal time to inform these individuals about the community's pollution prevention/good housekeeping efforts and the purpose of the community's municipal pollution prevention/good housekeeping program. It is also a good time to collect additional information about the activities that are conducted at each hotspot facility and the pollution prevention/good housekeeping practices that may already be in place at each facility. Table 3 provides a list of example questions that can be used to collect additional information from individual hotspot facility managers.

Table 3: Sample Discussion Questions
• Are you familiar with our pollution prevention/good housekeeping efforts and the purpose of our municipal pollution prevention/good housekeeping program? • What pollution-generating activities are conducted at your facility? • What pollution source areas can be found at your facility? • What stormwater pollutants are associated with the activities conducted at your facility? • Do you understand how the activities conducted at your facility can impact stormwater quality? • Have you implemented any pollution prevention/good housekeeping practices to prevent or mitigate these impacts? • Has a stormwater pollution prevention plan or spill response plan been developed for your facility? • Do you provide regular stormwater pollution prevention training to employees who work at your facility?

Step 3: Complete the Municipal Operations Analysis (MOA)

The next step in the process is to use the basic information that you have collected about each municipal hotspot facility to complete Section 1 of the MOA. This section of the MOA asks a series of questions about the nature, scope and distribution of the municipal stormwater hotspot facilities found within your community. In some cases, you will be able to answer all of the questions using only the information that you have already collected about each of the hotspot facilities. In most cases, however, answering the questions will require additional input from the individuals who manage or oversee each of the facilities as well as site visits to the hotspot facilities themselves.

Once you have answered all of the questions presented within Section 1 of the MOA, you should calculate your score to determine how well your community is currently managing its stormwater hotspot facilities. When you have completed the entire MOA, you should also compare the score that you received in Section 1 with the scores you received in each of the other sections of the analysis. This will help you focus your pollution prevention/good housekeeping efforts on the municipal operations that have the greatest influence on water quality in your community.

Step 4: Focus Pollution Prevention/Good Housekeeping Efforts

The next step in the process is to use the results of the MOA, as well as information about local subwatershed restoration goals and objectives, to develop a list of the municipal operations in the order in which they will be further investigated and improved. This list, known as the prioritized municipal operations list, can be used to guide your local pollution prevention/good housekeeping efforts and ensure that you are using your resources on improving the operations that have the greatest influence on water quality in your community. The operations at the top of the prioritized municipal operations list should be those that you will address first, while those at the bottom should be those that you will address over time.

If hotspot facility management comes out on top of your prioritized municipal operations list, the next step in the process is to further investigate each publicly-owned or -operated stormwater hotspot facility and determine the pollution prevention/good housekeeping practices that can be

used to reduce the amount of stormwater pollution that they create. If it does not, you should begin investigating the operation that is located at the top of your list. The other profile sheets presented in this chapter provide additional information about investigating each of the other municipal operations.

Step 5: Investigate Municipal Operations and Select Pollution Prevention/Good Housekeeping Efforts

Step 5.1: Conduct Field Investigations

Once hotspot facility management becomes the focus of your pollution prevention/good housekeeping efforts, the next step is to investigate each hotspot facility to identify the pollution-generating activities at it. This investigation, known as the Hotspot Site Investigation (HSI), can be used to systematically evaluate the six categories of pollution-generating activities illustrated in Figure 2 that commonly contribute to stormwater quality problems:

- Outdoor Materials Handling
- Physical Plant Maintenance
- Stormwater Infrastructure
- Turf/Landscape Management
- Vehicle Operations
- Waste Management

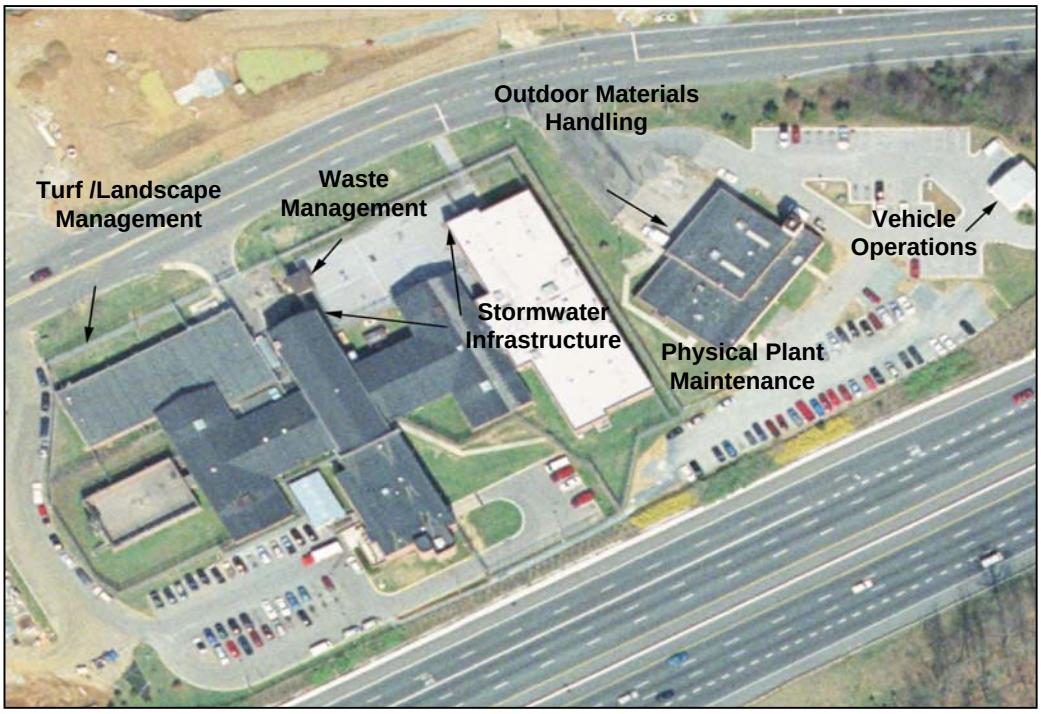

Figure 2: Six categories of pollution-generating activities should be assessed at stormwater hotspot facilities

While conducting the HSI, you should focus your attention on these six categories of pollution-generating activities. Doing so will help you quickly identify the pollution sources associated with each facility. Manual 11 contains additional information about conducting the HSI.

Ideally, the individuals who manage or oversee each of facilities will be present during the HSI. They will be able to answer questions about the activities that are conducted at their facility and will be able to explain any pollution prevention/good housekeeping practices that may already be in place. It is also a great opportunity for them to learn more about the community's pollution prevention/good housekeeping efforts and how the activities conducted at their facility can influence stormwater quality.

During the HSI, it is helpful to have an aerial photograph or site plan on which the locations of proposed pollution prevention/good housekeeping practices or stormwater retrofits can be marked.

Be sure to bring a camera when conducting the HSI. Pictures are a great way to document areas that need improvement and good examples of stormwater management and pollution prevention/good housekeeping practices. The pictures can also be used to educate the facility manager and other municipal staff during employee training sessions.

Step 5.2: Rank Hotspots According to Severity

At the completion of each HSI, each publicly-owned or -operated facility is assigned a hotspot designation: severe hotspot, confirmed hotspot, potential hotspot or not a hotspot. Once you have completed your field investigations, you should use these designations to rank your municipal hotspot facilities in order from most severe to least severe. The outcome of this step is a list of the municipal hotspot facilities in the order in which they will be improved. The facilities at the top of the list, which are those rated severe, should be those that you will improve first, while those at the bottom, which are those rated not a hotspot, should be those that you will improve over time.

Step 5.3: Prescribe Pollution Prevention/Good Housekeeping Practices

Once you have completed your field investigations, the next step in the process is to identify some pollution prevention/good housekeeping practices that can be used to address the pollution-generating activities associated with each hotspot facility. In many cases, pollution prevention/good housekeeping practices can be prescribed using the information that was gathered during the initial field investigation. In other cases, however, additional site visits may be required.

A wide range of pollution prevention/good housekeeping practices can be used to address the pollution-generating activities conducted at municipal hotspot facilities. Some of the most commonly used practices are listed in Table 4.

Table 4: Pollution Prevention/Good Housekeeping Practices Commonly Used to Control Stormwater Pollution at Municipal Hotspot Facilities	
Hotspot Activity	**Pollution Prevention/Good Housekeeping Practices**
Vehicle Maintenance and Repair	Drip pans, tarps, covered outdoor storage areas, secondary containment, discharge of washwater to sanitary sewer system, proper disposal of used fluids, disconnected storm drains, automatic shutoff nozzles, signs, spill response plans, spill clean up materials, dry clean up methods, employee training, stormwater retrofits
Vehicle Fueling	
Vehicle Washing	
Vehicle Storage	
Outdoor Loading and Unloading	Covered loading and unloading areas, secondary containment, storm drain disconnection or treatment, inventory control, spill response plans, spill clean up materials, dry clean up methods, employee training, stormwater retrofits
Outdoor Storage	
Dumpster/Waste Management	Dumpster/waste management, secondary containment, storm drain disconnection or treatment, liquid separation/containment, employee training
Building Repair	Temporary covers/tarps, employee training, contractor training, proper cleanup and disposal procedures, disconnected storm drains, dry cleaning methods, stormwater retrofits
Building Maintenance	
Parking Lot Maintenance	
Turf Management	Integrated pest management, reduced non-target irrigation, careful applications, proper disposal of landscaping waste, avoid blowing and hosing to storm drain, employee training, stormwater retrofits
Landscaping	
Swimming Pool Discharges	Discharge to sanitary sewer system, discharge to pervious areas, employee training

In many cases, the pollution prevention/good housekeeping practices that can be used to address the pollution-generating activities associated with a municipal hotspot facility save time and money, reduce liability and do not greatly interfere with normal operations. For example, the pollution prevention/good housekeeping practices applied at a vehicle storage and maintenance yard might include the use of drip pans under vehicles, tarps for covering disabled vehicles, dry clean-up methods for spills, proper disposal of used fluids and covering and providing secondary containment for any outdoor storage area (Figure 3). In some cases, however, more costly on-site stormwater retrofit practices may be needed to control and treat stormwater runoff, especially when the facility is rated as a severe hotspot. For additional information on stormwater retrofits and pollution prevention practices see Manuals 3 and 8, respectively.

Step 5.4: Develop Implementation Plans

The next step in the process is to develop a brief implementation plan for each municipal hotspot facility. Each implementation plan should summarize the results of the HSI, the specific pollution-generating activities associated with each facility, and the pollution prevention/good housekeeping practices that will be used to address each of these activities. Implementation plans should also include a schedule that describes some implementation milestones for the prescribed pollution prevention/good housekeeping practices. The contents of each implementation plan should be developed in cooperation with the individuals responsible for managing or overseeing each of the hotspot facilities.

Figure 3: Pollution prevention/good housekeeping practices commonly used at municipal hotspot facilities include (from top left) secondary containment, wash water containment and covered loading/unloading areas.

A key element of each implementation plan is an estimate of the budget required to implement the recommended pollution prevention/good housekeeping practices. Although providing detailed cost information about all of the pollution prevention/good housekeeping practices that can be used to address the specific pollution-generating activities associated with municipal stormwater hotspot facilities is beyond the scope of this manual, there are some useful resources that can be used to gather this information, including Manual 8 and U.S. EPA's *National Menu of Stormwater Management Best Management Practices,* which is available online at: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm.

The implementation plans can be used to guide the implementation of the prescribed pollution prevention/good housekeeping practices and, if necessary or desired, create a stormwater pollution prevention plans (SWPPPs) for each facility. A SWPPP is a written plan that summarizes existing operations and pollution-generating activities and identifies the pollution prevention/good housekeeping practices, both existing and future, that will be used prevent or reduce stormwater pollution at a stormwater hotspot facility. Each SWPPP should include the following elements:

- A description of the facility (e.g. facility name, street address, facility type)

- Facility manager name and contact information
- Site plans and aerial photographs of the facility
- A summary of the pollution-generating activities conducted at the facility
- A description of the pollution prevention/good housekeeping practices, both existing and future, needed to prevent or reduce stormwater pollution at the facility, including a schedule for implementation
- An outline of the routine and annual inspection procedures used to evaluate the effectiveness of the pollution prevention/good housekeeping practices

Links to several example SWPPPs are provided at the end of this profile sheet.

Step 6: Implement Pollution Prevention/Good Housekeeping Practices

Once your municipal stormwater hotspot facilities have been investigated and assessed, the next step in the process is implementing the prescribed pollution prevention/good housekeeping practices. Although it may be tempting to hand the responsibility for implementation over to the individuals who manage or oversee each of the hotspot facilities, it is important to work with these individuals during the implementation phase to get the recommended improvements "in the ground." Simple techniques that can be used to do this include providing additional education and information about the prescribed pollution prevention/good housekeeping practices and providing assistance in securing funding for the recommended improvements.

Step 7: Evaluate Progress in Implementation

The last step in the process involves evaluating the progress made in implementing the prescribed pollution prevention/good housekeeping practices. Measurable performance goals and implementation milestones will be needed to evaluate progress in implementation and track success in addressing local water quality issues and subwatershed restoration goals and objectives. Some example measurable goals and implementation milestones are presented in Table 5. These *output-based* measurable goals can be thought of as activities that need to be completed in order to improve the way that municipal stormwater hotspot facilities are managed in your community.

The methods used to evaluate success in meeting these measurable performance goals and implementation milestones can be as simple as a semi-annual or annual inspections used to identify the pollution prevention/good housekeeping practices that have been put in place and the improvements that still need to be made.

Scoping the Required Level of Effort

The level of effort required to improve the way that municipal stormwater hotspot facilities are managed varies greatly from one community to the next. It depends on the number of hotspot facilities found within the community and on the number and type of pollution prevention/good housekeeping practices that are needed to improve the way those facilities are managed. Basic guidance that communities can use to scope the level of effort required to improve the way that municipal stormwater hotspot facilities are managed is provided in Table 6.

It is important to note that the assessment of existing operations, particularly the field investigation, usually consumes the most staff time. Be sure to budget enough time for this step. It may also take some effort to coordinate with the various hotspot facility managers and some time to process the information collected from them. Be sure to budget at least a week of staff time to process and interpret the field investigation data (e.g. field sheet completion, data entry, quality control, data evaluation).

Table 5: Measurable Goals and Implementation Milestones for Improving Municipal Hotspot Facility Management[1]

Example Measurable Goals	Timeframe	Priority
Goals related to program startup		
Identify and collect basic information about all municipal stormwater hotspot facilities	Complete shortly after program startup; update regularly after that	●
Compile a simple database or binder that contains basic information about each municipal hotspot facility		●
Develop a digital (e.g. GIS) or hard copy map showing the location of all municipal hotspot facilities		⦿
Complete Section 1 of the Municipal Operations Analysis (MOA)	Year 1; repeat every 5 years	●
Prioritize local pollution prevention/good housekeeping efforts based on the results of the MOA and other factors, such as local pollutants of concern		●
Goals related to preventing or reducing stormwater pollution		
Conduct follow-up investigations on all municipal stormwater hotspot facilities (assuming that hotspot facility management is on top of the prioritized municipal operations list)	Year 1	●
Identify the pollution-generating activities associated with each municipal hotspot facility		●
Prescribe pollution prevention/good housekeeping practices to address specific pollution-generating activities		●
Develop implementation plans for each municipal stormwater hotspot facility		●
Secure funding and resources to implement prescribed pollution prevention/good housekeeping practices	Begin in Year 1	●
Implement prescribed pollution prevention/good housekeeping practices	Begin in Year 2	●
Goals related to program evaluation		
Develop measurable performance goals and implementation milestones	Complete shortly after program startup; update regularly after that	●
Evaluate progress in meeting measurable goals and implementation milestones		●
Evaluate progress in implementing prescribed pollution prevention/good housekeeping practices	End of Year 1 and each year after that	●

Notes
1: Assumes that hotspot facility management is as the top of your prioritized municipal operations list.
Key
● = Essential
⦿ = Optional but Recommended

Table 6: Scoping the Level of Effort Required to Improve Municipal Hotspot Facility Management	
Step	**Staff Hours**
Step 1: Identify Existing Municipal Operations	4-8[1]
Step 2: Collect Information About Each Hotspot Facility	4-8
Step 3: Complete Section 1 of the Municipal Operations Analysis (MOA)	10-20
Step 4: Focus Pollution Prevention/Good Housekeeping Efforts	4-8[1]
Step 5: Investigate Municipal Operations and Select Pollution Prevention/Good Housekeeping Practices	120-240
Step 5.1: Conduct Field Investigations	
HSI	2/hotspot
Post-Processing	40-60
Step 5.2: Rank Hotspots According to Severity	4-8
Step 5.3: Prescribe Pollution Prevention/Good Housekeeping Practices	20-40
Step 5.4: Develop Implementation Plans	40-80
Step 6: Implement Pollution Prevention/Good Housekeeping Practices	Varies[2]
Step 7: Evaluate Progress in Implementation	20-40/evaluation[1]
Notes 1: Represents total level of effort required to complete step for all municipal operations. 2: Varies according to the extent and type of improvements required.	

Resources

Urban Subwatershed Restoration Manual 11: Unified Subwatershed and Site Reconnaissance: A User's Manual. http://www.cwp.org/PublicationStore/USRM.htm

Urban Subwatershed Restoration Manual 8: Pollution Source Control Practices. http://www.cwp.org/PublicationStore/USRM.htm

Urban Subwatershed Restoration Manual 3: Urban Stormwater Retrofit Practices. http://www.cwp.org/PublicationStore/USRM.htm

The Smart Watershed Benchmarking Tool
http://cwp.org.master.com/texis/master/search/+/form/Smart_Watershed.html

North Carolina Cooperative Extension Service. How to Do Phase II: Guidance for Local Governments. Inspection and Evaluation of Facilities and Operations
http://www.bae.ncsu.edu/topic/phase2/measure6b.htm

California Stormwater Best Management Practice Handbook: Municipal.
http://www.cabmphandbooks.com/

Stormwater Management Manual for Western Washington: Volume IV – Source Control BMPs.
http://www.ecy.wa.gov/biblio/0510032.html

Land of Sky Regional Council. Stormwater Fact Sheet No. 5: Municipal Pollution Prevention Planning. http://h2o.enr.state.nc.us/su/PDF_Files/Land_of_Sky_factsheets/FactSheet_5.pdf

Riverside County, CA Flood Control Water Conservation District. Template Pollution Prevention Plan for Municipal Facilities. http://www.floodcontrol.co.riverside.ca.us/downloads/NPDES/App%20J%20Template%20Pollution%20Prevention%20Plan%20for%20Municipal%20Facilities.pdf

Edina, MN. Stormwater Pollution Prevention Plan: Public Works Facilities. http://209.85.215.104/search?q=cache:t7rcLiGJHMAJ:www.ci.edina.mn.us/PDFs/Swppp.pdf+public+works+facility+stormwater+pollution+prevention+plan&hl=en&ct=clnk&cd=1&gl=us

MO-2	Municipal Operations CONSTRUCTION PROJECT MANAGEMENT	

Description

A community may engage in any number of capital improvement, development and redevelopment projects, which can generate a wide range of stormwater pollutants, including sediment, nutrients, hydrocarbons, pesticides, trash and construction debris. Common municipal construction projects include:

- Public buildings (e.g. schools, libraries, police and fire departments)
- Public golf courses
- Public works facilities
- Road construction and widening
- Utility construction and repair
- Water and wastewater treatment facilities

These municipally funded construction projects can have a number of negative impacts on water quality both during and after construction.

From a water quality standpoint, the construction phase is often considered the most damaging phase of the land development cycle. Active construction sites can generate a variety of stormwater pollutants, including sediment, nutrients, hydrocarbons, toxics, pesticides and construction debris (Figure 1). Of these, sediment is the most significant. During a short period of time, active construction sites can contribute more sediment to streams than is contributed naturally to those same streams over several decades (U.S. EPA, 2000).

Even after construction is complete, development sites can continue to contribute stormwater pollution to receiving waters. The pollutants contained within post-construction stormwater runoff vary according to land use, but typically include sediment, nutrients, metals, hydrocarbons and trash. If not carefully planned and managed, municipally funded construction projects can have significant negative impacts on receiving waters.

Investigating and Improving the Operation

Improving the way that municipal construction projects are managed in your community can reduce the amount of stormwater pollution that is conveyed into local aquatic resources. It requires you to examine your existing practices and programs and identify the pollution prevention/good housekeeping practices that can be used to reduce the amount of stormwater pollution that municipal construction projects create. This can be accomplished within the context of the seven-step program planning and development process (Chapter 2), as described below.

Figure 1. Active construction sites can generate a variety of stormwater pollutants, the most notable of which is sediment.

Step 1: Identify Existing Municipal Operations

Recall that the first step in the process is to identify the municipal operations that are conducted within your community. In terms of construction project management, this means determining whether or not your community funds or otherwise contributes to capital improvement, development or redevelopment projects. If it does, the next step in the process is to collect some basic information about how those projects are managed. If not, you should begin investigating the other municipal operations that are conducted within your community.

Step 2: Collect Information About Each Operation

Once you have determined that your community does fund or otherwise contribute to capital improvement, development or redevelopment projects, the next step in the process is to collect some basic information about how those projects are managed. Basic information to collect about municipal construction projects includes:

- Narrative description of active and planned municipal construction projects
- Locations of active and planned municipal construction projects

    - Street address
    - Watershed and subwatershed address
    - Geospatial coordinates (e.g. latitude, longitude)
- Map showing locations of active and planned municipal construction projects
- Operation manager name
- Operation manager contact information
- Site plans for active and planned municipal construction projects, if available

This information should be added to the simple database or binder that contains the information about all of the municipal operations conducted in your community.

As you identify the municipal construction projects that are occurring or are planned in your community and collect some basic information about them, you should begin communicating with the individuals who oversee or manage these projects. This is an ideal time to inform these individuals about the community's pollution prevention/good housekeeping efforts and the purpose of the community's municipal pollution prevention/good housekeeping program. It is also a good time to educate them about the influence that municipal construction projects can have on water quality and how pollution prevention/good housekeeping practices can be used to reduce the amount of stormwater pollution that these projects create.

Step 3: Complete the Municipal Operations Analysis (MOA)

The next step in the process is to use the basic information that you have collected about the way that municipal construction projects are managed in your community to complete Section 2 of the MOA. This section of the MOA asks a series of questions about the nature, scope and distribution of the municipal construction projects conducted within your community. In some cases, you will be able to answer all of the questions using only the information that you have already collected about each of the active or planned projects. In most cases, however, answering the questions will require additional input from the individuals who manage or oversee each of the projects as well as discussions with other local agencies and departments.

Once you have answered all of the questions presented within Section 2 of the MOA, you should calculate your score to determine how well your community is currently managing its capital improvement, development and redevelopment. When you have completed the entire MOA, you should also compare the score that you received in Section 2 with the scores you received in each of the other sections of the analysis. This will help you focus your pollution prevention/good housekeeping efforts on the municipal operations that have the greatest influence on water quality in your community.

Step 4: Focus Pollution Prevention/Good Housekeeping Efforts

The next step in the process is to use the results of the MOA, as well as information about local subwatershed restoration goals and objectives, to develop a list of the municipal operations in the order in which they will be further investigated and improved. This list, known as the prioritized municipal operations list, can be used to guide your local pollution prevention/good housekeeping efforts and ensure that you are using your resources on improving the operations

that have the greatest influence on water quality in your community. The operations at the top of the prioritized municipal operations list should be those that you will address first, while those at the bottom should be those that you will address over time.

If construction project management comes out on top of your prioritized municipal operations list, the next step in the process is to further investigate the way that municipal construction projects are managed in your community and determine the pollution prevention/good housekeeping practices that can be used to reduce the amount of stormwater pollution they create. If it does not, you should begin investigating the operation that is located at the top of your list. The other profile sheets presented in this chapter provide additional information about investigating each of the other municipal operations.

Step 5: Investigate Municipal Operations and Select Pollution Prevention/Good Housekeeping Practices

Step 5.1: Identify Erosion and Sediment Control and Stormwater Management Regulations that Apply to Municipal Construction Projects

Once you have determined that construction project management will be the focus of your pollution prevention/good housekeeping efforts, the next step in the process is to identify the erosion and sediment control and stormwater management regulations that currently apply to the municipal construction projects carried out in your community. In many cases, these requirements will be contained within local erosion and sediment control and stormwater management ordinances, as many communities have developed these ordinances to comply with the requirements of the NPDES stormwater program. The program requires communities and, in particular, smaller communities regulated under Phase II of the program, to develop erosion and sediment control and stormwater management programs that:

- Are supported by an ordinance or other regulatory mechanism that requires the implementation of erosion and sediment controls and permanent stormwater management practices on regulated development sites
- Include plan review and site inspection procedures to ensure that proposed development projects meet the requirements of the local erosion and sediment control and stormwater management ordinances

These requirements are intended to promote local regulation of development activities to reduce the amount of stormwater pollution that they create. If your community has already developed its own erosion and sediment control and stormwater management regulations, you should check to make sure that municipal construction projects are subject to these requirements. Consult the ordinances or check with local development review staff to determine how local erosion and sediment control and stormwater management regulations apply to municipal construction projects.

Like pollution prevention/good housekeeping programs, construction and post-construction runoff control are requirements of the NPDES stormwater programs. Often, municipal programs developed to address any one of the minimum control measures can be used to address one or more of the others. In this case, construction and post-construction runoff control program can be used to help a community improve its pollution prevention/good housekeeping program.

Step 5.2: Review Procedures Used During the Contractor Selection Process

The next step in the process is to review the contractor selection process that your community uses for municipal construction projects. The purpose of this review is to determine if erosion and sediment control and stormwater management are considered during the process. By retaining design consultants and contractors that are experienced and/or certified with erosion and sediment control and stormwater management practices, a community can reduce the amount of stormwater pollution that is generated by municipally-funded capital improvement, development and redevelopment projects.

Communicating and coordinating with the municipal staff responsible for procurement and/or contract administration is the best way to determine how design consultants and contractors are currently selected to work on municipal construction projects. Table 1 provides a list of example questions that can be used to collect information from procurement and/or contract administration staff.

Table 1: Example Discussion Questions

- Are you familiar with our pollution prevention/good housekeeping efforts and the purpose of our municipal pollution prevention/good housekeeping program?
- Are erosion and sediment control and stormwater management credentials and/or certification considered during the contractor selection process for municipally funded construction projects?
- Does the contractor selection process simply consider the lowest bid?
- Do you keep a list of design engineers and contractors who have performed poorly on past projects?
- Does the list consider performance on erosion and sediment control and stormwater management?
- Are erosion and sediment control and stormwater management discussed with the references provided by contractors and design consultants?
- Are there incentives and penalties for erosion and sediment control and stormwater management built into the standard contract language?
- Do contracts include provisions, such as contingencies, that allow contractors to recover the full cost of maintaining erosion and sediment control practices?

Step 5.3: Review Local Erosion and Sediment Control Regulations and Guidance Documents

The step in the process is to review the local erosion and sediment control regulations to determine the specific requirements that must be met at municipal construction sites. To best protect water quality, the local erosion and sediment control regulations should include the 10 critical elements of erosion and sediment control plans, as illustrated in Figure 2. You should

determine if these 10 elements are a requirement of the local erosion and sediment control ordinance and if they are typically used on municipal construction projects. If the ordinance doesn't require these 10 elements, you should encourage their use on municipal construction projects and consider revising or amending the local erosion and sediment control ordinance. Additional information about the 10 critical elements of an effective erosion and sediment control plan is presented in Brown and Caraco (2000).

Step 5.4: Review Local Stormwater Management Regulations and Guidance Documents

The next step in the process is to review the local stormwater management regulations to identify the stormwater management practices that can be used to manage post-construction stormwater runoff on development and redevelopment sites. You should also determine which of these practices are typically used at municipal development and redevelopment sites. In order for municipal development projects to serve as examples to the regulated community, they should demonstrate innovative stormwater management practices, such as rain gardens, cisterns and green roofs (Table 2). Technical guidance on the use of these innovative practices is provided in a number of existing stormwater guidance manuals, links to which are provided in the additional resources section at the end of this profile sheet.

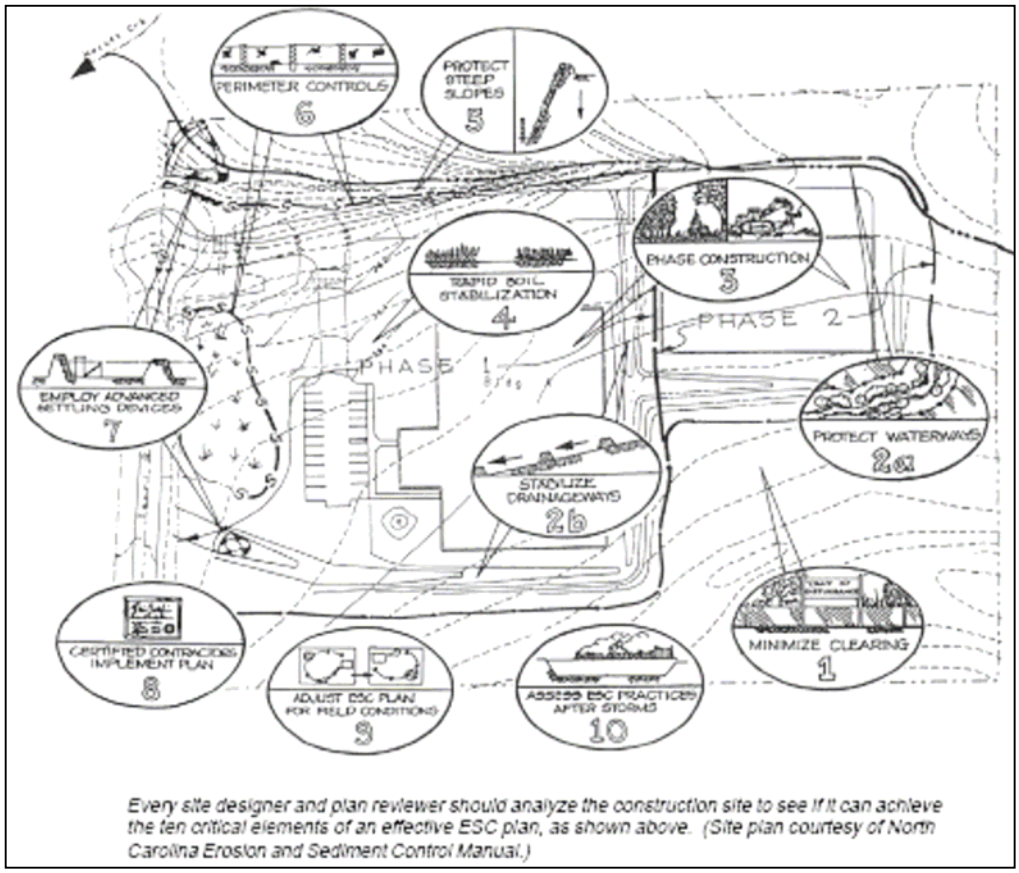

Figure 2. The 10 critical elements of an effective erosion and sediment control plan

Table 2: Innovative Stormwater Management Practices	
• Soil Amendments • Downspout Disconnection • Impervious Cover Disconnection • Rainwater Harvesting • Rain Gardens • Bioretention Areas • Dry Wells	• French Drains • Green Rooftops • Porous Pavement • Stormwater Planters • Vegetated Filter Strips • Vegetated Channels

Chicago, Illinois is an example of a community that has used publicly funded development projects to demonstrate innovative stormwater management practices. Because it believes so strongly in the benefits of green rooftops, the City recently adopted a policy that encourages and, in some cases, requires the use of green rooftops on publicly funded development projects. As a result of the initiative, the City has installed green rooftops on a number of its own buildings, and as of October 2006, there were more than 250 green rooftops that were under design and/or construction in the City of Chicago (Chicago, 2007).

Step 5.5: Prescribe Pollution Prevention/Good Housekeeping Practices

Once you have assessed how municipal construction projects are currently managed within your community, the next step is to identify some pollution prevention/good housekeeping practices that can be used to reduce the stormwater pollution generated by them. Depending on the results of your assessment and the information you've collected, a wide range of practices can be used. Some of the practices most commonly used to improve the way that municipal construction projects are managed are listed in Table 3.

Table 3: Pollution Prevention/Good Housekeeping Practices Commonly Used to Improve Municipal Construction Project Management	
Existing Condition	**Recommended Improvements**
• No local erosion and sediment control and/or stormwater ordinance in place	• Develop a local erosion and sediment control and/or stormwater management ordinance • Ensure that municipal construction sites are required to meet the provisions of each ordinance
• Municipal construction projects are not subject to the requirements of the local erosion and sediment control and/or stormwater management ordinance	• Revise the local erosion and sediment control and/or stormwater management ordinance to ensure that municipal construction sites are required to meet the provisions of each ordinance • To set a better example for the regulated community, consider regulating municipal construction sites that are smaller than the one acre threshold, such as those that disturb more than 5,000 square feet
• Municipal construction projects are	• Revise the local development review process to

Table 3: Pollution Prevention/Good Housekeeping Practices Commonly Used to Improve Municipal Construction Project Management	
Existing Condition	**Recommended Improvements**
not subject to local plan review and site inspection procedures	ensure that municipal construction sites are subject to local plan review and site inspection procedures
• Existing contractor selection and procurement procedures do not consider erosion and sediment control and/or stormwater management	• Revise the selection and procurement procedures to ensure that erosion and sediment control and stormwater management are considered during the selection process
• Erosion and sediment control ordinance does not require use of the 10 critical elements	• Encourage the use of the 10 critical erosion and sediment control plan elements on all municipal construction projects • Revise the local erosion and sediment control ordinance to ensure that it includes the 10 critical elements • Provide training to design engineers and contractors on the 10 critical erosion and sediment control plan elements
• Innovative stormwater management practices are not used on municipal development projects	• Revise the local stormwater management ordinance to ensure these practices are allowed • Promote the use of innovative stormwater management practices on all municipal construction projects • Provide training to design engineers and contractors on the design and installation of innovative stormwater management practices

Step 5.5: Develop Implementation Plan

The next step in the process is to develop a brief implementation plan for your recommended improvements. The implementation plan should summarize the results of your assessment and the pollution prevention/good housekeeping practices that will be used to improve the way that municipal construction projects are managed in your community. The plan should also include a schedule that describes some implementation milestones for the prescribed pollution prevention/good housekeeping practices. The contents of the implementation plan should be developed in cooperation with the individuals who oversee or manage the municipally funded construction projects conducted in your community.

Step 6: Implement Pollution Prevention/Good Housekeeping Practices

Once you have investigated and assessed the way that municipal construction projects are currently managed within your community, the next step in the process is implementing the prescribed pollution prevention/good housekeeping practices. Because this typically involves revisions to local ordinances, technical guidance documents, and local plan review and site

inspection procedures, implementation often requires a coordinated effort among multiple local agencies and departments and elected officials. It is important to work with these individuals during the implementation phase and to work closely with them to get the recommended improvements "in the ground." Simple techniques that can be used to do this include providing additional education and information about the prescribed pollution prevention/good housekeeping practices and providing assistance in securing funding for the recommended improvements.

Step 7: Evaluate Progress in Implementation

The last step in the process involves evaluating the progress made in implementing the prescribed pollution prevention/good housekeeping practices. Measurable performance goals and implementation milestones will be needed to evaluate progress in implementation and track success in addressing local water quality issues and subwatershed restoration goals and objectives. Some example measurable goals and implementation milestones are presented in Table 4. These *output-based* measurable goals can be thought of as activities that need to be completed in order to improve the way that municipal construction projects are managed in your community.

Table 4: Measurable Goals and Implementation Milestones for Improving Municipal Construction Project Management[1]

Example Measurable Goals	Timeframe	Priority
Goals related to program startup		
Identify and collect basic information about active and planned municipal construction projects	Complete shortly after program startup; update regularly after that	●
Add the information about active and planned municipal construction projects to the simple database or binder that contains basic information about each municipal operation		●
Develop a digital (e.g. GIS) or hard copy map showing the location of all active and planned municipal construction projects		◉
Complete Section 2 of the Municipal Operations Analysis (MOA)	Year 1; repeat every 5 years	●
Prioritize local pollution prevention/good housekeeping efforts based on the results of the MOA and other factors, such as local pollutants of concern		●
Goals related to preventing or reducing stormwater pollution		
Conduct follow-up investigations on the way that municipal construction projects are managed within your community	Year 1	●
Prescribe pollution prevention/good housekeeping practices to address deficiencies and improve the way that municipal construction projects are managed within your community		●
Develop implementation plan for prescribed pollution prevention/good housekeeping practices		●
Secure funding and resources to implement prescribed pollution prevention/good housekeeping practices	Begin in Year 1	●
Implement prescribed pollution prevention/good housekeeping practices	Begin in Year 2	●

Table 4: Measurable Goals and Implementation Milestones for Improving Municipal Construction Project Management[1]		
Example Measurable Goals	**Timeframe**	**Priority**
Goals related to program evaluation		
Develop measurable performance goals and implementation milestones	Complete shortly after program startup; update regularly after that	●
Evaluate progress in meeting measurable goals and implementation milestones		●
Evaluate progress in implementing prescribed pollution prevention/good housekeeping practices	End of Year 1 and each year after that	●
Notes 1) Assumes that construction project management is as the top of your prioritized municipal operations list. *Key* ● = Essential ⦿ = Optional but Recommended		

The methods used to evaluate success in meeting these measurable performance goals and implementation milestones can be as simple as a semi-annual or annual inspections used to identify the pollution prevention/good housekeeping practices that have been put in place and the improvements that still need to be made.

Scoping the Required Level of Effort

The level of effort required to improve the way that municipal construction projects are managed varies greatly from one community to the next. It depends on a number of factors, including the amount of review that must be performed on local ordinances, technical guidance documents and local plan review and site inspection procedures. These tasks usually consume a fair amount of staff time, although good coordination with local plan review and site inspection staff can help reduce the level of effort needed to complete them. Be sure to budget at least a week of staff time to process and interpret the data gathered during the assessment of existing operations.

Basic guidance on scoping the level of effort required to improve the way that municipal construction projects are managed is provided in Table 5. Communities can use this information to estimate the level of effort required to improve the way that their own municipally funded capital improvement, development and redevelopment projects are managed.

Table 5: Scoping the Level of Effort Required to Improve Municipal Construction Project Management	
Step	**Staff Hours**
Step 1: Identify Existing Municipal Operations	4-8[1]
Step 2: Collect Information About Municipal Construction Projects	4-8
Step 3: Complete Section 2 of the Municipal Operations Analysis (MOA)	10-20
Step 4: Focus Pollution Prevention/Good Housekeeping Efforts	4-8[1]
Step 5: Investigate Municipal Operations and Select Pollution Prevention/Good Housekeeping Practices	80-160
Step 5.1: Identify Erosion and Sediment Control and Stormwater Management Regulations that Apply to Municipal Construction Projects	4-8
Step 5.2: Review Procedures Used During the Contractor Selection Process	4-8
Step 5.3: Review Local Erosion and Sediment Control Regulations and Guidance Documents	20-40
Step 5.4: Review Local Stormwater Management Regulations and Guidance Documents	20-40
Step 5.5: Prescribe Pollution Prevention/Good Housekeeping Practices	20-40
Step 5.5: Develop Implementation Plan	20-40
Step 6: Implement Pollution Prevention/Good Housekeeping Practices	Varies[2]
Step 7: Evaluate Progress in Implementation	20-40/evaluation[1]
Notes 1: Represents total level of effort required to complete step for all municipal operations. 2: Varies according to the extent and type of improvements required.	

Resources

Stormwater Manager's Resource Center. Ordinance: Erosion and Sediment Control. http://www.stormwatercenter.net/

Delaware Sediment and Stormwater Program. Certified Construction Reviewer Policy for State and Federal Projects. http://www.dnrec.state.de.us/DNREC2000/Divisions/Soil/Stormwater/CCR_policy.pdf

The Practice of Watershed Protection: Article 52. Muddy Water In, Muddy Water Out? http://www.cwp.org/PublicationStore/practice.htm

California Stormwater Best Management Practice Handbook: Construction. http://www.cabmphandbooks.com/

City of Dana Point, CA. Construction Urban Runoff BMP Requirements. http://www.danapoint.org/water/

Delaware Erosion and Sediment Control Handbook. http://www.dnrec.state.de.us/DNREC2000/Divisions/Soil/Stormwater/New/Delaware%20ESC%20Handbook_06-05.pdf

Georgia Stormwater Management Manual. Volume 2: Technical Handbook. http://www.georgiastormwater.com/

City of Philadelphia, PA. Stormwater Management Guidance Manual.
http://www.phillyriverinfo.org/Programs/SubprogramMain.aspx?Id=StormwaterManual

City of Portland, OR. Stormwater Management Manual.
http://www.portlandonline.com/bes/index.cfm?c=dfbcc

MO-3	Municipal Operation STREET REPAIR AND MAINTENANCE	

Description

Public streets and roadways make up a significant percentage of the urban infrastructure and require regular maintenance to keep them in good condition. Regular municipal street repair and maintenance activities, such as pavement marking, repair, patching, resurfacing, sealing and right-of-way maintenance, can generate a range of stormwater pollutants, including metals, chlorides, hydrocarbons (e.g. benzene, toluene, ethylbenzene, xylene), nutrients, sediment and trash. If not properly managed, these activities can negatively impact the health of local aquatic resources (Figure 1).

There are three primary street repair and maintenance activities that can influence stormwater quality:

- Routine road and bridge maintenance: Re-chipping, grinding, pothole repair, pavement striping, asphalt re-paving, saw cutting
  - Potential pollutants: Sediment, chloride, cyanide, and phosphorus

- Winter operations: Sanding, application of deicing compounds
  - Potential pollutants: Fine particles, creosote and PAH

- Right-of-way maintenance: Herbicide and pesticide application, vegetation selection
  - Potential pollutants: Nutrients, herbicides, pesticides

All streets and roadways have routine maintenance needs such as mowing and sweeping, with other maintenance needs dictated by age, traffic volume or climatic conditions. Recommended pollution prevention/good housekeeping techniques for roadways are applied through municipal employee, utility employee and contractor training (see profile sheet MO-10), as well as municipal contracting specifications. Not all roadway pollution prevention/good housekeeping techniques are presented here, and the reader is encouraged to review Manual 8 for additional recommendations.

Figure 1: Roadway repairs and maintenance can generate significant amounts of sediment.

Investigating and Improving the Operation

Improving the way that municipal street repair and maintenance activities are conducted within your community can reduce the amount of stormwater pollution that is conveyed into local aquatic resources. It requires you to examine your existing practices and programs and identify the pollution prevention/good housekeeping practices that can be used to reduce the amount of stormwater pollution that street repair and maintenance activities create. This can be accomplished within the context of the seven-step program planning and development process (Chapter 2), as described below.

Step 1: Identify Existing Municipal Operations

Recall that the first step in the process is to identify the municipal operations that are conducted within your community. In terms of municipal street repair and maintenance, this means determining whether or not your community conducts any routine street repair and maintenance activities, such as street resurfacing, bridge repair or right-of-way maintenance. If it does, the next step in the process is to collect some basic information about those activities. If not, you should begin investigating the other municipal operations that are conducted within your community.

Step 2: Collect Information About Each Operation

Once you have determined that your community does conduct street repair and maintenance activities, the next step in the process is to collect some basic information about how those activities. Basic information to collect about the street repair and maintenance activities conducted in your community includes:

- Narrative description of active and planned street repair and maintenance activities
- Locations of active and planned street repair and maintenance activities
    - Street address
    - Watershed and subwatershed address
    - Geospatial coordinates (e.g. latitude, longitude)
- Map showing locations of active and planned street repair and maintenance activities
- Operation manager name
- Operation manager contact information

This information should be added to the simple database or binder that contains the information about all of the municipal operations conducted in your community.

As you identify the municipal street repair and maintenance activities that are occurring or are planned in your community and collect some basic information about them, you should begin communicating with the individuals who oversee or manage these operations. This is an ideal time to inform these individuals about the community's pollution prevention/good housekeeping efforts and the purpose of the community's municipal pollution prevention/good housekeeping program. It is also a good time to educate them about the influence that street repair and maintenance activities can have on water quality and how pollution prevention/good

housekeeping practices can be used to reduce the amount of stormwater pollution that these activities create.

Step 3: Complete the Municipal Operations Analysis (MOA)

The next step in the process is to use the basic information that you have collected about the street repair and maintenance activities conducted in your community to complete Section 3 of the MOA. This section of the MOA asks a series of questions about the nature, scope and distribution of the street repair and maintenance activities conducted within your community. In some cases, you will be able to answer all of the questions using only the information that you have already collected about the each of the active or planned activities. In most cases, however, answering the questions will require additional input from the individuals who manage or oversee each of the activities as well as site visits to the locations or areas where the activities are being conducted.

Once you have answered all of the questions presented within Section 3 of the MOA, you should calculate your score to determine how well your community is currently managing its capital improvement, development and redevelopment. When you have completed the entire MOA, you should also compare the score that you received in Section 3 with the scores you received in each of the other sections of the analysis. This will help you focus your pollution prevention/good housekeeping efforts on the municipal operations that have the greatest influence on water quality in your community.

Step 4: Focus Pollution Prevention/Good Housekeeping Efforts

The next step in the process is to use the results of the MOA, as well as information about local subwatershed restoration goals and objectives, to develop a list of the municipal operations in the order in which they will be further investigated and improved. This list, known as the prioritized municipal operations list, can be used to guide your local pollution prevention/good housekeeping efforts and ensure that you are using your resources on improving the operations that have the greatest influence on water quality in your community. The operations at the top of the prioritized municipal operations list should be those that you will address first, while those at the bottom should be those that you will address over time.

If street repair and maintenance comes out on top of your prioritized municipal operations list, the next step in the process is to further investigate the way that street repair and maintenance activities are conducted within your community and determine the pollution prevention/good housekeeping practices that can be used to reduce the amount of stormwater pollution they create. If it does not, you should begin investigating the operation that is located at the top of your list. The other profile sheets presented in this chapter provide additional information about investigating each of the other municipal operations.

Step 5: Investigate Municipal Operations and Select Pollution Prevention/Good Housekeeping Practices

Step 5.1: Collect Additional Information About Street Repair and Maintenance Activities

Once you have determined that street repair and maintenance will be the focus of your pollution prevention/good housekeeping efforts, the next step in the process is to collect some additional information about these activities to determine the pollution prevention/good housekeeping practices that can be used to reduce the amount of stormwater pollution they create. To collect this additional information, you should coordinate with the individuals who manage or oversee these operations. These individuals will be able to answer questions about each of the street repair and maintenance activities and will be able to explain any pollution prevention/good housekeeping practices that may already be using. It is also a good opportunity for them to learn more about how the activities that they manage can influence stormwater quality. Table 1 provides a list of example questions that can be used to collect additional information from the individuals who manage or oversee the street repair and maintenance activities conducted in your community.

Table 2: Sample Discussion Questions

- Are you familiar with our pollution prevention/good housekeeping efforts and the purpose of our municipal pollution prevention/good housekeeping program?
- What street repair and maintenance activities are conducted within our community?
- What stormwater pollutants are associated with the street repair and maintenance activities conducted within our community?
- Do you understand how street repair and maintenance activities can impact stormwater quality?
- Have you implemented any pollution prevention/good housekeeping practices to prevent or mitigate these impacts?
- Do you provide regular stormwater pollution prevention training to employees who are involved with street repair and maintenance activities?

Step 5.2: Prescribe Pollution Prevention/Good Housekeeping Practices

Once you have assessed how street repair and maintenance activities are currently conducted within your community, the next step is to identify some pollution prevention/good housekeeping practices that can be used to reduce the stormwater pollution generated by them. Depending on the results of your assessment and the information you've collected, a wide range of practices can be used. Some of the practices most commonly used to improve the way that municipal street repair and maintenance activities are conducted are listed in Table 2.

Table 2: Pollution Prevention/Good Housekeeping Practices Commonly Used to Improve Street Repair and Maintenance Operations	
Street Repair or Maintenance Activity	**Recommended Improvements**
Routine Road and Bridge Maintenance	• Prevent paving materials and wastes from entering the storm drain system • Minimize the area of soils left exposed or graded • Collect any loose sand, gravel, asphalt, or other material as soon as possible after construction activities • When placing chip seals, limit spreading aggregate to the sealed surface and sweep up excess aggregate once cured and each day thereafter until aggregate loss is insignificant • Mix road stabilization materials during periods of calm, dry weather, and seal as soon as possible after dressing • Fill and compact soil, gravel, and asphalt in layers • Reuse road spoil in repairs if possible and sweep up and dispose of properly • Eliminate 'edge break' by fully sealing road shoulders • When striping, use water-based paints or thermoplastics rather than solvent-based ones • Avoid striping operations while the pavement is wet, during humid conditions, or if rain is likely • Avoid applying thermoplastics at low temperatures, i.e. below 13°C • When possible, use portable drip trays under equipment to catch spills • Use a skirt around the blaster to minimize the spraying of material away from the work site • Coordinate street-sweeping with line removal, so that waste material is picked up before it can be transported by rain, wind, and traffic • Use dry cutting techniques when saw cutting and sweep or vacuum up residue • Construct runoff barriers to protect storm drains from wet saw-cut runoff • Place drip pans or absorbent materials under saw-cut equipment when not in use • Use as little cooling water as possible and switch the water off when the saw is not in use
Winter-time Operations	• Ensure that the equipment is calibrated to optimum levels according to manufacturer's instructions • Place barriers in site-specific locations, i.e., along streams or direct drainages to route deicing material away from water bodies • Reduce plowing speed in sensitive areas to prevent exposure to deicing material • Identify and create facilities to capture deicing materials, where practical using booms or other similar barrier materials
Vegetative Maintenance	• Use mechanical methods of vegetation removal rather than herbicides • Dispose of lawn clippings at a landfill; clippings should not be disposed of in streams or storm drains • Avoid applying herbicides and pesticides if rain is expected • Calibrate equipment to avoid over application

Step 5.3: Develop Implementation Plan

Once you have selected some appropriate pollution prevention/good housekeeping practices, a brief implementation plan should be created. The plan should summarize the results of the assessment and the pollution prevention/good housekeeping practices that will be used to reduce the stormwater pollution generated by municipal street repair and maintenance activities. The plan should also include a schedule that describes when the prescribed pollution prevention/good housekeeping practices will be implemented. The contents of the implementation plan should be reviewed with the individual who manages the street repair and maintenance activities conducted

in your community. The implementation plan can be used to guide the implementation of the prescribed pollution prevention/good housekeeping practices.

Step 6: Implement Pollution Prevention/Good Housekeeping Practices

Once an implementation plan has been created, the next step in the process is implementing the prescribed pollution prevention/good housekeeping practices. Although the ultimate responsibility for implementation often falls upon the individual who oversees the street repair and maintenance activities, it is important to maintain a relationship with this person during the implementation phase and to work closely with them to get the recommended improvements "in the ground." Simple techniques that can be used to do this include providing additional education and information about the prescribed pollution prevention/good housekeeping practices and providing assistance in securing funding for the recommended improvements.

Step 7: Evaluate Progress in Implementation

The last step in the process involves evaluating the progress made in implementing the prescribed pollution prevention/good housekeeping practices. Measurable performance goals and implementation milestones will be needed to evaluate progress in implementation and track success in addressing local water quality issues and subwatershed restoration goals and objectives. Some example measurable goals and implementation milestones are presented in Table 3. These *output-based* measurable goals can be thought of as activities that need to be completed in order to improve the way that municipal construction projects are managed in your community.

Table 3: Measurable Goals and Implementation Milestones for Improving Municipal Street Repair and Maintenance Operations[1]

Example Measurable Goals	Timeframe	Priority
Goals related to program startup		
Identify and collect basic information about active and planned municipal street repair and maintenance activities	Complete shortly after program startup; update regularly after that	●
Add the information about street repair and maintenance activities to the simple database or binder that contains basic information about each municipal operation		●
Develop a digital (e.g. GIS) or hard copy map showing the location of all active and planned municipal street repair and maintenance operations.		◉
Complete Section 3 of the Municipal Operations Analysis (MOA)	Year 1; repeat every 5 years	●
Prioritize local pollution prevention/good housekeeping efforts based on the results of the MOA and other factors, such as local pollutants of concern		●
Goals related to preventing or reducing stormwater pollution		
Conduct follow-up investigations on the way that municipal street repair and maintenance activities are conducted within your community	Year 1	●
Prescribe pollution prevention/good housekeeping practices to address deficiencies and improve the way that street repair and maintenance activities are conducted within your community		●

Table 3: Measurable Goals and Implementation Milestones for Improving Municipal Street Repair and Maintenance Operations[1]		
Example Measurable Goals	**Timeframe**	**Priority**
Develop implementation plan for prescribed pollution prevention/good housekeeping practices		●
Secure funding and resources to implement prescribed pollution prevention/good housekeeping practices	Begin in Year 1	●
Implement prescribed pollution prevention/good housekeeping practices	Begin in Year 2	●
Goals related to program evaluation		
Develop measurable performance goals and implementation milestones	Complete shortly after program startup; update regularly after that	●
Evaluate progress in meeting measurable goals and implementation milestones		●
Evaluate progress in implementing prescribed pollution prevention/good housekeeping practices	End of Year 1 and each year after that	●
Notes 1) Assumes that construction project management is as the top of your prioritized municipal operations list. *Key* ● = Essential ⦿ = Optional but Recommended		

The methods used to evaluate success in meeting these measurable performance goals and implementation milestones can be as simple as a semi-annual or annual inspections used to identify the pollution prevention/good housekeeping practices that have been put in place and the improvements that still need to be made.

In 2005, in the City of Austin, TX, banned the use and sale of coal tar pavement sealants, which are primarily used in parking lots and driveways. The City discovered increased level of polyaromatic hydrocarbons (PAH) in local streams and the source was traced to neighboring parking lots. Further study identified coal tar-based pavement sealants as a source of PAH.
Since then, the City of Madison, WI has also passed a similar ban.

Scoping the Required Level of Effort

The level of effort required to improve existing street repair and maintenance activities varies greatly from one community to the next. Basic guidance on scoping the level of effort required to improve the way that municipal street repair and maintenance activities are conducted is provided in Table 4. Communities can use this information to estimate the level of effort required to improve the way that their own street repair and maintenance activities are conducted.

Table 4: Scoping the Level of Effort Required to Improve Street Repair and Maintenance Operations	
Step	**Staff Hours**
Step 1: Identify Existing Municipal Operations	4-8[1]
Step 2: Collect Information About Street Repair and Maintenance Activities	4-8
Step 3: Complete Section 3 of the Municipal Operations Analysis (MOA)	10-20
Step 4: Focus Pollution Prevention/Good Housekeeping Efforts	4-8[1]
Step 5: Investigate Municipal Operations and Select Pollution Prevention/Good Housekeeping Practices	60-120
Step 5.1: Collect Additional Information About Street Repair and Maintenance Activities	20-40
Step 5.2: Prescribe Pollution Prevention/Good Housekeeping Practices	20-40
Step 5.3: Develop Implementation Plan	20-40
Step 6: Implement Pollution Prevention/Good Housekeeping Practices	Varies[2]
Step 7: Evaluate Progress in Implementation	20-40/evaluation[1]
Notes 1: Represents total level of effort required to complete step for all municipal operations. 2: Varies according to the extent and type of improvements required.	

Resources

Urban Subwatershed Restoration Manual 8: Pollution Source Control Practices http://www.cwp.org/PublicationStore/USRM.htm

Urban Subwatershed Restoration Manual 11: Unified Subwatershed and Site Reconnaissance: A User's Manual. http://www.cwp.org/PublicationStore/USRM.htm

Schueler, T. and H. Holland. 2000. Sources of Urban Stormwater Pollutants Defined in Wisconsin. Article 7 in the Practice of Watershed Protection. http://www.cwp.org/PublicationStore/practice.htm

American Association of State Highway and Transportation Officials (AASHTO). Environmental Stewardship Practices, Procedures, and Policies for Highway Construction and Maintenance. http://www.environment.transportation.org/center/products_programs/environmental_stewardship.aspx

An Assessment of Road Maintenance Activities In Frederick County And Their Effect On Stormwater Runoff Quality www.watershed-alliance.com/publications/Road%20Maintenance%20Report/roadmaint.pdf

California Stormwater Best Management Practice Handbook Fact Sheet: Road and Street Maintenance http://www.cabmphandbooks.com/Documents/Municipal/SC-70.pdf

California Stormwater Best Management Practice Handbook Fact Sheet: Landscape Maintenance http://www.cabmphandbooks.com/Documents/Municipal/SC-73.pdf

City of Austin, TX. Coal Tar Ban Website:
http://www.ci.austin.tx.us/watershed/coaltar_main.htm

Oregon Department of Transportation (ODOT). 2004. Routine Road Maintenance: Water Quality and Habitat Guide Best Management Practices. Salem, OR.
http://egov.oregon.gov/ODOT/HWY/GEOENVIRONMENTAL/docs/research-roadside_maintenance_manual.pdf

U.S. EPA National Menu of Stormwater Best Management Practices for Stormwater Phase II: Roadway and Bridge Maintenance Fact Sheet
http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=100

U.S. EPA National Menu of Stormwater Best Management Practices for Stormwater Phase II: Road Salt Application and Storage Fact Sheet
http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=100

MO-4	Municipal Operation	
	STREET SWEEPING	

Description

Public streets and roadways can comprise as much as 10 to 20% of total impervious cover in suburban subwatersheds and as much as 20 to 40% in highly urban subwatersheds. Particulate matter or "street dirt" tends to accumulate along the curbs of streets and roadways in between rainfall events. Sources of pollutants include run-on, atmospheric deposition, vehicle emissions and wear and tear, breakup of street surface, littering, leaves and other organic material and sanding. This results in the accumulation of stormwater pollutants such as sediment, nutrients, metals, hydrocarbons, bacteria, pesticides, trash and other toxic chemicals.

In many communities, these pollutants remain on public streets and roadways until they are washed into the storm drain system during a rainfall event. However, some communities use street sweeping (Figure 1) to remove some of these pollutants and prevent them from being conveyed into the storm drain system.

The ability of street sweepers to remove common stormwater pollutants varies depending on sweeper technology, sweeper operation and frequency, street conditions and the chemical and physical characteristics of the pollutants that have accumulated on the pavement. Although newer street sweeping technology can remove more than 90% of street dirt under ideal conditions, street sweeping does not necessarily guarantee water quality improvements (CWP, 2006a). Street sweepers are typically more effective at removing larger-sized particles than fine-grained particles and nutrients, although newer technology such as small-micron surface cleaning technologies may be capable of picking up smaller particles (Sutherland and Jelen, 1997). However, as illustrated in Figure 2, only 27% of Chesapeake Bay communities rely on this modern sweeping technology. The street sweepers most commonly used by Chesapeake Bay communities are mechanical brush and mechanical brush with vacuum assist sweepers (CWP, 2006b), which tend to have lower pollutant removal capabilities than newer air or vacuum assist technologies.

Figure 1. This broom sweeper is assisted by a following vacuum sweeper for increased removal.

Table 1 provides expected pollutant removal rates for street sweeping. These pollutant removal rates are lower than reported "pick-up" efficiencies of street sweepers, due to a number of discount factors that impact the effectiveness of street sweeping (CWP

2006a). In general, street sweeping is usually more effective in arid and semi-arid climates where pollutants can accumulate over longer intervals on street and curb surfaces.

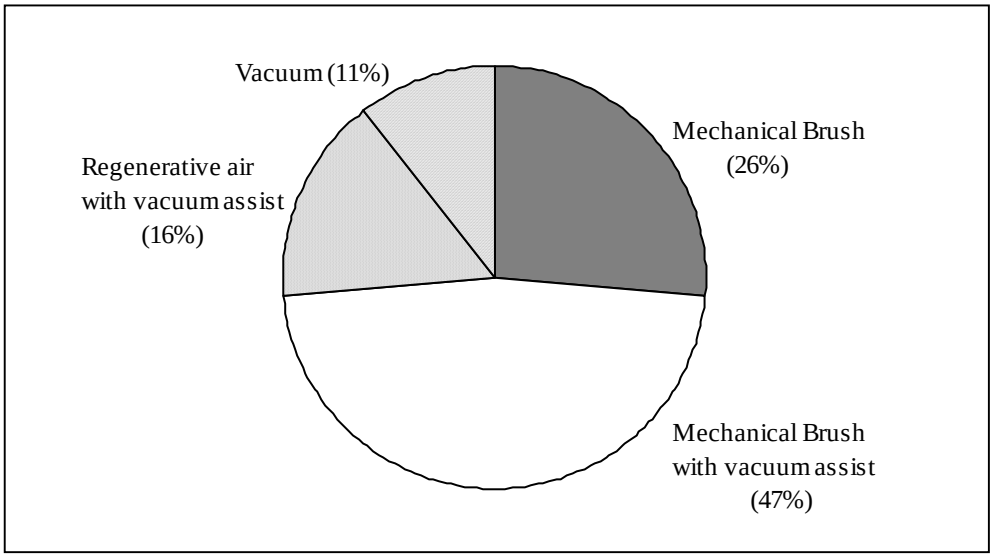

Figure 2. Most common street sweeping technology used by Chesapeake Bay communities

Table 1: Expected Pollutant Removal Rates for Street Sweeping (Law et al., 2008)

Frequency	Technology	Total Suspended Solids	Total Phosphorus	Total Nitrogen
Monthly	Mechanical	9%	3%	3%
	Regenerative Air/Vacuum	22%	4%	4%
Weekly	Mechanical	13%	5%	6%
	Regenerative Air/Vacuum	31%	8%	7%

Investigating and Improving the Operation

Improving or initiating street sweeping activities in your community can reduce the amount of stormwater pollution that is conveyed into local aquatic resources. It requires you to examine your existing street sweeping operations, if they exist, and identify where improvements can be made to reduce the amount of pollution that has accumulated on public streets and roadways. This can be accomplished within the context of the seven-step program planning and development process (Chapter 2), as described below.

Step 1: Identify Existing Municipal Operations

Recall that the first step in the process is to identify the municipal operations that are conducted within your community. In terms of street sweeping, this means determining whether or not your community currently sweeps any public streets and roadways. If it does, the next step in the process is to collect some basic information about how the way those activities are conducted. If not, you should consider developing a street sweeping program or begin investigating the other municipal operations that are conducted within your community.

Step 2: Collect Information About Each Operation

Once you have determined that your community currently conducts street sweeping operations, the next step in the process is to collect some basic information about how those operations are carried out. Basic information to collect about the street sweeping activities conducted in your community includes:

- Narrative description of the street sweeping activities
- Locations of active and planned street sweeping activities
    - Street address
    - Watershed and subwatershed address
    - Geospatial coordinates (e.g. latitude, longitude)
- Map showing locations of active and planned street sweeping activities
- Operation manager name
- Operation manager contact information

This information should be added to the simple database or binder that contains the information about all of the municipal operations conducted in your community.

As you collect some basic information about the street sweeping operations conducted in your community, you should begin communicating with the individual who oversees or manages these activities. This is an ideal time to inform this individual about the community's pollution prevention/good housekeeping efforts and the purpose of the community's municipal pollution prevention/good housekeeping program. It is also a good time to educate them about the influence that street sweeping can have on water quality and how it can be used to reduce the amount of pollution that has accumulated on public streets and roadways.

Step 3: Complete the Municipal Operations Analysis (MOA)

The next step in the process is to use the basic information that you have collected about the street sweeping activities conducted in your community to complete Section 4 of the MOA. This section of the MOA asks a series of questions about the nature, scope and distribution of the street sweeping operations conducted within your community. In some cases, you will be able to answer all of the questions using only the information that you have already collected about the street sweeping activities. In most cases, however, answering the questions will require additional input from the individual who manages or oversees your community's street sweeping operation.

Once you have answered all of the questions presented within Section 4 of the MOA, you should calculate your score to determine how well your community is currently conducting its street sweeping activities. When you have completed the entire MOA, you should also compare the score that you received in Section 4 with the scores you received in each of the other sections of the analysis. This will help you focus your pollution prevention/good housekeeping efforts on the municipal operations that have the greatest influence on water quality in your community.

Step 4: Focus Pollution Prevention/Good Housekeeping Efforts

The next step in the process is to use the results of the MOA, as well as information about local subwatershed restoration goals and objectives, to develop a list of the municipal operations in the order in which they will be further investigated and improved. This list, known as the prioritized municipal operations list, can be used to guide your local pollution prevention/good housekeeping efforts and ensure that you are using your resources on improving the operations that have the greatest influence on water quality in your community. The operations at the top of the prioritized municipal operations list should be those that you will address first, while those at the bottom should be those that you will address over time.

If street sweeping comes out on top of your prioritized municipal operations list, the next step in the process is to further investigate the way that street sweeping activities are conducted in your community and determine the improvements that can be used to reduce the amount of pollution that has accumulated on public streets and roadways. If it does not, you should begin investigating the operation that is located at the top of your list. The other profile sheets presented in this chapter provide additional information about investigating each of the other municipal operations.

Step 5: Investigate Municipal Operations and Select Pollution Prevention/Good Housekeeping Practices

Step 5.1: Collect Additional Information About Street Sweeping Activities

Once you have determined that street sweeping will be the focus of your pollution prevention/good housekeeping efforts, the next step in the process is to collect some additional information about these activities to determine how they can be improve to reduce the amount of stormwater pollution that has accumulated on public streets and roadways. To collect this additional information, you should coordinate with the individual who manages or oversees these activities. This individual will be able to answer questions about the street sweeping activities and help you determine where improvements can be made. It is also a good opportunity for them to learn more about how street sweeping can influence stormwater quality. Table 2 provides a list of example questions that can be used to collect additional information from the individual who manages or oversees the street sweeping activities conducted in your community.

Table 2: Sample Discussion Questions

- Are you familiar with our pollution prevention/good housekeeping efforts and the purpose of our municipal pollution prevention/good housekeeping program?
- What pollutants are most commonly associated with street dirt?
- What areas or streets in the community are dirtier than others (e.g. have higher street particulate matter loadings compared to others)?
- What proportion of streets in the community is swept?
- Do sweepers pick up leaf piles?
- How is sweeping frequency defined?
- Is sweeping coordinated with fall leaf pickup?
- Is tandem sweeping used?
- Are no-parking zones used to increase pick up efficiency?
- What technology is being used and what is the size of the street sweeper fleet?

Table 2: Sample Discussion Questions
• What is the frequency of street sweeping for public streets? • Do you have a training program for street sweeper operators? • How do you dispose of material collected from the street sweepers? • What problems affect the performance of street sweeping (e.g., on-street parking, inadequate budget, untrained operators)

When collecting addition information about the street sweeping activities conducted in your community, you should strive to determine what streets are being swept (if any), how frequently they are swept (e.g. twice a month) and the technology that is used to sweep them. The basic idea is to determine if the street sweeping program is operating at a level where measurable pollutant reductions can be achieved. In particular, you should evaluate:

- *Sweeper frequency* - should be defined based on local rainfall statistics, where the optimal frequency is about twice the interstorm period (runoff producing event) based on national rainfall statistics (i.e., approximately once a week, if the storm frequency is once every two weeks). At a minimum, sweeping should occur during periods of heavy accumulation. For example before the rain or wet season in drier, arid climates or in the fall and early spring in temperate climate. In the fall, sweepers should pick up leaves (and not avoid them) as they can contribute 25% of nutrient loadings in catch basins. If more substantial piles of leaves are found in your community during the fall, street sweeping activities should be coordinated with leaf pickup. Equally important is an early spring sweeping before rains begin to pick up sand, de-icing material and winter debris, to include municipally owned parking lots. More frequent sweeping may reduce the need for catch basin cleaning (see Profile Sheet MO-5). Figure 3 illustrates the percent of Chesapeake Bay communities that sweep more than once per year and the associated street sweeping frequency.

- *Sweeper technology and operations* – the ability of street sweeping to impact water quality is dependent on the sweeper's pick-up efficiency of fine-grained sediment. There are three main types of sweepers: mechanical, regenerative air, and vacuum sweepers. Mechanical sweepers (broom-type) are typically the least expensive and are better suited to pick up large-grained sediment particles. Vacuum and regenerative air sweepers are better at removing fine grained sediment particles and are more effective as part of a NPDES plan (Partland, 2001), but are less effective on wet surfaces and are more expensive. Removal efficiency can be improved through tandem sweeping (two sweepers sweeping the same route, with one following the other to pick up missed material) or if the street sweeper makes multiple passes on a street.

- *Conditions* – access to the curb is paramount to street sweeping efficiency, as the majority of pollutants on streets are closest to the curb. Parked cars can restrict access; a regional survey conducted for Concord, CA revealed that appropriately enforced no-parking zones overwhelming achieved adequate compliance to allow street sweeping (Berryman and Henigar, 2003).

- *Distance to storage and disposal facilities* - street sweepers do not travel very quickly so the distance to the storage and disposal facilities can significantly reduce the number of hours that operators actually spend sweeping streets.

- *Staff training* - street sweepers are a major investment and operators must be specially trained on how to properly drive and maintain them. Training should be held at least once a year for all staff to provide them with a thorough understanding of the proper implementation of sweeping and other pollution prevention/good housekeeping practices, and safety procedures. Also see Profile Sheet MO-10.

The most common purposes for street sweeping in the Chesapeake Bay area are aesthetics, followed by residential demand. Keeping material out of the storm drains and street safety were also common responses. Public health, safety, permit requirements, and water quality were not among the most frequently cited reasons for street sweeping, but are considered important by a significant proportion of communities (CWP 2006b).

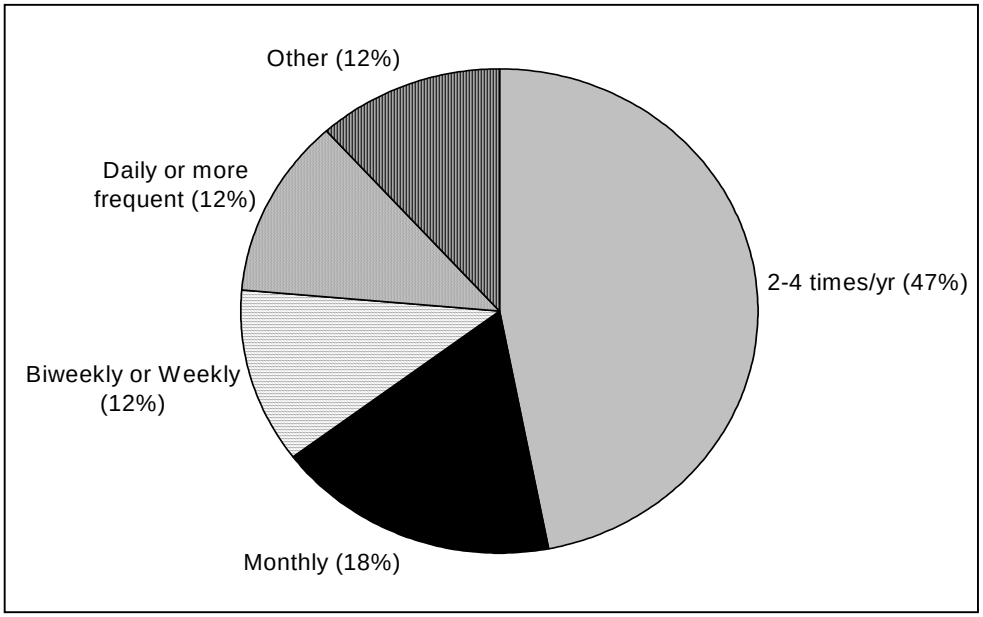

Figure 3. Percentage of communities that sweep more than once per year and the associated sweeping frequency

Step 5.2: Conduct Field Investigations

Once you have collected some additional information about the street sweeping activities conducted in your community, the next task is to conduct some field work to determine where street sweeping can be most effective in improving water quality your community. The Street and Storm Drains (SSD) investigation measures the average pollutant accumulation in the streets, curbs and catch basins of a subwatershed. It is a visual inspection of pollutant accumulation along streets curb and gutters, and storm drain inlets. This information should be used to identify the dirtiest streets and quantify the impact of current maintenance practices on urban streams and identify changes to current street sweeping program. For example, a high accumulation rate may suggest that more regularly scheduled street sweeping is needed. The SSD is time intensive and probably cannot be completed for all streets in a community; however,

the stormwater manager should consider conducting the SSD in subwatersheds with impaired waters or sensitive aquatic resources. This information is particularly useful for communities with limited resources who may not be able to increase street sweeping in all areas. For more information on the SSD, see Manual 11.

Step 5.3: Prescribe Pollution Prevention/Good Housekeeping Practices

Once existing operations have been assessed, the next step in the process is to develop a targeted street sweeping program that can help improve water quality by removing and properly disposing of the street dirt that has accumulated on public streets and roadways. In order to observe water quality improvements, most communities will need to invest in better street sweeping technologies and increase sweeping frequency. Depending on the results of Step 1, a variety of improvements can be made to the way that street sweeping operations currently occur (Table 3). If resources are limited, street sweeping should be concentrated on the dirtiest streets in sensitive subwatersheds at the right times of year (fall and early spring).

Table 3: Good Housekeeping Techniques for Street and Parking Lot Sweeping

- Analyze sweeper wastes for hazardous waste content and dispose of properly at the landfill
- Sweep prior to rainstorms so pollutants are not washed into storm drain system
- Sweep as soon as possible following application of deicers or other applied chemicals
- Properly maintain sweepers and operate according to manufacturers directions
- Store swept material in a covered and contained site until it can be disposed of at a landfill
- Implement parking controls to improve street sweeper efficiency by maximizing sweepable street edges where dirt tends to collect
- Routinely inspect street curbs for sediment and debris and schedule dirtiest streets for regular sweeping
- Coordinate seasonal sweeping schedules to coincide with important pollution prevention events during the subwatershed year. These include the end of curbside leaf collection, winter sanding operations, and peak pollen production in the spring
- Select the most effective combination of street sweeper technology that is consistent with municipal budget resources
- Sweep streets at the optimal frequency to remove the greatest pollutant removal, given local rainfall, street density, curb access and traffic safety
- Post permanent signs to notify vehicle owners and residents about forthcoming sweeping operations and associated parking restrictions
- Work with local police department to patrol designated routes to ticket illegally parked cars

Step 5.4: Develop Implementation Plan

Once there is a targeted street sweeping program, a brief implementation plan should be created. The plan should summarize the results of the assessment and the street sweeping effort that will be used to reduce the amount of pollution that has accumulated on public streets and roadways. The plan should also include a schedule that describes when the street sweeping program will be implemented. The implementation plan can be used to guide the implementation of the prescribed street sweeping program.

Step 6: Implement Pollution Prevention/Good Housekeeping Practices

Once an implementation plan has been created, the next step in the process is implementing the prescribed street sweeping program. Although it may be tempting to hand the responsibility for implementation over to the individual who manages or oversees the community's street

sweeping activities, it is important to work with this individual during the implementation phase to get the prescribed street sweeping program up and running. Simple techniques that can be used to do this include providing additional education and information about the prescribed street sweeping program and providing assistance in securing funding for the program.

Step 7: Evaluate Progress in Implementation

The last step in the process involves evaluating the progress made in implementing the prescribed pollution prevention/good housekeeping practices. Measurable performance goals and implementation milestones will be needed to evaluate progress in implementation and track success in addressing local water quality issues and subwatershed restoration goals and objectives. Some example measurable goals and implementation milestones are presented in Table 4.

Table 4: Measurable Goals and Implementation Milestones for Improving Municipal Street Sweeping Activities[1]

Example Measurable Goals	Timeframe	Priority
Goals related to program startup		
Identify and collect basic information about municipal street sweeping activities	Complete shortly after program startup; update regularly after that	●
Add the information about street sweeping activities to the simple database or binder that contains basic information about each municipal operation		●
Develop a digital GIS or hard copy map showing the location of all municipal street sweeping activities		◉
Complete Section 4 of the Municipal Operations Analysis (MOA)	Year 1; repeat every 5 years	●
Prioritize local pollution prevention/good housekeeping efforts based on the results of the MOA and other factors, such as local pollutants of concern		●
Goals related to preventing or reducing stormwater pollution		
Collect additional information about the way that street sweeping activities are conducted within your community	Year 1	●
Prescribe pollution prevention/good housekeeping practices to improve the way that municipal street sweeping activities are conducted within your community		●
Develop implementation plan for prescribed street sweeping program		●
Secure funding and resources to implement prescribed street sweeping program	Begin in Year 1	●
Implement prescribed street sweeping program	Begin in Year 2	●
Goals related to program evaluation		
Develop measurable performance goals and implementation milestones	Complete shortly after program startup; update regularly after that	●
Evaluate progress in meeting measurable goals and implementation milestones		●
Evaluate progress in implementing prescribed pollution prevention/good housekeeping practices	End of Year 1 and each year after that	●

Table 4: Measurable Goals and Implementation Milestones for Improving Municipal Street Sweeping Activities[1]		
Example Measurable Goals	**Timeframe**	**Priority**
Notes 1) Assumes that street sweeping is as the top of your prioritized municipal operations list. *Key* ● = Essential ⦿ = Optional but Recommended		

The methods used to evaluate success in meeting these measurable performance goals and implementation milestones can be as simple as a semi-annual or annual inspections used to identify the improvements that have been put in place and the improvements that still need to be made.

Scoping the Required Level of Effort

The level of effort required to develop an effective street sweeping program varies greatly from one community to the next. Basic guidance on scoping the level of effort required to develop a street sweeping program is provided in Table 5. Communities can use this information to estimate the level of effort required to develop their own street sweeping programs.

Table 5: Scoping the Level of Effort Required to Improve Street Sweeping Operations	
Step	**Staff Hours**
Step 1: Identify Existing Municipal Operations	4-8[1]
Step 2: Collect Information About Street Sweeping Activities	4-8
Step 3: Complete Section 4 of the Municipal Operations Analysis (MOA)	10-20
Step 4: Focus Pollution Prevention/Good Housekeeping Efforts	4-8[1]
Step 5: Investigate Municipal Operations and Select Pollution Prevention/Good Housekeeping Practices	80-200
Step 5.1: Collect Additional Information About Street Sweeping Activities	20-40
Step 5.2: Conduct Field Investigations	20-80
Step 5.3: Prescribe Pollution Prevention/Good Housekeeping Practices	20-40
Step 5.4: Develop Implementation Plan	20-40
Step 6: Implement Pollution Prevention/Good Housekeeping Practices	Varies[2]
Step 7: Evaluate Progress in Implementation	20-40/evaluation[1]
Notes 1: Represents total level of effort required to complete step for all municipal operations. 2: Varies according to the extent and type of improvements required.	

Resources

Urban Subwatershed Restoration Manual 11: Unified Subwatershed and Site Reconnaissance: A User's Manual. http://www.cwp.org/PublicationStore/USRM.htm

The Smart Watershed Benchmarking Tool.
http://cwp.org.master.com/texis/master/search/+/form/Smart_Watershed.html

City Madison Street Sweeping Study
http://www.ci.madison.wi.us/engineering/stormwater/street_sweeping.htm

Stormwater Effects Handbook: Chapter 5
http://www.epa.gov/ednnrmrl/publications/books/handbook/index.htm

Sutherland, R.C., and Jelen, S.L. (1997). Contrary to Conventional Wisdom: Street Sweeping can be an Effective BMP. In James, W. *Advances in Modeling the Management of Stormwater Impacts* – Vol. 5. Published by CHI, Guelph, Canada. pp 179-190.

US Department of Transportation, Federal Highway Administration's Stormwater Best Management Practices in an Ultra-Urban Setting: Selection and Monitoring: Street Sweeping Fact Sheet http://www.fhwa.dot.gov/environment/ultraurb/3fs16.htm

Walker, T. and Wong, T. (1999). Effectiveness of Street Sweeping for Stormwater Pollution Control. Technical Report 99/08. Cooperative Research Centre for Catchment Hydrology, Melbourne, AUS. http://www.catchment.crc.org.au/archive/pubs/1000009.html

Waschbusch, Robert J.; Selbig, W. R.; Bannerman, Roger T.1999. WRI 99-4021. Sources of phosphorus in stormwater and street dirt from two urban residential basins in Madison, Wisconsin, 1994-95. http://wi.water.usgs.gov/pubs/WRIR-99-4021/

World Sweeper Website http://www.worldsweeper.com/Street/Studies/index.html

MO-5	Municipal Operation	
	STORM DRAIN MAINTENANCE	

Description

Public streets and roadways can comprise as much as 10 to 20% of total impervious cover in suburban subwatersheds and from 20 to 40% of highly urban subwatersheds. Fine particles and pollutants naturally tend to accumulate along the curbs of roads in between rainfall events. Sources of pollutants include run-on, atmospheric deposition, vehicle emissions, breakup of street surface, littering, and sanding. This results in the accumulation of stormwater pollutants such as sediment, nutrients, metals, hydrocarbons, bacteria, pesticides, trash and other toxic chemicals.

Storm drain maintenance is often the last opportunity to remove pollutants before they enter the storm drain system. The effectiveness of this pollution prevention/good housekeeping practice depends on the basic design of the stormwater conveyance in a subwatershed. Most systems have a catch basin or sump pit located in the storm drain inlet to trap sediment and organic matter and prevent clogging (Figure 1). In some eras, however, conveyance systems were designed to be self-cleansing and thus have no storage. Each catch basin or sump pit tends to be unique in how quickly it fills up, and whether the trapped material is liquid, solid or organic. To this extent, each reflects the conditions and behaviors that occur within the few hundred feet of street it serves.

Storm drain maintenance can be an effective strategy in urban subwatersheds that have few other feasible options to remove pollutants. For many communities, storm drain maintenance is reactive and conducted in response to complaints from residents. Water quality is not a commonly cited reason for a storm drain cleanout program (see Figure 2). When performed properly, regular maintenance can improve water quality and prevent clogging and flooding.

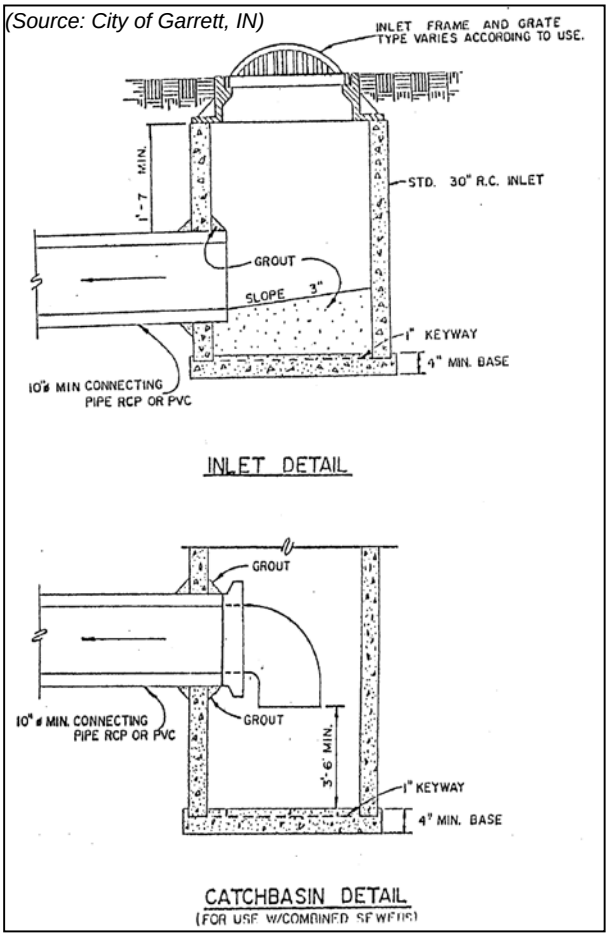

Figure 1. Catch Basin Detail

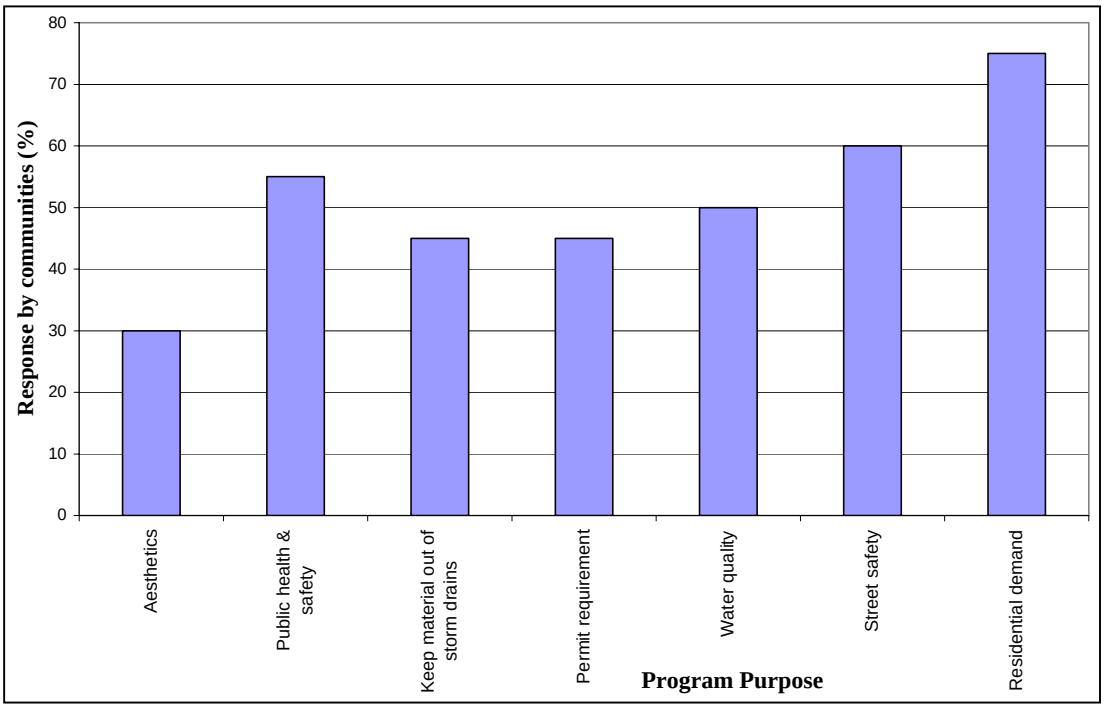

Figure 2: Purpose of storm drain cleanout programs in the Chesapeake Bay watershed

The amount of pollution removed by storm drain maintenance is influenced by the amount of pollution removed by street sweeping (see profile sheet MO-4). The amount of dirt removed by street sweeping influences the quantity of dirt that can be trapped within storm drains, inlets or catch basins. Storm drain cleanout effectiveness is also impacted by both the frequency and method of cleanout. Table 1 provides estimated pollutant removal rates for catch basin cleanouts.

Table 1: Expected Pollutant Removal Rates for Catch Basin Cleanouts (Law et al., 2008)

Frequency	Total Suspended Solids	Total Phosphorus	Total Nitrogen
Annual	18%	< 1%	3%
Semi-Annual	35%	2%	6%

Investigating and Improving the Operation

Improving or initiating storm drain maintenance your community can reduce the amount of stormwater pollution that is conveyed into local aquatic resources. It requires an examination of existing storm drain maintenance operations to identify where improvements can be made to reduce pollutant accumulation in catch basins, inlets and storm drain pipes. This can be accomplished within the context of the seven-step program planning and development process (Chapter 2), as described below.

Step 1: Identify Existing Municipal Operations

In this step, determine whether catch basin, inlet and storm drain cleanouts are currently conducted. If so, the next step in the process is to collect some basic information about how these activities are conducted. If not, you should consider developing a storm drain maintenance plan or investigating the other municipal operations that are conducted within the community.

Step 2: Collect Information About Each Operation

Once you have determined that your community currently conducts storm drain maintenance activities, the next step in the process is to collect some basic information about how those operations are conducted. Basic information to collect about the storm drain maintenance activities conducted in your community includes:

- Narrative description of the storm drain maintenance activities
- Locations of storm drain maintenance activities
    - Street address
    - Watershed and subwatershed address
    - Geospatial coordinates (e.g. latitude, longitude)
- Map showing locations of storm drain maintenance activities
- Operation manager name
- Operation manager contact information

This information should be added to the simple database or binder that contains the information about all of the municipal operations conducted in your community.

After collecting basic information about storm drain maintenance activities, begin communicating with the individual who oversees or manages these activities. This is an ideal time to inform this individual about the community's pollution prevention/good housekeeping efforts and its purpose. It is also a good time to educate them about the influence that storm drain maintenance can have on water quality and how it can be used to reduce the amount of pollution that has accumulated on public streets and roadways.

Step 3: Complete the Municipal Operations Analysis (MOA)

The next step in the process is to use the basic information that you have collected about the storm drain maintenance activities conducted in your community to complete Section 5 of the MOA. This section of the MOA asks a series of questions about the nature, scope and distribution of the storm drain maintenance operations. In some cases, you will be able to answer all of the questions using only the information that you have already collected about the street sweeping activities. In most cases, however, answering the questions will require additional input from the individual who manages or oversees your community's storm drain maintenance activities.

Once you have answered all of the questions presented within Section 5 of the MOA, you should calculate your score to determine how well your community is currently conducting its storm

drain maintenance activities. When you have completed the entire MOA, you should also compare the score that you received in Section 5 with the scores you received in each of the other sections of the analysis. This will help you focus your pollution prevention/good housekeeping efforts on the municipal operations that have the greatest influence on water quality in your community.

Step 4: Focus Pollution Prevention/Good Housekeeping Efforts

The next step in the process is to use the results of the MOA, as well as information about local subwatershed restoration goals and objectives, to develop a list of the municipal operations in the order in which they will be further investigated and improved. This list, known as the prioritized municipal operations list, can be used to guide your local pollution prevention/good housekeeping efforts and ensure that you are using your resources on improving the operations that have the greatest influence on water quality in your community. The operations at the top of the prioritized municipal operations list should be those that you will address first, while those at the bottom should be those that you will address over time.

If storm drain maintenance comes out on top of your prioritized municipal operations list, the next step in the process is to further investigate the way that storm drain maintenance activities are conducted in your community and determine the improvements that can be used to reduce the amount of pollution that has accumulated in inlets, catch basins and storm drain pipes. If it does not, you should begin investigating the operation that is located at the top of your list. The other profile sheets presented in this chapter provide additional information about investigating each of the other municipal operations.

Step 5: Investigate Municipal Operations and Select Pollution Prevention/Good Housekeeping Practices

Step 5.1: Collect Additional Information About Storm Drain Maintenance Activities

Once you have determined that storm drain maintenance will be the focus of your pollution prevention/good housekeeping efforts, the next step in the process is to collect some additional information about these activities to determine how they can be improve to reduce the amount of stormwater pollution that has accumulated in inlets, catch basins and storm drain pipes. To collect this additional information, you should coordinate with the individual who manages or oversees these activities. This individual will be able to answer questions about the storm drain maintenance activities and help you determine where improvements can be made. It is also a good opportunity for them to learn more about how street sweeping can influence stormwater quality. Table 2 provides a list of example questions that can be used to collect additional information from the individual who manages or oversees the storm drain maintenance activities conducted in your community.

Table 2: Sample Discussion Questions
• Are you familiar with our pollution prevention/good housekeeping efforts and the purpose of our municipal pollution prevention/good housekeeping program? • Do you understand how storm drain maintenance can impact stormwater quality? • How frequently do you perform catch basin, inlet and storm drain cleanouts? • How do you dispose of materials removed from the storm drain system? • What additional resources would you need to improve the community's existing storm drain maintenance program? • Do you provide regular stormwater pollution prevention training to employees who are involved with storm drain maintenance activities?

When collecting addition information about the storm drain maintenance activities conducted in your community, you should strive to determine how the storm drain system is currently being maintained, how frequently it is maintained and the technology that is used to maintain it. The basic idea is to determine if the storm drain maintenance program is operating at a level where measurable pollutant reductions can be achieved. In particular, you should evaluate:

- *Tracking* – the location and maintenance of storm drains should be tracked using a database and spatial referencing system (e.g., Global Positioning System, Geographic Information System). Additionally, knowing the type and era of the storm drain system may be of use since some inlets/catch basins are designed to be self-cleaning while others have some trapping capacity.

- *Frequency* – should be defined such that blockage of storm sewer outlet is prevented and it is recommended that the sump should not exceed 40 – 50 percent of its capacity. Semiannual cleanouts in residential streets and monthly cleanouts for industrial streets are suggested by Pitt and Bissonnett (1984) and Mineart and Singh (1994). More frequent cleanouts should be scheduled in the fall as leaves can contribute 25% of nutrient loadings in catch basins.

- *Technology* – the four common methods of cleaning catch basins are described in Table 3. Almost 65% of the Chesapeake Bay communities used vacuum-based technology or hydraulic suctions to cleanout storm drains (Figure 3). The remaining communities use more basic technology such as manual removal or bucket loaders.

- *Staff training* - operators need to be properly trained in catch basin maintenance including waste collection and disposal methods. Staff should also be trained to report water quality problems and illicit discharges. See profile sheet MO-10 for more on employee training.

- *Material disposal* - since catch basin waste may contain hazardous material, it should be tested and disposed of accordingly. Maintenance personnel should keep a log of the amount of sediment collected and the removal date at the catch basin.

Table 3: Equipment Used for Catch Basin and Inlet Cleaning (from Lager et al. 1979)	
Equipment	**Description**
Manual cleaning	Bail out sediment-laden water and shovel into street then truck. Or crew enters catch basin and fill buckets with sediment that are then carried to a dump truck. Clean water is used to refill the catch basin.
Eductor cleaning	Eductor truck evacuates the catchment of the sediment-laden water into a settling tank.
Vacuum cleaning	Air blower of the vacuum truck is used to create a vacuum and the air-solid-liquid material is separated in the vacuum truck unit by gravity separation and baffles.
Vacuum combination jet cleaning (e.g. Vaccon)	A vacuum assisted truck that uses a combination of air, water and hydraulic suction. Suction is used to extract material from storm inlets. Water is used to clear material from storm drain pipes that is not removed by the vacuum. The material is stored in the truck holding tank and transported for disposal.

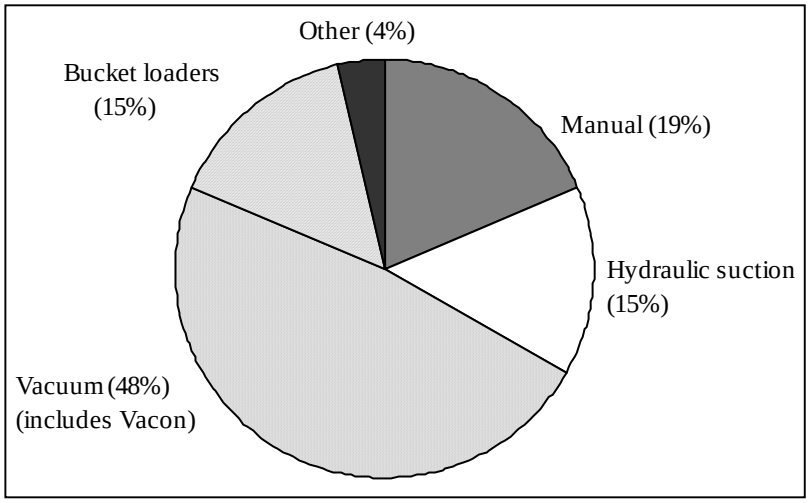

Figure 3. Most common storm drain cleanout technology used in NPDES Phase I and II Chesapeake Bay communities

Step 5.2: Conduct Field Investigations

After collecting some additional information about the storm drain maintenance activities in the community, it is time to conduct some field work to determine where storm drain maintenance can provide the most improvement to water quality (Figure 4). Conducting these field assessments is a key way to transform existing storm drain maintenance activities from reactive (response to resident complaints) to proactive activities. The Street and Storm Drains (SSD) investigation measures the average pollutant accumulation in the streets, curbs and catch basins of a subwatershed. The SSD can be used to characterize the current condition of storm drain infrastructure and the degree of pollutant accumulation in catch basins. This information should be used to quantify the impact of current maintenance practices on urban streams and identify changes to current storm drain maintenance program. For example, a high accumulation rate may suggest that more frequent and regular cleanouts are needed. The SSD is time intensive and

probably cannot be completed for all streets, but the stormwater manager should consider conducting the SSD in subwatersheds with impaired waters or sensitive aquatic resources. This information is particularly useful for communities with limited resources who may not be able to increase storm drain maintenance in all areas. For more information on the SSD, see Manual 11.

Figure 4. Conducting the SSD in Watershed 263, Baltimore, MD

Step 5.3: Prescribe Pollution Prevention/Good Housekeeping Practices

Once existing operations have been assessed, the next step in the process is to select and implement the pollution prevention/good housekeeping practices that can help improve water quality through storm drain maintenance procedures and training. In order to observe water quality improvements, most communities will need to track maintenance activities and increase frequency. Depending on the results of Step 1, a variety of improvements can be made to the way that storm drain maintenance currently occurs (Table 4). If resources are limited, storm drain maintenance should be concentrated on the dirtiest streets in sensitive subwatersheds at the right times of year (just before and after rainy season).

Table 4: Good Housekeeping Techniques for Storm Drain Cleanout
• Maintain a log of the amount of sediment collected and the date removed
• Analyze waste to determine the nature of disposal method
• Any liquids collected during cleanouts should be decanted and disposed of separately, depending on its hazard class
• Minimally clean once or twice per year (just before and just after the rainy season) or when the catch basin storage is one-third full, whichever happens first
• Plan cleaning to coincide with municipal street sweeping (MO-4)
• Locate and map all the catch basins within the community, and use these maps to promote widespread storm drain stenciling
• Keep records on accumulation rates within each individual catch basin using GIS or other tracking system
• Report all suspicious catch basins to appropriate local authorities for follow-up inspection and enforcement (e.g., inappropriate discharges and illegal dumping)

Step 5.4: Develop Implementation Plan

Once you have developed a targeted storm drain maintenance program, a brief implementation plan should be created. The plan should summarize the results of the assessment and the storm drain maintenance effort that will be used to reduce the amount of pollution that has accumulated in inlets, catch basins and storm drain pipes. The plan should also include a schedule that describes when the storm drain maintenance program will be implemented. The implementation plan can be used to guide the implementation of the prescribed storm drain maintenance program.

Step 6: Implement Pollution Prevention/Good Housekeeping Practices

Once an implementation plan has been created, the next step in the process is implementing the prescribed storm drain maintenance program. Although it may be tempting to hand the responsibility for implementation over to the individual who manages or oversees the community's storm drain maintenance activities, it is important to work with this individual during the implementation phase to get the prescribed storm drain maintenance program up and running. Simple techniques that can be used to do this include providing additional education and information about the prescribed storm drain program and providing assistance in securing funding for the program.

Step 7: Evaluate Progress in Implementation

The last step in the process involves evaluating the progress made in implementing the prescribed pollution prevention/good housekeeping practices. Measurable performance goals and implementation milestones will be needed to evaluate progress in implementation and track success in addressing local water quality issues and subwatershed restoration goals and objectives. Some example measurable goals and implementation milestones are presented in Table 5.

Table 5: Measurable Goals and Implementation Milestones for Improving Municipal Storm Drain Maintenance Operations[1]

Example Measurable Goals	Timeframe	Priority
Goals related to program startup		
Identify and collect basic information about current municipal storm drain maintenance operations	Complete shortly after program startup; update regularly after that	●
Add the information about storm drain maintenance activities to the simple database or binder that contains basic information about each municipal operation		●
Develop a digital (e.g. GIS) or hard copy map showing the location of all storm drain maintenance activities		◉
Complete Section 5 of the Municipal Operations Analysis (MOA)	Year 1; repeat every 5 years	●
Prioritize local pollution prevention/good housekeeping efforts based on the results of the MOA and other factors, such as local pollutants of concern		●
Goals related to preventing or reducing stormwater pollution		
Collect additional information about the way that storm drain maintenance activities are conducted within your community	Year 1	●
Prescribe pollution prevention/good housekeeping practices to address deficiencies and improve the way that the municipal storm drain system is maintained within your community		●
Develop implementation plan for prescribed pollution prevention/good housekeeping practices		●
Secure funding and resources to implement prescribed pollution prevention/good housekeeping practices	Begin in Year 1	●
Implement prescribed pollution prevention/good housekeeping practices	Begin in Year 2	●

Table 5: Measurable Goals and Implementation Milestones for Improving Municipal Storm Drain Maintenance Operations[1]		
Example Measurable Goals	**Timeframe**	**Priority**
Goals related to program evaluation		
Develop measurable performance goals and implementation milestones	Complete shortly after program startup; update regularly after that	●
Evaluate progress in meeting measurable goals and implementation milestones		●
Evaluate progress in implementing prescribed pollution prevention/good housekeeping practices	End of Year 1 and each year after that	●
Notes 1) Assumes that storm drain maintenance is as the top of your prioritized municipal operations list. *Key* ● = Essential ⦿ = Optional but Recommended		

The methods used to evaluate success in meeting these measurable performance goals and implementation milestones can be as simple as a semi-annual or annual inspections used to identify the improvements that have been put in place and the improvements that still need to be made.

Scoping the Required Level of Effort

The level of effort required to develop an effective storm drain maintenance program varies greatly from one community to the next. Basic guidance on scoping the level of effort required to improve storm drain maintenance operations is provided in Table 6. Communities can use this information to estimate the level of effort required to improve their own storm drain maintenance programs.

Table 6: Scoping the Level of Effort Required to Improve Storm Drain Maintenance Operations	
Step	**Staff Hours**
Step 1: Identify Existing Municipal Operations	4-8[1]
Step 2: Collect Information About Street Sweeping Activities	4-8
Step 3: Complete Section 5 of the Municipal Operations Analysis (MOA)	10-20
Step 4: Focus Pollution Prevention/Good Housekeeping Efforts	4-8[1]
Step 5: Investigate Municipal Operations and Select Pollution Prevention/Good Housekeeping Practices	80-200
Step 5.1: Collect Additional Information About Storm Drain Maintenance Activities	20-40
Step 5.2: Conduct Field Investigations	20-8
Step 5.3: Prescribe Pollution Prevention/Good Housekeeping Practices	20-40
Step 5.4: Develop Implementation Plan	20-40
Step 6: Implement Pollution Prevention/Good Housekeeping Practices	Varies[2]
Step 7: Evaluate Progress in Implementation	20-40/evaluation[1]
Notes 1: Represents total level of effort required to complete step for all municipal operations. 2: Varies according to the extent and type of improvements required.	

Resources

Urban Subwatershed Restoration Manual 11: Unified Subwatershed and Site Reconnaissance: A User's Manual. http://www.cwp.org/PublicationStore/USRM.htm

The Smart Watershed Benchmarking Tool.
http://cwp.org.master.com/texis/master/search/+/form/Smart_Watershed.html

U.S. EPA, Office of Water. Stormwater O&M Fact Sheet: Catch Basin Cleaning
http://www.epa.gov/owm/mtb/catchbas.pdf

Santa Clara Valley Urban Runoff Pollution Prevention Program
http://www.scvurppp.org/

MO-6	Municipal Operations	
	STORMWATER HOTLINE RESPONSE	

Description

A local stormwater hotline can be a dedicated or non-dedicated phone line, e-mail address or website where citizens can report a variety of water quality problems, including spills, dumping or suspicious discharges. Although there is an almost endless list of problems that could be reported through a stormwater hotline, some common examples include (Figure 1):

- A gasoline tanker traveling through town that has overturned
- A local do-it-yourself mechanic has dumped automotive fluids into a nearby storm drain
- A poorly-maintained construction site that is discharging a significant amount of sediment to a storm drain or stream
- A sanitary sewer overflow that has made its way to the surface and into a storm drain

Figure 1: A variety of water quality problems can be reported through a local stormwater hotline, including (clockwise from top left) emergency spills, illegal dumping, poor construction site management and sanitary sewer overflows.

Most of the time, municipal staff will not be able to prevent these events from happening, so prompt response to them is the best and sometimes only way to prevent them from negatively impacting local water resources. Local stormwater hotlines can be used to help communities determine when and where these events occur. With prompt and appropriate response to reports of these events, a community can reduce the amount of pollution that is conveyed into receiving waters through the municipal storm drain system.

Investigating and Improving the Operation

Improving the way that your community responds to reports of spills, dumping and illicit discharges can reduce the amount of stormwater pollution that is conveyed into local aquatic resources. It requires you to examine your existing stormwater hotline response procedures and identify the improvements that can be made to reduce the amount of stormwater pollution that is created by spills, dumping and illicit discharges create in your community. This can be accomplished within the context of the seven-step program planning and development process (Chapter 2), as described below.

Step 1: Identify Existing Municipal Operations

Recall that the first step in the process is to identify the municipal operations that are conducted within your community. In terms of stormwater hotline response, this means determining whether or not your community has a stormwater hotline that residents can use to report water quality problems. If it does, the next step in the process is to collect some basic information about how your community responds to reports made through the hotline. If not, you should consider developing a local stormwater hotline or begin investigating the other municipal operations that are conducted within your community.

Step 2: Collect Information About Each Operation

Once you have determined that your community does provide a stormwater hotline that residents can use to report water quality problems, the next step in the process is to collect some basic information about how that hotline is managed. Basic information to collect about the stormwater hotline response activities conducted in your community includes:

- Narrative description of procedures used to track and document hotline reports
- Information about previous hotline reports
    - Type (e.g. spill, illicit discharge, sanitary sewer overflow)
    - Street address
    - Watershed and subwatershed address
    - Geospatial coordinates (e.g. latitude, longitude)
- Map showing locations of previous hotline reports
- Operation manager name
- Operation manager contact information

This information should be added to the simple database or binder that contains the information about all of the municipal operations conducted in your community.

As you collect some basic information about the stormwater hotline response activities conducted within your community, you should be communicating with the individual who oversees or manages these activities. This is an ideal time to inform these individuals about the community's pollution prevention/good housekeeping efforts and the purpose of the community's municipal pollution prevention/good housekeeping program. It is also a good time to educate them on how a stormwater hotline response can be used to improve water quality and reduce stormwater pollution.

Step 3: Complete the Municipal Operations Analysis (MOA)

The next step in the process is to use the basic information that you have collected about the stormwater hotline response activities conducted in your community to complete Section 6 of the MOA. This section of the MOA asks a series of questions about the nature, scope and distribution of the street sweeping operations conducted within your community. In some cases, you will be able to answer all of the questions using only the information that you have already collected about the street sweeping activities. In most cases, however, answering the questions will require additional input from the individual who manages or oversees your community's street sweeping operation.

Once you have answered all of the questions presented within Section 6 of the MOA, you should calculate your score to determine how well your community is currently conducting its street sweeping activities. When you have completed the entire MOA, you should also compare the score that you received in Section 4 with the scores you received in each of the other sections of the analysis. This will help you focus your pollution prevention/good housekeeping efforts on the municipal operations that have the greatest influence on water quality in your community.

Step 4: Focus Pollution Prevention/Good Housekeeping Efforts

The next step in the process is to use the results of the MOA, as well as information about local subwatershed restoration goals and objectives, to develop a list of the municipal operations in the order in which they will be further investigated and improved. This list, known as the prioritized municipal operations list, can be used to guide your local pollution prevention/good housekeeping efforts and ensure that you are using your resources on improving the operations that have the greatest influence on water quality in your community. The operations at the top of the prioritized municipal operations list should be those that you will address first, while those at the bottom should be those that you will address over time.

If street sweeping comes out on top of your prioritized municipal operations list, the next step in the process is to further investigate the way that street sweeping activities are conducted in your community and determine the improvements that can be used to reduce the amount of pollution that has accumulated on public streets and roadways. If it does not, you should begin investigating the operation that is located at the top of your list. The other profile sheets presented in this chapter provide additional information about investigating each of the other municipal operations.

Step 5: Investigate Municipal Operations and Select Pollution Prevention/Good Housekeeping Practices

Step 5.1: Assess Local Stormwater Hotline and Incident Tracking Procedures

Once you have determined that stormwater hotline response will be the focus of your pollution prevention/good housekeeping efforts, the next step in the process is do assess the procedures used to respond to reports received through the hotline. Local stormwater hotlines can take a variety of forms, depending on the size of the community and the number of reports that it might receive. Some communities use a dedicated phone line, e-mail address or website to field reports, while others use the phone number or email address of a particular staff member, department or agency for this purpose. No matter which option is used, communities should advertise the contact information for their local stormwater hotline several times a year. Advertising serves several purposes and many communities have noted an increase in incident reporting following an advertising campaign (CWP and Pitt, 2004). Effective advertising methods include magnets, stickers, phone book advertisements, flyers, utility or tax bill inserts, displays and newspaper articles.

If a community does provide a local stormwater hotline, you should check to make sure that complaints are documented and tracked and that an incident report is completed for each complaint received. The simplest way to collect this information is to consult with the individual responsible for managing the local stormwater hotline.

If complaints are not documented and tracked, you should work with the individual responsible for managing the local stormwater hotline to create a tracking and reporting system. The amount of information that should be collected about each complaint depends on a number of factors, including the size of the community, the number of complaints it receives, and the resources (e.g. staff time, staff availability, technical resources) that it has available. Many communities collect only basic information about each incident; however, some communities will collect more detailed information can be used to help prioritize and guide follow-up investigations. At the very least, incident reports should contain the information presented in Table 1 (U.S. EPA Office of Emergency and Remedial Response; 1990; MDE, 2003). CWP and Pitt (2004) provides additional information about creating an incident tracking and reporting system.

A local stormwater hotline can help a regulated municipality meet a number of the minimum control measures outlined in the NPDES Phase II regulations, including public education and outreach, illicit discharge detection and elimination, construction site runoff control and municipal good housekeeping. If the municipality has not yet established a stormwater hotline, consult the additional resources section at the end of this profile sheet for additional guidance on setting one up.

Table 1: Information to Record in an Incident Report	
• Date and time of the incident • Weather conditions • Location of the incident • Whether it was a transportation-related incident or a spill or discharge from a specific location • Type of material spilled • Estimated amount of material spilled • Duration of the spill or discharge • Cause of the spill or discharge	• Response procedures implemented • Agencies and departments involved in cleanup activities • Materials/methods used for cleanup • Additional persons or agencies notified • Person/company responsible for the incident and their contact information • Potential environmental problems associated with the incident

Step 5.2: Assess Local Incident Response Procedures

The next task is to assess local incident response procedures. As they are fielded, incident reports should be passed along to the appropriate response agency. Some reports may need to be passed on to the appropriate response agency right away (e.g. emergency spills), while others are not as critical. The individual responsible for managing the local stormwater hotline should be able to identify the proper response procedures and the agencies that are responsible for responding to a variety of incident reports in your community.

At this point, you should work with the individual responsible for managing the local stormwater hotline to identify the proper response agency for each type of incident report that the community may receive. Typically, the fire department serves as the responder to non-sewage spills, and the public works department serves as the responder to sewage overflows and illicit discharges. A simple table, like that shown in Table 2, can be used to compile this information. If you find that there is no agency assigned to respond to a particular type of hotline complaint, you should work with the individual responsible for managing the local stormwater hotline to determine who is best suited to handle that type of complaint.

Table 2: Example Incident Responder Database

Hotline Report	Responsible Agency or Department
Emergency Spill	Fire Department
Sanitary Sewer Overflow	Department of Public Works
Combined Sewer Overflow	Department of Public Works
Illicit Discharge	Department of Public Works
Illegal Dumping	Department of Public Works
Poorly Maintained Construction Site	Building Services Department
Traffic Control/Public Safety	Police Department

In some hotline response situations, such as emergency spills, local and/or state police may be needed to help manage traffic and keep onlookers safe. Therefore, local and state police agencies should be included in the contact database as an agency supporting stormwater hotline response activities.

Once an incident report is received, response teams should react according to the procedures outlined in a written response plan. Response plans should summarize appropriate response procedures and should indicate when it is appropriate to call in additional agencies or departments for support. The plan should also contain contact information for the other responding agencies so that it is readily available in the field. At a minimum, response plans should:

- Identify the individuals involved with response activities
- Outline the procedures for containing, diverting, isolating, and cleaning up the spill or discharge
- Describe the response equipment to be used, including safety and clean up equipment
- Outline the procedures for proper disposal of clean up materials, including contaminated tools, equipment and clothing
- Describe the hazards of and safety measures to be taken with each type of spill or discharge
- Specify when to call in additional agencies or departments, such as police and fire departments, hospitals, or public works departments for support
- Provide contact information for the additional agencies or departments that may need to be called in for support

You should consult with each of the response agencies in your community to determine if written response plans have been created and if they include the information described above. If not, you should work with them to create or revise their response plans. The information presented in Table 3 can be helpful in developing response plans for local response agencies.

Table 3: General Spill and Discharge Response Procedures (CASQA, 2003)

- Prevent wet and dry spills from entering the storm drain system by installing temporary barriers around catch basins and inlets
- Use a rag, damp cloth or absorbent materials to clean up small quantities of non-hazardous liquids
- Clean up of larger quantities of non-hazardous liquids can be achieved with the use of absorbents, gels and foams
- Use brooms or shovels to clean up of small quantities of dry materials; street sweepers may be used to clean up larger quantities of dry materials
- Promptly remove and properly dispose of any adsorbent materials used to clean up liquid spills
- If water is used to clean up spills or other discharges, it must be collected and properly disposed of; wash water cannot be allowed to enter the storm drain system
- Clean or dispose of any equipment used to clean up the spill properly
- For hazardous or very large spills, a private cleanup company or Hazmat team may need to be contacted to assess the situation and/or conduct the cleanup and disposal of the materials
- If the spilled material is hazardous, then the used cleanup materials and equipment are also hazardous and must be sent to a certified laundry or disposed of as hazardous waste

Step 5.3: Assess Local Incident Response Training Programs

The next step in the process is to determine whether or not regular training is provided to the employees involved with incident response activities in your community. If not, you should work with each of the response agencies to develop employee training programs. The level of training provided to each employee depends on the types of incidents they respond to and the types of materials that they may deal with in the field. At a minimum, training programs should:

- Detail the procedures to contain, divert, isolate and clean up a spill or discharge
- Describe the response equipment to be used, including safety and cleanup equipment
- Outline the procedures for proper disposal of clean up materials, including contaminated tools, equipment and clothing
- Describe the hazards associated with and safety measures to be taken with each type of spill or discharge
- Provide contact information for the additional agencies and departments that may need to be called in for support

Several of the additional resources highlighted at the end of this profile sheet provide information that can be used to educate employees on proper incident response procedures.

> The local fire department, HAZMAT team, or other municipal entity assigned to dealing specifically with hazardous materials will require specialized training. OSHA and EPA regulations define five training levels for emergency responders based on the functions they may be expected to perform at a hazardous materials incident (U.S. Fire Administration, 1999):
>
> 1. *First Responder Awareness* – Individuals that are likely to witness or discover the release of a hazardous material. Personnel should be trained to initiate the appropriate response activities and take no further action.
> 2. *First Responder Operations* – Individuals that respond to reports of releases of hazardous substances as part of initial response activity. Personnel are expected to take defensive actions without trying to stop the release for the purpose of protecting persons, property, and the environment. This is generally considered the minimum acceptable level of training for members of fire and EMS departments.
> 3. *Hazardous Materials Technician* – Individuals that respond to a hazardous materials incident for the purpose of stopping the release. These individuals are often members of a Hazmat team.
> 4. *Hazardous Materials Specialist* – Individuals that respond with and support hazardous materials technicians. They possess specialized knowledge of chemical hazards or container characteristics.
> 5. *On-scene Incident Commander* – Individuals that assume control of the incident beyond the first responder awareness level. This individual must possess minimum training at the first responder operations level with additional knowledge of state, local, and federal response plans.

Step 5.4: Prescribe Pollution Prevention/Good Housekeeping Practices

Once you have assessed your community's existing stormwater hotline and its response procedures, the next step in the process is to prescribe some pollution prevention/good housekeeping practices that can help improve them. Depending on the results of the assessment, a variety of pollution prevention/good housekeeping practices can be used to improve an existing stormwater hotline or existing stormwater hotline response procedures (Table 4).

Table 4: Ways to Improve Stormwater Hotline Response Procedures	
Existing Condition	**Recommended Improvements**
Community does not currently provide a stormwater hotline	Develop a local stormwater hotline and assign a staff member, department or agency to be responsible for managing the hotline
Contact information for the local stormwater hotline is not regularly advertised	Advertise the contact information for the local stormwater hotline on a regular basis; effective advertising methods include magnets, stickers, phone book advertisements, flyers, utility or tax bill inserts, displays and newspaper articles
No department or agency assigned to respond to a particular type of spill or discharge	Work with the stormwater hotline manager to determine what agency or department is best suited to respond to that type of complaint Provide the response entity with appropriate training
No standard response plans in place for responding to reports of spills and other discharges	Work with the appropriate response agency or department to develop or revise standard response plans for each type of hotline report Provide the response entity with appropriate training
Hotline reports are not currently documented or tracked	Work with the stormwater hotline manager to develop an incident tracking system
No regular training is provided for employees involved with hotline response activities	Develop a training program that can be used to educate employees involved in hotline response activities

Step 5.5: Develop Implementation Plan

Once you have prescribed some pollution prevention/good housekeeping practices, a brief implementation plan should be created. The plan should summarize the results of the assessment and the improvements that will be made to the community's existing stormwater hotline and hotline response procedures. The plan should also include a schedule that describes some implementation milestones for the recommended improvements. The implementation plan can be used to guide the implementation of the prescribed pollution prevention/good housekeeping practices.

Step 6: Implement Pollution Prevention/Good Housekeeping Practices

Once an implementation plan has been created, the next step in the process is implementing the prescribed pollution prevention/good housekeeping practices. Although it may be tempting to hand the responsibility for implementation over to the individual who manages or oversees the community's stormwater hotline, it is important to work with this individual during the implementation phase to get the recommended improvements "in the ground." Simple techniques that can be used to do this include providing additional education and information about the prescribed storm drain program and providing assistance in securing funding for the program.

Step 7: Evaluate Progress in Implementation

The last step in the process involves evaluating the progress made in implementing the prescribed pollution prevention/good housekeeping practices. Measurable performance goals and implementation milestones will be needed to evaluate progress in implementation and track success in addressing local water quality issues and subwatershed restoration goals and objectives. Some example measurable goals and implementation milestones are presented in Table 4.

Table 4: Measurable Goals and Implementation Milestones for Improving Municipal Stormwater Hotline Response[1]

Example Measurable Goals	Timeframe	Priority
Goals related to program startup		
Identify and collect basic information about the local stormwater hotline and hotline response procedures	Complete shortly after program startup; update regularly after that	●
Add the information about the local stormwater hotline and hotline response procedures to the simple database or binder that contains basic information about each municipal operation		●
Complete Section 6 of the Municipal Operations Analysis (MOA)	Year 1; repeat every 5 years	●
Prioritize local pollution prevention/good housekeeping efforts based on the results of the MOA and other factors, such as local pollutants of concern		●
Goals related to preventing or reducing stormwater pollution		
Further investigate and assess local stormwater hotline and incident tracking procedures	Year 1	●
Investigate and assess local incident response procedures		●
Investigate and assess local incident response training programs		●
Develop implementation plan for prescribed pollution prevention/good housekeeping practices		●
Prescribe pollution prevention/good housekeeping practices to address deficiencies and improve stormwater hotline response procedures within your community		
Secure funding and resources to implement prescribed pollution prevention/good housekeeping practices	Begin in Year 1	●
Implement prescribed pollution prevention/good housekeeping practices	Begin in Year 2	●
Goals related to program evaluation		
Develop measurable performance goals and implementation milestones	Complete shortly after program startup; update regularly after that	●
Evaluate progress in meeting measurable goals and implementation milestones		●
Evaluate progress in implementing prescribed pollution prevention/good housekeeping practices	End of Year 1 and each year after that	●

Notes
1) Assumes that stormwater hotline response is as the top of your prioritized municipal operations list.
Key
● = Essential
⦿ = Optional but Recommended

The methods used to evaluate success in meeting these measurable performance goals and implementation milestones can be as simple as a semi-annual or annual inspections used to identify the improvements that have been put in place and the improvements that still need to be made.

Scoping the Required Level of Effort

General guidance on scoping the level of effort needed to improve local stormwater hotline response procedures is provided in Table 6. Be sure to communicate and coordinate with the hotline manager and each of the response agencies in your community to reduce the level of effort needed to conduct the assessment, as they will be most familiar with the existing operation and may already have ideas on how it can be improved. Be sure to budget enough time to review the incident response plans, as this step requires coordination with each of the response entities and usually consumes the most staff time.

Table 5: Scoping the Level of Effort Required to Improve Stormwater Hotline Response Procedures

Step	Staff Hours
Step 1: Identify Existing Municipal Operations	4-8[1]
Step 2: Collect Information About Stormwater Hotline Response Procedures	4-8
Step 3: Complete Section 6 of the Municipal Operations Analysis (MOA)	10-20
Step 4: Focus Pollution Prevention/Good Housekeeping Efforts	4-8[1]
Step 5: Investigate Municipal Operations and Select Pollution Prevention/Good Housekeeping Practices	80-160
Step 5.1: Assess Local Stormwater Hotline and Incident Tracking Procedures	10-20
Step 5.2: Assess Local Incident Response Procedures	10-20
Step 5.3: Assess Local Incident Response Training Programs	20-40
Step 5.4: Prescribe Pollution Prevention/Good Housekeeping Practices	20-40
Step 5.5: Develop Implementation Plan	20-40
Step 6: Implement Pollution Prevention/Good Housekeeping Practices	Varies[2]
Step 7: Evaluate Progress in Implementation	20-40/evaluation[1]

Notes
1: Represents total level of effort required to complete step for all municipal operations.
2: Varies according to the extent and type of improvements required.

Resources

Illicit Discharge Detection and Elimination: A Guidance Manual for Program Development and Technical Assessments. http://www.cwp.org/PublicationStore/TechResearch.htm

Urban Subwatershed Restoration Manual 8: Pollution Source Control Practices. http://www.cwp.org/PublicationStore/USRM.htm

The Smart Watershed Benchmarking Tool
http://cwp.org.master.com/texis/master/search/+/form/Smart_Watershed.html

U.S. EPA National Menu of Stormwater BMPs: Community Hotlines.
http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=24

Orange County, CA. Online Stormwater Pollution Reporting Form.
http://www.freethmoroz.com/ocsw/pollution_reporting.htm

City of Seattle, WA. Reporting Surface Water Pollution.
http://www.seattle.gov/util/Services/Drainage_&_Sewer/Keep_Water_Safe_&_Clean/COS_002180.asp

California Stormwater Best Management Practice Handbook: Municipal
http://www.cabmphandbooks.com/

Maryland Department of the Environment Spill Report Form. .
http://www.mde.state.md.us/assets/document/emergency/mdespillreport.pdf

MO-7	Municipal Operation PARK AND LANDSCAPE MAINTENANCE	

Description

Figure 1. A yellow "Caution" sign alerts patrons to a recent pesticide application at this municipal park.

A community may own or control as much as 10% of all the land within a subwatershed, when all the parks, schools, golf courses, rights-of-way, easements, open space and municipal buildings are combined. It is not uncommon for these areas to be managed as vast expanses of turf (Figure 1). The maintenance of these areas frequently includes mowing, fertilization, pesticide application, and supplemental irrigation. Poor turf management and landscaping practices have the potential to create stormwater pollution, particularly in urban areas where soils are compacted and infiltration is minimized. Potential pollutants generated by landscape and park maintenance include nutrients, herbicides, organic debris, and sediment. Because of their large size and ownership, municipal lands are good candidates for pollution prevention/good housekeeping techniques such as riparian reforestation and integrated pest management.

Investigating and Improving the Operation

Improving the way that park and landscape maintenance activities are conducted within your community can reduce the amount of stormwater pollution that is conveyed into local aquatic resources. It requires you to examine your existing park and landscape maintenance operations and identify the improvements that can be used to reduce the amount of stormwater pollution they create. This can be accomplished within the context of the seven-step program planning and development process (Chapter 2), as described below.

Step 1: Identify Existing Municipal Operations

Recall that the first step in the process is to identify the municipal operations that are conducted within your community. In terms of municipal park and landscape maintenance, this means determining whether or not your community conducts any of these activities on publicly owned properties greater than one acre in size. If it does, the next step in the process is to collect some basic information about those maintenance activities. If not, you should begin investigating the other municipal operations that are conducted within your community.

Step 2: Collect Information About Each Operation

Once you have determined that your community does conduct park and landscape maintenance, the next step in the process is to collect some basic information about how those activities. Basic information to collect about the park and landscape maintenance activities conducted in your community includes:

- Narrative description of park and landscape maintenance activities
- Locations of park and landscape maintenance activities
    - Name
    - Street address
    - Watershed and subwatershed address
    - Geospatial coordinates (e.g. latitude, longitude)
    - Parcel size
- Map showing locations of park and landscape maintenance activities
- Operation manager name
- Operation manager contact information

This information should be added to the simple database or binder that contains the information about all of the municipal operations conducted in your community.

As you collect some basic information about the park and landscape maintenance activities conducted within your community, you should begin communicating with the individuals who oversee or manage those activities. This is an ideal time to inform these individuals about the community's pollution prevention/good housekeeping efforts and the purpose of the community's municipal pollution prevention/good housekeeping program. It is also a good time to educate them about the influence that park and landscape maintenance can have on water quality and how pollution prevention/good housekeeping practices can be used to reduce the amount of stormwater pollution that these activities create.

Step 3: Complete the Municipal Operations Analysis (MOA)

The next step in the process is to use the basic information that you have collected about the park and landscape maintenance activities conducted in your community to complete Section 7 of the MOA. This section of the MOA asks a series of questions about the nature, scope and distribution of the park and landscape maintenance activities conducted within your community. In some cases, you will be able to answer all of the questions using only the information that you have already collected about these activities. In most cases, however, answering the questions will require additional input from the individuals who manage or oversee each of the operations as well as site visits to the locations or areas where the activities are being conducted.

Once you have answered all of the questions presented within Section 7 of the MOA, you should calculate your score to determine how well your community is currently managing its park and landscape maintenance activities. When you have completed the entire MOA, you should also compare the score that you received in Section 7 with the scores you received in each of the other sections of the analysis. This will help you focus your pollution prevention/good

housekeeping efforts on the municipal operations that have the greatest influence on water quality in your community.

Step 4: Focus Pollution Prevention/Good Housekeeping Efforts

The next step in the process is to use the results of the MOA, as well as information about local subwatershed restoration goals and objectives, to develop a list of the municipal operations in the order in which they will be further investigated and improved. This list, known as the prioritized municipal operations list, can be used to guide your local pollution prevention/good housekeeping efforts and ensure that you are using your resources on improving the operations that have the greatest influence on water quality in your community. The operations at the top of the prioritized municipal operations list should be those that you will address first, while those at the bottom should be those that you will address over time.

If park and landscape maintenance comes out on top of your prioritized municipal operations list, the next step in the process is to further investigate the way that these activities are conducted within your community to determine the pollution prevention/good housekeeping practices that can be used to reduce the amount of stormwater pollution they create. If it does not, you should begin investigating the operation that is located at the top of your list. The other profile sheets presented in this chapter provide additional information about investigating each of the other municipal operations.

Step 5: Investigate Municipal Operations and Select Pollution Prevention/Good Housekeeping Practices

Step 5.1: Collect Additional Information About Park and Landscape Maintenance Activities

Once you have determined that park and landscape maintenance will be the focus of your pollution prevention/good housekeeping efforts, the next step in the process is to collect some additional information about this operation to determine how it can be improved to reduce the amount of stormwater pollution they create. To collect this additional information, you should coordinate with the individuals who manage or oversee the park and landscape maintenance activities conducted in your community. These individuals will be able to answer questions about the park and landscape maintenance activities and help you determine where improvements can be made. It is also a good opportunity for them to learn more about how park and landscape maintenance can influence stormwater quality. Table 2 provides a list of example questions that can be used to collect additional information from the individuals who manage or oversee the park and landscape maintenance activities conducted in your community.

Table 2: Example Discussion Questions
• Are you familiar with our pollution prevention/good housekeeping efforts and the purpose of our municipal pollution prevention/good housekeeping program? • Do you understand how routine park and landscape maintenance activities can influence water quality? • Are pesticides and fertilizers regularly used at the properties that you maintain? If so, do you use any procedures to ensure that you are applying the appropriate amount of these chemicals? • Do the properties that you maintain have permanent and/or temporary irrigation

Table 2: Example Discussion Questions
systems? • How are landscaping debris and grass clippings disposed of on the properties that you maintain? • Does the list consider performance on erosion and sediment control and stormwater management? • What additional resources would you need to improve the community's existing park and landscape maintenance program? • Do you provide regular stormwater pollution prevention training to employees who are involved with park and landscape maintenance activities?

Begin your follow-up investigation by interviewing the community's urban forester, if one exists. Working in conjunction with the community's urban forester and other community forestry staff will be key to improving the way that park and landscape maintenance activities are conducted within your community.

When collecting addition information about the park and landscape maintenance activities conducted in your community, you should strive to identify the specific activities that are conducted, how frequently these activities are carried out and the pollution prevention/good housekeeping practices that may already be in place to control the stormwater pollution that they create. In particular, you should evaluate:

- Fertilizer application timing and rates
- Pesticide/herbicide application timing and rates
- Irrigation practices
- Turf management practices
- Native landscaping/tree planting efforts

Step 5.2: Conduct Field Investigations

The next step in the process is to investigate each publicly owned property greater than one acre in size to identify subwatershed restoration and pollution prevention/good housekeeping opportunities. These investigations can be completed using the Pervious Area Assessment (PAA) and Hotspot Site Investigation (HSI) and Unified Stream Assessment (USA).

The PAA evaluates the feasibility of conducting reforestation or other revegetation efforts on large pervious areas. The PAA can be used to identify and prioritize reforestation projects at golf courses, parks and schools that will provide significant water quality and water quantity benefits and will help address subwatershed restoration goals and objectives. Manual 11 contains additional information about conducting the PAA.

The HSI can be used to systematically evaluate six categories of pollution-generating activities that commonly contribute to stormwater quality problems:

- Outdoor Materials Handling
- Physical Plant Maintenance
- Stormwater Infrastructure
- Turf/Landscape Management
- Vehicle Operations
- Waste Management

When conducting the HSI, you should focus your attention on the turf/landscape management activities. Doing so will help you quickly identify the pollution prevention/good housekeeping practices that can be used to improve the way that these activities are conducted. Manual 11 contains additional information about conducting the HSI.

The USA can be used to assess and evaluate park and landscape maintenance procedures and subwatershed restoration opportunities within the stream corridor. The USA should be completed for all streams that pass through the publicly owned lands in your community. The results of the USA can be used to identify opportunities for riparian reforestation, as well as other subwatershed restoration opportunities that are not directly related to park and landscape maintenance (e.g. streambank stabilization, illicit discharge detection and elimination and trash removal). Manual 10 contains additional information about conducting the USA.

Step 5.3: Prescribe Pollution Prevention/Good Housekeeping Practices

Once you have completed your field investigations, the next step in the process is to identify some pollution prevention/good housekeeping practices that can be used to improve the park and landscape maintenance activities conducted within your community. You can also use this step to identify some subwatershed restoration practices that can be implemented on the publicly owned properties found within your community. In most cases, pollution prevention/good housekeeping and subwatershed restoration practices can be developed using the information that was gathered during the initial field investigation. In a few cases, however, additional site visits may be required.

A wide range of pollution prevention/good housekeeping practices can be used to improve the way that park and landscape maintenance activities are conducted within a community. Some of the most commonly used practices are listed in Table 3.

Table 3: Pollution Prevention/Good Housekeeping Practices Commonly Used to Improve Park and Landscape Maintenance Operations

Activity	Pollution Prevention/Good Housekeeping Practices
Turf Reduction	• Plant trees and/or other native vegetation in suitable areas • Consider turf alternatives, such as native or low-water, cool-season turf grass • Allow natural regeneration in suitable areas
Turf Management	• Sweep any grass clippings away from paved surfaces after mowing • Use mulching type mowers or dispose of at local composting facility • Use erosion control measures when soils are exposed • Place stockpiled materials away from storm drains
Native Plantings	• Provide native and naturalized landscaping guidance and plant lists • Require use of appropriate native and naturalized landscaping on municipally-owned properties
Landscape Management	• Collect landscape waste (including grass clippings) and dispose of at a local yard waste recycling/composting facility • Do not use leaf blowers to blow waste into streets, storm drains or ditches
Pesticide/Herbicide Application	• Develop an integrated pest management plan that uses pesticides only as a last resort • Apply only when rain is not expected • Do not prepare herbicides or pesticides for application near storm drains • Use manual and/or mechanical methods to remove weeds rather than

Table 3: Pollution Prevention/Good Housekeeping Practices Commonly Used to Improve Park and Landscape Maintenance Operations	
Activity	**Pollution Prevention/Good Housekeeping Practices**
	herbicides • Consider a low or no pesticide approach to maintaining landscaped areas
Fertilizer Application	• Never apply fertilizers or pesticides within five feet of pavement, 25 feet of a storm drain inlet, or 50 feet of a stream or water body • Consider a low or no fertilizer approach to maintain turf • Apply only when rain is not expected • Perform a soil test to determine actual fertilization needs and application rate • Calibrate fertilizer spreaders to avoid excessive application
Irrigation	• Employ shutoff devices to prevent irrigation after precipitation or if a pressure drop occurs due to broken sprinkler heads or lines • Design irrigation systems specific to each landscaped area's water requirements • Select native plant species whenever possible and group together plants with similar water requirements in order to reduce excess irrigation • Use soaker hoses not sprinklers and irrigate in the morning or evening to conserve water
Employee Training	• Train employees on the use and appropriate application of pesticides, herbicides and fertilizers • Ensure that designated no mow areas are well advertised • Educate staff on the benefits of trees and native and naturalized species

Step 5.4: Develop Implementation Plan

The next step in the process is to develop a brief implementation plan. The implementation plan should summarize the results of assessment and field investigations, the specific pollution-generating activities associated with each publicly-owned property and the pollution prevention/good housekeeping practices that will be used to address each of these activities. Implementation plans should also include a schedule that describes some implementation milestones for the prescribed pollution prevention/good housekeeping practices. The contents of each implementation plan should be developed in cooperation with the individuals responsible for managing or overseeing each of the park and landscape maintenance activities.

A key element of each implementation plan is an estimate of the budget required to implement the recommended pollution prevention/good housekeeping practices. Although providing detailed cost information about all of the pollution prevention/good housekeeping practices that can be used to address the specific pollution-generating activities associated with municipal park and landscape maintenance activities is beyond the scope of this manual, there are some useful resources that can be used to gather this information, including Manual 8 and U.S. EPA's *National Menu of Stormwater Management Best Management Practices*, which is available online at: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm.

Step 6: Implement Pollution Prevention/Good Housekeeping Practices

Once your existing park and landscaping activities have been investigated and assessed, the next step in the process is implementing the prescribed pollution prevention/good housekeeping practices. Although it may be tempting to hand the responsibility for implementation over to the

local parks department or individual who manages or oversees the park and landscape maintenance activities conducted in your community, it is important to work with them during the implementation phase to get the recommended improvements "in the ground."

Step 7: Evaluate Progress in Implementation

The last step in the process involves evaluating the process made in implementing the prescribed pollution prevention/good housekeeping practices. Measurable performance goals and implementation milestones will be needed to evaluate progress in implementation and track success in addressing local water quality issues and subwatershed restoration goals and objectives. Some example *output-based* measurable goals and implementation milestones are presented in Table 4. They can be thought of as activities that need to be completed in order to improve the way that municipal stormwater hotspot facilities are managed in your community.

Table 4: Measurable Goals and Implementation Milestones for Improving Municipal Park and Landscape Maintenance Operations[1]

Example Measurable Goals	Timeframe	Priority
Goals related to program startup		
Identify and collect basic information about current municipal park and landscape maintenance operations	Complete shortly after program startup; update regularly after that	●
Add the information about park and maintenance activities to the simple database or binder that contains basic information about each municipal operation		●
Develop a digital (e.g. GIS) or hard copy map showing the location of all current municipal park and landscape maintenance activities		⦿
Complete Section 7 of the Municipal Operations Analysis (MOA)	Year 1; repeat every 5 years	●
Prioritize local pollution prevention/good housekeeping efforts based on the results of the MOA and other factors, such as local pollutants of concern		●
Goals related to preventing or reducing stormwater pollution		
Collect additional information about the way that park and landscape maintenance activities are conducted within your community	Year 1	●
Prescribe pollution prevention/good housekeeping practices to address deficiencies and improve the way that the parks and landscaped areas are maintained within your community		●
Develop implementation plan for prescribed pollution prevention/good housekeeping practices		●
Secure funding and resources to implement prescribed pollution prevention/good housekeeping practices	Begin in Year 1	●
Implement prescribed pollution prevention/good housekeeping practices	Begin in Year 2	●
Goals related to program evaluation		
Develop measurable performance goals and implementation milestones	Complete shortly after program startup; update	●

Table 4: Measurable Goals and Implementation Milestones for Improving Municipal Park and Landscape Maintenance Operations[1]		
Example Measurable Goals	**Timeframe**	**Priority**
Evaluate progress in meeting measurable goals and implementation milestones	regularly after that	●
Evaluate progress in implementing prescribed pollution prevention/good housekeeping practices	End of Year 1 and each year after that	●
Notes 1) Assumes that park and landscape maintenance is as the top of the prioritized municipal operations list. *Key* ● = Essential ⦿ = Optional but Recommended		

The methods used to evaluate success in meeting these measurable performance goals and implementation milestones can be as simple as semi-annual or annual inspections used to identify the pollution prevention/good housekeeping practices that have been put in place and the improvements that still need to be made.

Scoping the Required Level of Effort

The level of effort required to improve the way that municipal park and landscape maintenance activities are conducted varies greatly from one community to the next. It depends on the type of landscape and maintenance activities that are conducted within the community, the frequency and scope of those activities and on the number and type of pollution prevention/good housekeeping practices that are needed to improve those activities. Basic guidance on scoping the level of effort required to improve local park and landscape maintenance operations is provided in Table 5. Communities can use this information to scope the level of effort required to improve their own park and landscape maintenance activities.

Table 5: Scoping the Level of Effort Required to Improve Municipal Park and Landscape Maintenance Operations[1]	
Step	**Staff Hours**
Step 1: Identify Existing Municipal Operations	4-8[1]
Step 2: Collect Information About Park and Landscape Maintenance Activities	4-8
Step 3: Complete Section 7 of the Municipal Operations Analysis (MOA)	10-20
Step 4: Focus Pollution Prevention/Good Housekeeping Efforts	4-8[1]
Step 5: Investigate Municipal Operations and Select Pollution Prevention/Good Housekeeping Practices	120-240
Step 5.1: Collect Additional Information About Park and Landscape Maintenance Activities	20-40
Step 5.2: Conduct Field Investigations (two staff per team)	
USA	8/stream mile
PAA	1/site
HSI	2/site
Post-Processing	40-60
Step 5.3: Prescribe Pollution Prevention/Good Housekeeping Practices	20-40
Step 5.4: Develop Implementation Plan	20-40
Step 6: Implement Pollution Prevention/Good Housekeeping Practices	Varies[2]
Step 7: Evaluate Progress in Implementation	20-40/evaluation[1]

Table 5: Scoping the Level of Effort Required to Improve Municipal Park and Landscape Maintenance Operations[1]
Notes 1: Represents total level of effort required to complete step for all municipal operations. 2: Varies according to the extent and type of improvements required.

Resources

Urban Watershed Forestry Manual Part 1: Methods for Increasing Forest Cover in a Watershed http://www.cwp.org/forestry/index.htm

Urban Subwatershed Restoration Manual 8: Pollution Source Control Practices http://www.cwp.org/PublicationStore/USRM.htm

Urban Subwatershed Restoration Manual 10: Unified Stream Assessment http://www.cwp.org/PublicationStore/USRM.htm

Urban Subwatershed Restoration Manual 11: Unified Subwatershed Site Reconnaissance http://www.cwp.org/PublicationStore/USRM.htm

The Smart Watershed Benchmarking Tool http://cwp.org.master.com/texis/master/search/+/form/Smart_Watershed.html

California Stormwater Best Management Practice Handbook Fact Sheet: Landscape Maintenance http://www.cabmphandbooks.com/Documents/Municipal/SC-73.pdf

U.S. EPA National Menu of Stormwater Best Management Practices for Stormwater Phase II: Municipal Landscaping Fact Sheet http://cfpub1.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=1

Alameda Countywide Clean Water Program. School Facility Best Management Practices (BMPs) http://www.cleanwaterprogram.org/uploads/BMP_Booklet_Final-removed_crop_marks.pdf

Audubon Cooperative Sanctuary Program for Golf Courses http://www.audubonintl.org/programs/acss/golf.htm

Bellevue Parks and Community Services. Environmental Best Management Practices and Design Standards Manual http://bellevuewa.gov/Parks_Env_Best_Mgmt_Practices.htm

California Stormwater Best Management Practice Handbook Fact Sheet: Landscape Maintenance http://www.cabmphandbooks.com/Documents/Municipal/SC-73.pdf

Forest Conservancy District Board for Baltimore County. Schoolyard Reforestation Wildlife Habitat Program http://www.bcfb.sailorsite.net/Education/EducationSchoolYard.htm

Golf Course Superintendents Association of America (GCSAA). Environmental principles for golf courses in the United States http://www.gcsaa.org/resources/facts/principles.asp

Seattle Parks and Recreation. Best Management Practices (BMPs) for Landscape Maintenance Operations http://www.seattle.gov/parks/projects/bmp.htm

Spitzer Announces Agreements with Retailers to Remove Illegal Pesticides from Shelves http://www.oag.state.ny.us/press/2002/aug/aug20a_02.html

Three Rivers Park District http://www.threeriversparkdistrict.org/

MO-8	Municipal Operation	
	RESIDENTIAL STEWARDSHIP	

Description

Residents engage in many behaviors and activities that can influence water quality. Behaviors such as over-fertilizing, oil dumping, littering and excessive pesticide use can negatively impact water quality, while behaviors such as tree planting, disconnecting rooftops and picking up pet waste can help improve water quality. Communities have the ability to influence these residential behaviors by providing programs that improve the public's awareness about them. By developing residential stewardship programs that discourage negative behaviors and encourage positive ones, a community can reduce the amount of pollution that is conveyed into streams and other receiving waters through its storm drain system. These stewardship programs are often supplemented with education and outreach events, financial incentives and in-kind services.

Common residential behaviors have the potential to generate a wide variety of stormwater pollutants, including nutrients, hydrocarbons, pesticides, bacteria and trash (Table 1). An effective residential stewardship program targets the residential behaviors that are related to local water quality concerns and subwatershed restoration goals and objectives.

Table 1: Comparison of Pollutant Contribution from Various Residential Behaviors

Residential Polluting Behavior	Stormwater Pollutants						
	TSS	Nutrients	Metals	Bacteria	Trash	Oil	Toxins
Improper Fertilization	×	●	×	×	×	×	○
Excess Pesticide Use	×	×	×	×	×	×	●
Over-Watering	○	◉	○	×	○	×	◉
Extensive Turf Cover	○	◉	×	×	×	×	◉
Tree Clearing	◉	◉	×	×	×	×	×
Yard Waste Dumping	◉	●	×	○	○	×	×
Soil Compaction	◉	◉	○	○	×	×	×
Soil Erosion	●	◉	○	○	×	×	×
Failing Septic Systems	○	●	×	●	×	×	○
Pool Discharges	×	×	×	×	×	×	●
Car Washwater Flows	◉	●	◉	×	×	◉	◉
Hosing/Leaf-blowing	●	◉	◉	×	◉	◉	○
Use of De-icers	◉	○	○	×	×	×	◉
HHW Dumping	×	○	●	×	×	●	●
Car Fluid Spills/Dumping	×	×	◉	×	×	●	●
Connected Downspouts	◉	●	●	◉	×	○	○
Added IC and Bare Soil	●	○	◉	×	◉	○	○
Pet Waste Washoff	×	●	×	●	×	×	×
Poor STP Maintenance	●	●	●	◉	●	○	○
Buffer Encroachment	○	○	○	○	○	×	×
Storm Drain Dumping	◉	○	◉	◉	●	●	●

Table 1: Comparison of Pollutant Contribution from Various Residential Behaviors							
Residential Polluting Behavior	Stormwater Pollutants						
	TSS	Nutrients	Metals	Bacteria	Trash	Oil	Toxins
Key ● = major pollutant contribution ⦿ = moderate pollutant contribution ○ = minor pollutant contribution × = not a pollutant source							

Investigating and Improving the Operation

Improving or initiating residential stewardship programs in your community can reduce the amount of stormwater pollution that is conveyed into local aquatic resources. It requires you to examine your existing residential stewardship programs, if they exist, and identify where improvements can be made to reduce the amount of stormwater pollution that residential behaviors create. This can be accomplished within the context of the seven-step program planning and development process (Chapter 2), as described below.

> Implementation of this municipal operation can also help communities to make headway on two other Phase II minimum control measures: Public Education and Public Involvement.

Step 1: Identify Existing Municipal Operations

Recall that the first step in the process is to identify the municipal operations that are conducted within your community. In terms of residential stewardship, this means determining whether or not your community has developed any residential stewardship programs designed to help encourage positive behaviors and discourage negative ones. If it does, the next step in the process is to collect some basic information about those stewardship programs. If not, you should begin investigating the other municipal operations that are conducted within your community.

Step 2: Collect Information About Each Operation

Once you have determined that your community does have some residential stewardship programs in place, the next step in the process is to collect some basic information about those programs. Basic information to collect about the residential stewardship programs in place in your community includes:

- Narrative description of residential stewardship programs
- Types of residential stewardship programs
- Stormwater pollutants commonly associated with residential stewardship programs
- Operation manager name
- Operation manager contact information

This information should be added to the simple database or binder that contains the information about all of the municipal operations conducted in your community.

As you collect some basic information about the residential stewardship programs in place in your community, you should begin communicating with the individuals who oversee or manage those programs. This is an ideal time to inform these individuals about the community's pollution prevention/good housekeeping efforts and the purpose of the community's municipal pollution prevention/good housekeeping program. It is also a good time to educate them about the influence that residential stewardship can have on water quality and how pollution prevention/good housekeeping practices can be used to reduce the amount of stormwater pollution that residential behaviors create.

Step 3: Complete the Municipal Operations Analysis (MOA)

The next step in the process is to use the basic information that you have collected about the residential stewardship programs in place in your community to complete Section 8 of the MOA. This section of the MOA asks a series of questions about the nature, scope and distribution of the residential stewardship programs in place in your community. In some cases, you will be able to answer all of the questions using only the information that you have already collected about these programs. In most cases, however, answering the questions will require additional input from the individuals who manage or oversee each of the programs.

Once you have answered all of the questions presented within Section 8 of the MOA, you should calculate your score to determine how well your community is currently managing its park and landscape maintenance activities. When you have completed the entire MOA, you should also compare the score that you received in Section 8 with the scores you received in each of the other sections of the analysis. This will help you focus your pollution prevention/good housekeeping efforts on the municipal operations that have the greatest influence on water quality in your community.

Step 4: Focus Pollution Prevention/Good Housekeeping Efforts

The next step in the process is to use the results of the MOA, as well as information about local subwatershed restoration goals and objectives, to develop a list of the municipal operations in the order in which they will be further investigated and improved. This list, known as the prioritized municipal operations list, can be used to guide your local pollution prevention/good housekeeping efforts and ensure that you are using your resources on improving the operations that have the greatest influence on water quality in your community. The operations at the top of the prioritized municipal operations list should be those that you will address first, while those at the bottom should be those that you will address over time.

If residential stewardship comes out on top of your prioritized municipal operations list, the next step in the process is to further investigate these programs to determine the improvements that can be used to reduce the amount of stormwater pollution that residential behaviors create. If it does not, you should begin investigating the operation that is located at the top of your list. The

other profile sheets presented in this chapter provide additional information about investigating each of the other municipal operations.

Step 5: Investigate Municipal Operations and Select Pollution Prevention/Good Housekeeping Practices

Step 5.1: Collect Additional Information About Residential Stewardship Programs

Once you have determined that residential stewardship will be the focus of your pollution prevention/good housekeeping efforts, the next step in the process is to collect some additional information about these programs to determine how it can be improved to reduce the amount of stormwater pollution that residential behaviors create. To collect this additional information, you should coordinate with the individuals who manage or oversee the residential stewardship programs in place in your community. These individuals will be able to answer questions about the existing programs and help you determine where improvements can be made. It is also a good opportunity for them to learn more about how residential stewardship can influence stormwater quality. Table 2 provides a list of example questions that can be used to collect additional information from the individuals who manage or oversee the residential stewardship programs in place in your community.

Table 2: Example Interview Questions

- Are you familiar with our pollution prevention/good housekeeping efforts and the purpose of our municipal pollution prevention/good housekeeping program?
- How were residential stewardship services selected?
- Are residential stewardship services targeted towards particular pollutant of concern and/or neighborhoods?
- What is the frequency and ease?
- What is the participation rate for each service?
- How are the residential stewardship services advertised?

Step 5.2: Conduct Field Investigations

The next step in the process is to investigate the residential behaviors in your community to determine where residential stewardship programs will be most effective in addressing local water quality problems and subwatershed restoration goals and objectives. These investigations can be completed using the Neighborhood Source Assessment (NSA), which is a field assessment technique that can be used to profile pollution source areas, stewardship behaviors and restoration opportunities within individual neighborhoods. The data gathered from the NSA can be used to address neighborhood specific issues and opportunities. For example, a neighborhood with roof drains connected to the storm drain system may present an opportunity to disconnect rooftop drainage through a rain barrel program. The product of this step is a list of neighborhoods prioritized by their pollution potential and restoration opportunity, with specific details on the types of residential behaviors (e.g., pet waste pickup) that may be targeted in each neighborhood by providing residential services. More information on the NSA can be found in Manual 11.

To be effective, a carefully targeted outreach campaign may be needed to make residents aware of the services, as well as an efficient and timely delivery system for the service itself. In general,

participation rates in municipal service programs are strongly linked to how convenient residents perceive them to be.

Step 5.3: Prescribe Pollution Prevention/Good Housekeeping Practices

Once existing operations have been assessed, the next step in the process is to select and implement the services that can help improve water quality through residential stewardship. In order to realize the greatest water quality benefit, most communities will need to track residential stewardship activities and either add new services or increase the frequency of services currently provided. Table 3 outlines several of the pollution prevention/good housekeeping techniques that can be provided to improve residential stewardship (Figure 2).

Figure 2. Volunteers help disconnect rooftops in Portland, OR

Table 3: Good Housekeeping Techniques for Residential Stewardship

Service	Good Housekeeping Techniques
Storm drain stenciling	• Prioritize drains for marking in subwatersheds with impaired waters or sensitive aquatic resources • Provide stenciling supplies to volunteer groups • Target neighborhoods and areas where storm drain dumping is known/prevalent
Household hazardous waste collection	• If possible, provide curbside pickup of household hazardous waste • If resources are limited, provide widely advertised collection events several times a year • Provide public outreach documents potential effects of hazardous household materials on water quality and inform them how to properly store, handle, and dispose of the chemicals
Car fluid recycling	• Collect used oil/antifreeze through conveniently located collection centers or curbside pickup • Educate the public on how to manage car fluids properly and how to take advantage of your program's services.
Lawn care advice	• Provide a natural lawn care advice customer service line • Provide yard waste collections • Offer free soil tests to determine exact fertilizer and lime needs
Residential rooftop disconnection	• Provide downspout disconnection services • Offer a credit for rain barrel or rain garden installation • Distribute rain barrels at community and watershed-related events
Tree planting incentives	• Provide education about the multiple benefits of planting trees • Encourage private property tree plantings through incentives such as coupons for the purchase of qualifying trees at local nursery • Provide and plant free trees • Establish guidance on species selection and maintenance
Training	• Provide training to employees to conduct residential services such as rooftop disconnection, tree planting, etc.

An effective residential stewardship program targets the residential behaviors that can address local water quality concerns and subwatershed restoration goals and objectives. For example, if sediment is a local pollutant of concern, you may want to focus your residential stewardship program on municipal operations that can generate high sediment loads, such as construction project management and street sweeping. A different group of municipal operations should be targeted if nutrients are the primary pollutant of concern, including park and landscape maintenance and residential stewardship. Still a different group of municipal operations should be investigated if hydrocarbons and toxins are the pollutants of concern, including hotspot facility management and stormwater hotline response. Table 2 can be used to link municipal operations with particular pollutants of concern.

Step 5.4: Develop Implementation Plan

The next step in the process is to develop a brief implementation plan. The implementation plan should summarize the results of assessment and field investigations, the specific residential behaviors that can influence water quality and the residential stewardship programs that will be used to address each of those behaviors. Implementation plans should also include a schedule that describes some implementation milestones for the prescribed residential stewardship programs. The contents of each implementation plan should be developed in cooperation with the individuals responsible for managing or overseeing each of the residential stewardship programs.

A key element of each implementation plan is an estimate of the budget required to implement the recommended pollution prevention/good housekeeping practices. Although providing detailed cost information about all of the residential stewardship programs and pollution prevention/good housekeeping practices that can be used to address specific pollution-generating residential behaviors is beyond the scope of this manual, there are some useful resources that can be used to gather this information, including Manual 8 and U.S. EPA's *National Menu of Stormwater Management Best Management Practices*, which is available online at: http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm.

Step 6: Implement Pollution Prevention/Good Housekeeping Practices

Once your existing residential stewardship programs have been investigated and assessed, the next step in the process is implementing the prescribed pollution prevention/good housekeeping practices. Although it may be tempting to hand the responsibility for implementation over to the individuals who manage or oversee the residential stewardship programs conducted in your community, it is important to work with them during the implementation phase to get the recommended improvements "in the ground."

Step 7: Evaluate Progress in Implementation

The last step in the process involves evaluating the process made in implementing the prescribed pollution prevention/good housekeeping practices. Measurable performance goals and implementation milestones will be needed to evaluate progress in implementation and track success in addressing local water quality issues and subwatershed restoration goals and objectives. Some example *output-based* measurable goals and implementation milestones are

presented in Table 4. They can be thought of as activities that need to be completed in order to reduce the amount of stormwater pollution that residential behaviors create within your community.

Table 4: Measurable Goals and Implementation Milestones for Improving Residential Stewardship Programs[1]		
Example Measurable Goals	**Timeframe**	**Priority**
Goals related to program startup		
Identify and collect basic information about current residential stewardship practices and programs	Complete shortly after program startup; update regularly after that	●
Add the information about existing stewardship practices and programs to the simple database or binder that contains basic information about each municipal operation		●
Complete Section 8 of the Municipal Operations Analysis (MOA)	Year 1; repeat every 5 years	●
Prioritize local pollution prevention/good housekeeping efforts based on the results of the MOA and other factors, such as local pollutants of concern		●
Goals related to preventing or reducing stormwater pollution		
Collect additional information about the residential stewardship programs that are conducted within your community	Year 1	●
Prescribe pollution prevention/good housekeeping practices to address deficiencies and additional stewardship programs to improve residential behaviors within your community		●
Develop implementation plan for prescribed pollution prevention/good housekeeping practices and residential stewardship programs		●
Secure funding and resources to implement prescribed pollution prevention/good housekeeping practices and residential stewardship programs	Begin in Year 1	●
Implement prescribed pollution prevention/good housekeeping practices and residential stewardship programs	Begin in Year 2	●
Goals related to program evaluation		
Develop measurable performance goals and implementation milestones	Complete shortly after program startup; update regularly after that	●
Evaluate progress in meeting measurable goals and implementation milestones		●
Evaluate progress in implementing prescribed pollution prevention/good housekeeping practices	End of Year 1 and each year after that	●
Notes 1) Assumes that park and landscape maintenance tops the prioritized municipal operations list. *Key* ● = Essential ⦿ = Optional but Recommended		

The methods used to evaluate success in meeting these measurable performance goals and implementation milestones can be as simple as semi-annual or annual inspections used to identify the pollution prevention/good housekeeping practices that have been put in place and the improvements that still need to be made.

Scoping the Required Level of Effort

The level of effort required to develop effective residential stewardship programs varies greatly from one community to the next. Basic guidance on scoping the level of effort required to improve local residential stewardship programs is provided in Table 5. Communities can use this information to scope the level of effort required to improve their own park and landscape maintenance activities.

Table 5: Scoping the Level of Effort Required to Improve Residential Stewardship Programs

Step	Staff Hours
Step 1: Identify Existing Municipal Operations	4-8[1]
Step 2: Collect Information About Residential Stewardship Programs	4-8
Step 3: Complete Section 8 of the Municipal Operations Analysis (MOA)	10-20
Step 4: Focus Pollution Prevention/Good Housekeeping Efforts	4-8[1]
Step 5: Investigate Municipal Operations and Select Pollution Prevention/Good Housekeeping Practices	80-200
Step 5.1: Collect Additional Information About Existing Residential Stewardship Programs	20-40
Step 5.2: Conduct Field Investigations	
NSA	1/neighborhood
Post-Processing	40-60
Step 5.3: Prescribe Pollution Prevention/Good Housekeeping Practices	20-40
Step 5.4: Develop Implementation Plan	20-40
Step 6: Implement Pollution Prevention/Good Housekeeping Practices	Varies[2]
Step 7: Evaluate Progress in Implementation	20-40/evaluation[1]

Notes
1: Represents total level of effort required to complete step for all municipal operations.
2: Varies according to the extent and type of improvements required.

Resources

Urban Subwatershed Restoration Manual 1: An Integrated Framework to Restore Small Urban Watersheds http://www.cwp.org/PublicationStore/USRM.htm

Urban Subwatershed Restoration Manual 8: Pollution Source Control Practices
http://www.cwp.org/PublicationStore/USRM.htm

Urban Subwatershed Restoration Manual 11: Unified Subwatershed and Site Reconnaissance
http://www.cwp.org/PublicationStore/USRM.htm

The Smart Watershed Benchmarking Tool
http://cwp.org.master.com/texis/master/search/+/form/Smart_Watershed.html

U.S. EPA National Menu of Stormwater Best Management Practices for Stormwater Phase II: Storm Drain Marking
http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=15

U.S. EPA National Menu of Stormwater Best Management Practices for Stormwater Phase II: Proper Disposal of Household Hazardous Waste
http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=browse&Rbutton=detail&bmp=3

EPA Household Hazardous Waste Website
http://www.epa.gov/epaoswer/non-hw/muncpl/hhw.htm

City of Folsom, CA Household Hazardous Waste Program
http://www.folsom.ca.us/depts/utilities/hazmat/default.asp

North Carolina's Storm Drain Stenciling Project
http://www5.bae.ncsu.edu/programs/extension/wqg/smp-18/stormdrain/

How to Set Up a Local Program to Recycle Used Oil
http://www.epa.gov/epaoswer/non-hw/recycle/89039a.pdf

North Carolina Department of Agriculture Free Residential Lawn Soil Testing
http://www.ncagr.com/agronomi/stfaqs.htm

Seattle Public Utilities Natural Lawn Care
http://www.seattle.gov/util/Services/Yard/Natural_Lawn_&_Garden_Care/Natural_Lawn_Care/index.asp

Portland's Downspout Disconnection Program
http://www.portlandonline.com/oni/index.cfm?c=cijjc

Toronto's Downspout Disconnection Program
http://www.toronto.ca/water/protecting_quality/downspout.htm

Baltimore County's Growing Home Campaign
www.baltimorecountymd.gov/go/trees

City of Sacramento Department of Parks and Recreation: About Forest Services
http://www.cityofsacramento.org/parksandrecreation/urbanforest/

MO-9	**Municipal Operations**	
	STORMWATER MANAGEMENT PRACTICE MAINTENANCE	

Description

Stormwater management practices are engineered facilities designed to treat or otherwise manage post-construction stormwater runoff and mitigate the negative impacts of land development. These practices, which include extended detention ponds, wet ponds, stormwater wetlands, bioretention areas, swales, filtration practices and infiltration practices (Figure 1), provide a number of water quality and water quantity benefits and, if carefully designed, can provide a number of other benefits to the community (e.g. aesthetics, wildlife habitat)

Figure 1. Stormwater management practices include (clockwise from top left) extended detention ponds, wet ponds, bioretention area and swales

Although communities may not be responsible for the siting, design and construction of these practices, they are often responsible, at least in part, for their regular maintenance and upkeep as well as inspection and enforcement of maintenance performed by another entity, such as an HOA. If not properly maintained, they can lose much of their ability to treat stormwater runoff and mitigate the negative impacts of land development.

Under the NPDES Phase II regulations, regulated communities must ensure adequate long-term operation and maintenance of stormwater management practices. Within many communities, the municipality as well as homeowners associations and private landowners are responsible for the maintenance and upkeep of stormwater management practices. Regulated communities can help to ensure that privately owned and -operated facilities are maintained by including enforceable provisions within the local stormwater management ordinance that require regular maintenance of these facilities.

Investigating and Improving the Operation

Improving the way that stormwater management practice maintenance activities are conducted within your community can reduce the amount of stormwater pollution that is conveyed into local aquatic resources. It requires you to examine your stormwater management practice maintenance program and identify the improvements that can be used to improve the performance of these practices. This can be accomplished within the context of the seven-step program planning and development process (Chapter 2), as described below.

Step 1: Identify Existing Municipal Operations

Recall that the first step in the process is to identify the municipal operations that are conducted within your community. In terms of stormwater management practice maintenance, this means determining whether or not your community is responsible for the regular upkeep and maintenance of permanent stormwater management practices. If it is, the next step in the process is to collect some basic information about those maintenance activities. If not, you should begin investigating the other municipal operations that are conducted within your community.

Step 2: Collect Information About Each Operation

Once you have determined that your community does maintain some permanent stormwater management practices, the next step in the process is to collect some basic information about those maintenance activities. Basic information to collect about the stormwater management practice maintenance activities conducted in your community includes:

- Narrative description of stormwater management practice maintenance activities
- Locations of stormwater management practice maintenance activities
    - Type of facility
    - Street address
    - Watershed and subwatershed address

    - Geospatial coordinates (e.g. latitude, longitude)
    - Responsible party (e.g. community, homeowner's association)
- Map showing locations of stormwater management practice activities
- Operation manager name
- Operation manager contact information
- As-built plans, if available
- Inspection and maintenance reports, if available

This information should be added to the simple database or binder that contains the information about all of the municipal operations conducted in your community.

As you collect some basic information about the stormwater management practice maintenance activities conducted within your community, you should begin communicating with the individual who oversees or manages these operations. This is an ideal time to inform these individuals about the community's pollution prevention/good housekeeping efforts and the purpose of the community's municipal pollution prevention/good housekeeping program. It is also a good time to educate them about the influence that stormwater management practice maintenance can have on water quality and how pollution prevention/good housekeeping practices can be used to reduce the amount of stormwater pollution that is conveyed into local aquatic resources.

Step 3: Complete the Municipal Operations Analysis (MOA)

The next step in the process is to use the basic information that you have collected about the stormwater management practice maintenance activities conducted in your community to complete Section 9 of the MOA. This section of the MOA asks a series of questions about the nature, scope and distribution of the stormwater management practice maintenance activities conducted within your community. In some cases, you will be able to answer all of the questions using only the information that you have already collected about these activities. In most cases, however, answering the questions will require additional input from the individuals who manage or oversee each of the stormwater management practice maintenance operations in your community.

Once you have answered all of the questions presented within Section 9 of the MOA, you should calculate your score to determine how well your community is currently managing its park and landscape maintenance activities. When you have completed the entire MOA, you should also compare the score that you received in Section 9 with the scores you received in each of the other sections of the analysis. This will help you focus your pollution prevention/good housekeeping efforts on the municipal operations that have the greatest influence on water quality in your community.

Step 4: Focus Pollution Prevention/Good Housekeeping Efforts

The next step in the process is to use the results of the MOA, as well as information about local subwatershed restoration goals and objectives, to develop a list of the municipal operations in the order in which they will be further investigated and improved. This list, known as the prioritized

municipal operations list, can be used to guide your local pollution prevention/good housekeeping efforts and ensure that you are using your resources on improving the operations that have the greatest influence on water quality in your community. The operations at the top of the prioritized municipal operations list should be those that you will address first, while those at the bottom should be those that you will address over time.

If stormwater management practice maintenance comes out on top of your prioritized municipal operations list, the next step in the process is to further investigate the way that these activities are conducted within your community to determine the pollution prevention/good housekeeping practices that can be used to reduce the amount of stormwater pollution conveyed into local aquatic resources. If it does not, you should begin investigating the operation that is located at the top of your list. The other profile sheets presented in this chapter provide additional information about investigating each of the other municipal operations.

Step 5: Investigate Municipal Operations and Select Pollution Prevention/Good Housekeeping Practices

Step 5.1: Assess Existing Stormwater Management Practice Inspection and Maintenance Program

Once you have determined that stormwater management practice maintenance will be the focus of your pollution prevention/good housekeeping efforts, the next step in the process is to determine if your community has a stormwater management inspection and maintenance program in place. Under the requirements of the NPDES stormwater program, all regulated communities are required to develop, implement and enforce a program to reduce the pollution contained in post-construction stormwater runoff by ensuring adequate long-term operation and maintenance of stormwater management practices. A community can help meet this requirement by developing an inspection and maintenance program for the stormwater management practices located within its municipal boundaries.

If your community does not already have an inspection and maintenance program in place, you should work to develop one. The program should establish inspection frequencies for each publicly owned or -operated stormwater management practice, identify the party(ies) responsible for maintenance and identify required maintenance tasks. The program should also include a tracking and reporting component so that maintenance activities can be tracked. Although a full discussion on how to establish a stormwater management practice inspection and maintenance program is beyond the scope of this profile sheet, the additional resources section at the end of this profile sheet provides some information on establishing an inspection and maintenance program.

It should be noted that a dedicated funding source is needed to maintain an inspection and maintenance program. The most common financing mechanisms include:

- Operating budgets
- Debt financing
- State grants and revolving loans
- Property assessments
- Wastewater utility fees
- Stormwater utility or district fees
- Connection fees
- Plan review/inspection fees

One of the more attractive funding options is to establish a stormwater utility or district in your community. Several resources that can be used to help establish a local stormwater utility are provided in the additional resources section at the end of this profile sheet.

Step 5.2: Compile Information About Stormwater Management Practices

The next step in the process is to compile information about all of the permanent stormwater management practices found within your community. Information collected about each practice should include its type (e.g. wet pond, bioretention area), its physical location or address, its subwatershed, and whether or not the facility is regularly inspected and maintained. Much if this information may have been collected during Step 2, and all of it should be added to the simple database or binder that contains the information about all of the municipal operations conducted in your community. If your community already has an inspection and maintenance program in place, this information should be readily available.

Although not necessary, it is often helpful to create a map showing the location of each publicly owned and/or -operated stormwater management practice. You can use a geographic information system (GIS) or paper maps to create the map. Once created, the map should be updated on a regular basis to show the location of any newly constructed municipal stormwater management practices. If your community already has a stormwater inspection and maintenance program in place, a map showing the location of all municipally owned and/or -operated stormwater management practices may already be available.

> While inventorying municipally owned and/or -operated stormwater management practices, it may be helpful to also identify those owned and operated by homeowners associations and private landowners. Through education and outreach efforts, the community can work to ensure that these practices are regularly maintained.

Step 5.3: Conduct Field Investigations

The next step in the process is to conduct a site assessment of all municipally owned and/or -operated stormwater management practices to determine how well each practice is being maintained. The inspections can be conducted using locally adopted inspection procedures or using the procedures provided in existing stormwater guidance manuals listed in the additional resources section at the end of this profile sheet. An inspection checklist should be used to compile information during the assessment.

During this task, you may want to enlist the assistance of someone that is familiar with stormwater management practice inspection and maintenance procedures. Experience and expertise are extremely valuable when assessing the condition of existing stormwater management facilities.

Note that if your community already has a stormwater inspection and maintenance program in place, there should be records of previous inspections conducted at publicly owned and/or -operated stormwater management facilities. If such records exist, it is not necessary to inspect any stormwater management practices that were assessed within the last year. The inspection

report forms for these practices should contain all of the information that you need to complete the assessment.

> When conducting field investigations, bring a camera! Photos are a great way to document areas that need improvement as well as stormwater management practices that are in good condition and/or are well maintained.

Step 5.4: Rank Practices According to Condition

The next step in the process is a comparison of the inspection results to determine which stormwater treatment practices are in the worst condition and need the most attention. At the completion of each inspection, the local stormwater manager should make a note of any maintenance tasks that need to be performed and how urgent those tasks appear to be. He or she should use these designations to rank the stormwater management practices in order from those in poor condition to those in good condition. This list should be used to guide future maintenance activities.

If there are any urgent maintenance needs, the local stormwater manager should immediately notify individual responsible for the upkeep and maintenance of the stormwater management practices. These improvements, especially those that are needed to alleviate a safety hazard, should be made as soon as possible. This process should also help to identify any common problems with maintenance, which can result in recommended changes to the community's inspection and maintenance procedures.

Step 5.5: Prescribe Pollution Prevention/Good Housekeeping Practices

Once all of the stormwater management practices in your community have been assessed and ranked, the next step in the process is to identify some pollution prevention/good housekeeping practices that can be used to help improve the way that they are maintained. Depending on the results of the assessment, a variety of improvements can be made to the way that permanent stormwater management practices are currently maintained (Table 1).

Table 1: Appropriate Management Good Housekeeping Techniques

Existing Condition	Recommended Improvements
Community has not yet established a stormwater management practice inspection and maintenance program	Develop a local stormwater management practice inspection program and assign a department or agency to be responsible for managing the program Identify the dedicated funding source that will be used to maintain the inspection and maintenance program
Locations of permanent stormwater management practices have not been identified	Develop a map showing the location of all permanent stormwater management practices Collect basic information about each of the stormwater management practices (e.g. type and age of practice, previous maintenance activities)
Homeowners associations and individual property owners are responsible for the maintenance and	Develop a contact database listing the homeowners associations and individual property owners responsible for the maintenance and upkeep of stormwater management practices

Table 1: Appropriate Management Good Housekeeping Techniques	
Existing Condition	**Recommended Improvements**
upkeep of stormwater management practices	Include enforceable provisions within the local stormwater management ordinance that require regular maintenance on these facilities Conduct periodic inspections of facilities to ensure maintenance is being performed
Inspection and maintenance activities are not documented and tracked	Work with the department or agency responsible for the maintenance and upkeep of municipally-owned and/or operated stormwater management practices to develop a tracking system
Specific maintenance activities are not being performed	Update the inspection procedures or maintenance plan requirements to ensure maintenance is properly conducted

Step 5.6: Develop Implementation Plan

The next step in the process is to develop a brief implementation plan. The implementation plan should summarize the results of assessment and field investigations and the changes that can be made to improve the way that permanent stormwater management practices are maintained within your community. Implementation plans should also include a schedule that describes some implementation milestones for the recommended improvements. The contents of each implementation plan should be developed in cooperation with the individual responsible for managing or overseeing stormwater management practice maintenance in your community.

During this step, you should also summarize the improvements that are needed at each stormwater management facility using the results of the field investigations and inspection report forms for practices that have already been inspected. Proposed maintenance activities should be written up and provided to the individual responsible for the maintenance of the stormwater management practices in your community. The written summary can be used to guide the necessary improvements.

Step 6: Implement Pollution Prevention/Good Housekeeping Practices

Once your existing stormwater management practice maintenance program has been investigated and assessed, the next step in the process is implementing the prescribed pollution prevention/good housekeeping practices. Although it may be tempting to hand the responsibility for implementation over to the individual who manages or oversees the stormwater management practice maintenance program conducted in your community, it is important to work with them during the implementation phase to get the recommended improvements "in the ground."

Step 7: Evaluate Progress in Implementation

The last step in the process involves evaluating the process made in implementing the prescribed pollution prevention/good housekeeping practices. Measurable performance goals and implementation milestones will be needed to evaluate progress in implementation and track success in addressing local water quality issues and subwatershed restoration goals and objectives. Some example *output-based* measurable goals and implementation milestones are

presented in Table 2. They can be thought of as activities that need to be completed in order to reduce the amount of stormwater pollution that residential behaviors create within your community.

Table 2: Measurable Goals and Implementation Milestones for Improving Stormwater Management Practice Maintenance Operations[1]		
Example Measurable Goals	**Timeframe**	**Priority**
Goals related to program startup		
Identify and collect basic information about current municipal stormwater management practice maintenance activities	Complete shortly after program startup; update regularly after that	●
Add the information about stormwater management practice maintenance activities to the simple database or binder that contains basic information about each municipal operation		●
Develop a digital (e.g. GIS) or hard copy map showing the location of all existing stormwater management practices		◉
Complete Section 9 of the Municipal Operations Analysis (MOA)	Year 1; repeat every 5 years	●
Prioritize local pollution prevention/good housekeeping efforts based on the results of the MOA and other factors, such as local pollutants of concern		●
Goals related to preventing or reducing stormwater pollution		
Further investigate and assess existing municipal stormwater management practice inspection and maintenance program	Year 1	●
Compile information about existing stormwater management practices within the community		●
Conduct field investigations and prescribe pollution prevention/good housekeeping practices to address deficiencies and improve the way that stormwater management practices are maintained within your community		●
Develop implementation plan for prescribed pollution prevention/good housekeeping practices		●
Secure funding and resources to implement prescribed pollution prevention/good housekeeping practices	Begin in Year 1	●
Implement prescribed pollution prevention/good housekeeping practices	Begin in Year 2	●
Goals related to program evaluation		
Develop measurable performance goals and implementation milestones	Complete shortly after program startup; update regularly after that	●
Evaluate progress in meeting measurable goals and implementation milestones		●
Evaluate progress in implementing prescribed pollution prevention/good housekeeping practices	End of Year 1 and each year after that	●
Notes 1) Assumes that stormwater management practice maintenance is as the top of your prioritized municipal operations list. *Key* ● = Essential ◉ = Optional but Recommended		

The methods used to evaluate success in meeting these measurable performance goals and implementation milestones can be as simple as semi-annual or annual inspections used to

identify the pollution prevention/good housekeeping practices that have been put in place and the improvements that still need to be made.

Scoping the Required Level of Effort

The level of effort required to improve stormwater management practice maintenance operations varies greatly from one community to the next. It depends mainly on the number of stormwater management practices found within a community. Basic guidance on scoping the level of effort required to improve local residential stewardship programs is provided in Table 3. Communities can use this information to scope the level of effort required to improve their own park and landscape maintenance activities.

The assessment of existing operations, particularly the field investigation, usually consumes the most staff time, so be sure to budget enough time for this step. Be sure to budget at least a week of staff time to process and interpret the field investigation data (e.g., checklist completion, data entry, quality control, data evaluation). It is also important to note that the level of effort for the field investigation can decrease significantly if there are current inspection and maintenance records available for existing stormwater management practices.

Table 3: Scoping the Level of Effort Required to Improve Stormwater Management Practice Maintenance Operations

Step	Staff Hours
Step 1: Identify Existing Municipal Operations	4-8[1]
Step 2: Collect Information About Stormwater Management Practice Maintenance Activities	4-8
Step 3: Complete Section 9 of the Municipal Operations Analysis (MOA)	10-20
Step 4: Focus Pollution Prevention/Good Housekeeping Efforts	4-8[1]
Step 5: Investigate Municipal Operations and Select Pollution Prevention/Good Housekeeping Practices	120-240[2]
Step 5.1: Assess Existing Municipal Stormwater Management Practice Inspection and Maintenance Program	20-40
Step 5.2: Compile Information About Existing Stormwater Management Practices	20-40
Step 5.3: Conduct Field Investigations	
Inspections	1/facility
Post-Processing	40-60
Step 5.4: Rank Stormwater Management Practices According to Existing Condition	4-8
Step 5.5: Prescribe Pollution Prevention/Good Housekeeping Practices	20-40
Step 5.6: Develop Implementation Plan	20-40
Step 6: Implement Pollution Prevention/Good Housekeeping Practices	Varies[2]
Step 7: Evaluate Progress in Implementation	20-40/evaluation[1]

Notes
1: Represents total level of effort required to complete step for all municipal operations.
2: Can be reduced if stormwater management practice inspection and maintenance forms are used to aid the field investigations
3: Varies according to the extent and type of improvements required.

Resources

Stormwater Manager's Resource Center. Program Resources: Stormwater Treatment Practice Maintenance http://www.stormwatercenter.net/

Pond and Wetland Maintenance Guidebook
http://www.stormwatercenter.net/Manual_Builder/Maintenance_Manual/pondwetlandguidebookdraft.pdf

The Smart Watersheds Benchmarking Tool
http://cwp.org.master.com/texis/master/search/+/form/Smart_Watershed.html

Lexington-Fayette County (KY) Urban County Government. Maintenance Manual for Stormwater Best Management Practices http://www.lfucg.com/Engineering/EngManSW.asp

Maintaining Your BMP: A Guidebook for Private Owners and Operators in Northern Virginia.
http://www.novaregion.org/pdf/Maintaining_BMPs.pdf

Connecticut Stormwater Quality Manual
http://ct.gov/dep/cwp/view.asp?a=2721&q=325704&depNav_GID=1654

U.S. EPA National Menu of Stormwater BMPs: BMP Inspection and Maintenance.
http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=129

An Internet Guide to Financing Stormwater Management
http://stormwaterfinance.urbancenter.iupui.edu

Establishing a Stormwater Utility http://www.florida-stormwater.org/manual.html

Santa Clara Valley (CA) Urban Runoff Pollution Prevention Program. Stormwater Treatment BMP Inspection Program Elements http://www.scvurppp-w2k.com/project_reports_fy0203/156_Stormwater_Treatment_BMP_Inspection_Program_Elements.pdf

MO-10	Municipal Operations	
	EMPLOYEE TRAINING	

Description

Every day, municipal employees engage in a variety of activities that influence water quality. Some of these activities, such as hotspot facility management, construction project management and street repair and maintenance can negatively impact water quality, while others, such as street sweeping, storm drain maintenance and employee training, can help improve it. Employees that are educated about the link between their work and stormwater quality and on the community's larger good housekeeping/pollution prevention efforts will help reduce the amount of stormwater pollution that is conveyed into receiving waters. Employee training is a necessary component of any municipal pollution prevention/good housekeeping program. In order for municipal pollution prevention/good housekeeping programs to achieve success, employees must be trained on how to incorporate pollution prevention/good housekeeping practices into their everyday activities.

Called out specifically in the NPDES Phase II regulations, employee training is an integral part of municipal pollution prevention/good housekeeping efforts. As outlined in the good housekeeping minimum control measure, a regulated community must provide employee training on how to use good housekeeping techniques when conducting municipal operations. Training and education can also help the effectiveness of other municipal stormwater programs, such as illicit discharge detection and elimination and post-construction runoff control.

Investigating and Improving the Operation

Improving your local employee training programs can reduce the amount of stormwater pollution that is conveyed into local aquatic resources. It requires you to examine your existing employee training programs and identify the improvements that can be used to improve these programs. This can be accomplished within the context of the seven-step program planning and development process (Chapter 2), as described below.

Step 1: Identify Existing Municipal Operations

Recall that the first step in the process is to identify the municipal operations that are conducted within your community. In terms of employee training, this means determining whether or not your community provides regular stormwater pollution prevention training and education to municipal employees and contractors. If it does, the next step in the process is to collect some

basic information about these training activities. If not, you should begin investigating the other municipal operations that are conducted within your community.

Step 2: Collect Information About Each Operation

Once you have determined that the community provides regular stormwater pollution prevention training and education to municipal employees and contractors, the next step in the process is to collect some basic information about these training activities. Basic information to collect about the employee training conducted in your community includes:

- Narrative description of employee training activities
- Types of stormwater pollution prevention training provided
- Lists of employees who have attended previous training activities
- Operation manager name
- Operation manager contact information
- As-built plans, if available
- Inspection and maintenance reports, if available

This information should be added to the simple database or binder that contains the information about all of the municipal operations conducted in your community.

As you collect some basic information about the employee training activities conducted within your community, you should begin communicating with the individual who oversees or manages these operations. This is an ideal time to inform these individuals about the community's pollution prevention/good housekeeping efforts and the purpose of the community's municipal pollution prevention/good housekeeping program. It is also a good time to educate them about the influence that employee training can have on water quality and how pollution prevention/good housekeeping practices can be used to reduce the amount of stormwater pollution that is conveyed into local aquatic resources.

Step 3: Complete the Municipal Operations Analysis (MOA)

The next step in the process is to use the basic information that you have collected about the employee training activities conducted in your community to complete Section 10 of the MOA. This section of the MOA asks a series of questions about the nature, scope and distribution of the employee training activities conducted within your community. In some cases, you will be able to answer all of the questions using only the information that you have already collected about these activities. In most cases, however, answering the questions will require additional input from the individuals who manage or oversee the employee training activities conducted within your community.

Once you have answered all of the questions presented within Section 10 of the MOA, you should calculate your score to determine how well your community is currently managing its park and landscape maintenance activities. When you have completed the entire MOA, you should also compare the score that you received in Section 10 with the scores you received in each of the other sections of the analysis. This will help you focus your pollution

prevention/good housekeeping efforts on the municipal operations that have the greatest influence on water quality in your community.

Step 4: Focus Pollution Prevention/Good Housekeeping Efforts

The next step in the process is to use the results of the MOA, as well as information about local subwatershed restoration goals and objectives, to develop a list of the municipal operations in the order in which they will be further investigated and improved. This list, known as the prioritized municipal operations list, can be used to guide your local pollution prevention/good housekeeping efforts and ensure that you are using your resources on improving the operations that have the greatest influence on water quality in your community. The operations at the top of the prioritized municipal operations list should be those that you will address first, while those at the bottom should be those that you will address over time.

If employee training comes out on top of your prioritized municipal operations list, the next step in the process is to further investigate the way that these activities are conducted within your community to determine the pollution prevention/good housekeeping practices that can be used to reduce the amount of stormwater pollution conveyed into local aquatic resources. If it does not, you should begin investigating the operation that is located at the top of your list. The other profile sheets presented in this chapter provide additional information about investigating each of the other municipal operations.

Step 5: Investigate Municipal Operations and Select Pollution Prevention/Good Housekeeping Practices

Step 5.1: Identify Municipal Operations with the Most Significant Influence on Water Quality
The first task is to list the municipal operations in the order in which they impact stormwater quality, based mainly on the results of the MOA, but also on the scale at which each of the municipal operations are conducted, and any pollutants of concern that have been identified in your community. The operations located at the top of the list should be those that have the greatest impact on stormwater quality, while those at the bottom should have the least.

Step 5.2: Identify Employees Associated with Municipal Operations
The next task is to identify the employees associated with each of the municipal operations conducted in your community, beginning with the operation that is on top of the prioritized list. The simplest way to do this is to consult with the individuals that are responsible for managing each of the operations. They should be able to quickly identify the employees that are involved with each operation. You can use a simple database or table, like that shown in Table 1, to compile the information collected during this task.

Table 1: Example Municipal Employee Contact Database

Municipal Operation: Street Sweeping		
Name	**Title**	**Phone**
Jonathon Jones	Director of Public Works	(555) 271-1241
Charles Thomas	Street Maintenance Supervisor	(555) 271-1367
Jason Taylor	Operator	(555) 271-1370
Tamara Brown	Operator	(555) 271-1371

Table 1: Example Municipal Employee Contact Database		
Municipal Operation: Street Sweeping		
Name	**Title**	**Phone**
Henry Adams	Operator	(555) 271-1378
David Johnson	Fleet Maintenance Supervisor	(555) 271-1365

Step5. 3: Assess Existing Employee Training Programs

The next task is to assess the employee training programs that are associated with each of the municipal operations conducted in your community, beginning with the operation that is on top of your prioritized list. The basic idea is to determine the type of training that is currently provided to the employees involved with each operations and whether or not they are provided with any training about pollution prevention/good housekeeping.

Coordinating and communicating with the individuals who manage or oversee the existing training activities is perhaps the most effective way to collect this information. Simple techniques that can be used for this coordination effort include casual discussions, phone conversations, individual or group meetings and site visits. Table 2 provides a list of example questions that can be used to collect information from the individuals responsible for managing each of the municipal operations conducted in your community.

Table 2: Example Discussion Questions
• Are you familiar with our municipal pollution prevention/good housekeeping efforts? • Do you understand the requirements of the NPDES Phase II permit? • Do you understand how training employees on pollution prevention/good housekeeping practices can help improve stormwater quality? • What type of training, if any, is provided to employees involved with your municipal operation? • How often is training provided to employees involved with your municipal operation? • Are there specialized training programs for employees involved with particular activities related to you operation or is general training provided for everyone? • Do you document (e.g. date and time, subject, agenda, attendees) each of the training sessions that you conduct? • Have you previously discussed stormwater pollution prevention and good housekeeping in any training sessions?

Step 5.4: Prescribe Pollution Prevention/Good Housekeeping Practices

Once you have assessed your community's existing training and education programs, the next step is to determine how they can be improved to better educate employees on good housekeeping techniques. The key is to provide municipal employees with specific information about the actions they can take to prevent or reduce stormwater pollution. Table 3 presents the range of training topics that can be provided for each municipal operation.

> Employee and contractor training do not always have to occur as in the form of a formal power point presentation. Consider getting the message out through inexpensive and creative methods such as posters and signs.

The most effective pollution prevention/good housekeeping training programs are the ones that provide the right information to the right employees. For example, employees engaged in landscape and park maintenance should be trained in landscaping techniques that use less

fertilizer and pesticides, while employees responsible for maintaining fleet vehicles should be trained in the proper disposal of waste automotive fluids and how to correctly deal with leaky or disabled vehicles.

Table 3: Employee Training Programs - Presenting the Right Information to the Right Audience

Municipal Operation	Training Targets	Training Topics
Hotspot facility management	• Facility managers • Building maintenance staff • Fleet maintenance staff	• Vehicle maintenance and repair procedures • Vehicle washing procedures • Materials loading and unloading procedures • Materials storage procedures (outdoor storage) • Spill prevention and response • Dumpster management • Building repair and maintenance procedures
Construction project management	• Contract administration staff • Building services staff • Plan review staff • Site inspection staff	• Considering erosion and sediment control and stormwater management during contractor selection • Plan review techniques • Erosion and sediment control practices • Ordinance enforcement procedures
Street repair and maintenance	• Street maintenance staff • Vehicle operators	• Road maintenance procedures • Winter road maintenance procedures • Handling and application of pesticides and other chemicals
Street sweeping	• Street maintenance staff • Vehicle operators	• Street sweeping procedures • Materials disposal • Street sweeper maintenance
Storm drain maintenance	• Storm drain staff • Street maintenance staff • Vehicle operators	• Storm drain maintenance procedures • Materials disposal • Vacuum truck maintenance
Stormwater hotline response	• Stormwater hotline staff • Fire department staff • Police department staff • Public works staff • Storm drain staff • Site inspection staff	• Public relations • Response, cleanup and disposal procedures • Reporting procedures
Park and landscape maintenance	• Parks and recreation staff • Community forestry staff • Landscaping staff • Mowing staff	• Use and appropriate application of pesticides, herbicides and fertilizers • No mow areas • Benefits of trees and native and naturalized species
Residential stewardship	• Parks and recreation staff • Public school staff • Community outreach staff	• Providing residential services such as rooftop disconnection, tree planting, etc.
Stormwater management practice maintenance	• Storm drain staff • Site inspection staff • Maintenance staff	• Stormwater management practice inspection procedures • Stormwater management practice maintenance procedures

There are a variety of methods that can be used to educate municipal employees on stormwater pollution prevention/good housekeeping practices, including:

- Annual Performance Reviews
- Brochures
- Conferences
- Meetings
- Training Sessions
- Videos
- Walkthroughs
- Workplace Posters
- Workshops

A number of useful employee training resources can be obtained free of charge online. See the additional resources section at the end of this profile sheet for links to some of these resources. These materials can be used as is, or can be adapted to meet the needs of your community.

> General pollution prevention education should be provided to all municipal employees to make them aware of the community's pollution prevention/good housekeeping efforts and educate them on link between municipal operations and stormwater quality. If they are not already familiar with the requirements of the NPDES Phase II permit, a general training session is a good opportunity to educate employees about them.

> Employee turnover is an important consideration when developing an employee training and education program. The key to an effective program is to ensure that institutional knowledge about pollution prevention and pollution prevention/good housekeeping practices is maintained over time. An effective tracking system, such as a simple database, that identifies the staff members that have received training on particular pollution prevention/good housekeeping practices is one way to accomplish this.

Step 5.5: Develop Implementation Plan

The next step in the process is to develop a brief implementation plan. The implementation plan should summarize the results of assessment and the changes that can be made to improve the way that employee training is conducted within your community. Implementation plans should also include a schedule that describes some implementation milestones for the recommended improvements. The contents of each implementation plan should be developed in cooperation with the individual responsible for managing or overseeing the employee training programs conducted within your community.

Step 6: Implement Pollution Prevention/Good Housekeeping Practices

Once your existing employee training programs has been investigated and assessed, the next step in the process is implementing the prescribed pollution prevention/good housekeeping practices. Although it may be tempting to hand the responsibility for implementation over to the individual who manages or oversees the employee training programs conducted in your community, it is important to work with them during the implementation phase to get the recommended improvements "in the ground."

Step 7: Evaluate Progress in Implementation

The last step in the process involves evaluating the process made in implementing the prescribed pollution prevention/good housekeeping practices. Measurable performance goals and implementation milestones will be needed to evaluate progress in implementation and track success in addressing local water quality issues and subwatershed restoration goals and objectives. Some example *output-based* measurable goals and implementation milestones are presented in Table 4. They can be thought of as activities that need to be completed in order to reduce the amount of stormwater pollution that residential behaviors create within your community.

Table 4: Measurable Goals and Implementation Milestones for Improving Employee Training and Education[1]

Example Measurable Goals	Timeframe	Priority
Goals related to program startup		
Identify and collect basic information about employee training and education activities	Complete shortly after program startup; update regularly after that	●
Add the information about current employee training and education activities to the simple database or binder that contains basic information about each municipal operation		●
Complete Section 10 of the Municipal Operations Analysis (MOA)	Year 1; repeat every 5 years	●
Prioritize local pollution prevention/good housekeeping efforts based on the results of the MOA and other factors, such as local pollutants of concern		●
Goals related to preventing or reducing stormwater pollution		
Identify municipal operation with the greatest influence on water quality in your community	Year 1	●
Identify employees associated with the municipal operation that has the greatest influence on water quality in your community		●
Further investigate and assess existing employee training and education programs		●
Prescribe pollution prevention/good housekeeping practices to address deficiencies and educate employees on the link between municipal operations and stormwater quality		●
Develop implementation plan for prescribed pollution prevention/good housekeeping practices and employee training and education program		●
Secure funding and resources to implement prescribed pollution prevention/good housekeeping practices and employee training and education program	Begin in Year 1	●
Implement prescribed pollution prevention/good housekeeping practices and employee training and education program	Begin in Year 2	●
Goals related to program evaluation		
Develop measurable performance goals and implementation milestones	Complete shortly after program startup; update regularly after that	●
Evaluate progress in meeting measurable goals and implementation milestones		●
Evaluate progress in implementing prescribed pollution prevention/good housekeeping practices	End of Year 1 and each year after that	●

Table 4: Measurable Goals and Implementation Milestones for Improving Employee Training and Education[1]		
Example Measurable Goals	**Timeframe**	**Priority**
Notes 1) Assumes that stormwater management practice maintenance is as the top of your prioritized municipal operations list. *Key* ● = Essential ⦿ = Optional but Recommended		

The methods used to evaluate success in meeting these measurable performance goals and implementation milestones can be as simple as semi-annual or annual inspections used to identify the pollution prevention/good housekeeping practices that have been put in place and the improvements that still need to be made.

Scoping the Required Level of Effort

Basic guidance on scoping the level of effort required to develop an effective employee training and education program is provided in Table 5. Communities can use this information to estimate the level of effort required to educate their employees about pollution prevention/good housekeeping practices and the larger efforts of the pollution prevention/good housekeeping program.

It is important to note that the assessment of existing employee training and education programs usually consumes the most staff time. Be sure to budget enough time for this task. It may also take some effort to coordinate with the individuals that oversee or manage each of the municipal operations and some time to process the information collected from them. Be sure to budget at least a week of staff time to process and interpret the information gathered during the assessment step.

Table 5: Scoping the Level of Effort Required to Improve Employee Training and Education	
Step	**Staff Hours**
Step 1: Identify Existing Municipal Operations	4-8[1]
Step 2: Collect Information About Employee Training and Education Programs	4-8
Step 3: Complete Section 10 of the Municipal Operations Analysis (MOA)	10-20
Step 4: Focus Pollution Prevention/Good Housekeeping Efforts	4-8[1]
Step 5: Investigate Municipal Operations and Select Pollution Prevention/Good Housekeeping Practices	80-160
Step 5.1: Identify Municipal Operation with the Greatest Influence on Stormwater Quality	2-4
Step 5.2: Identify Employees Associated with Municipal Operations	20-40
Step 5.3: Further Investigate and Assess Existing Employee Training Programs and Activities	20-40
Step 5.3: Prescribe Pollution Prevention/Good Housekeeping Practices	20-40
Step 5.4: Develop Implementation Plan	20-40
Step 6: Implement Pollution Prevention/Good Housekeeping Practices	Varies[2]
Step 7: Evaluate Progress in Implementation	20-40/evaluation[1]
Notes 1: Represents total level of effort required to complete step for all municipal operations. 2: Varies according to the extent and type of improvements required.	

Resources

U.S. EPA National Menu of Stormwater BMPs: Municipal Employee Training and Education. http://cfpub.epa.gov/npdes/stormwater/menuofbmps/index.cfm?action=factsheet_results&view=specific&bmp=129

California Stormwater Best Management Practice Handbook: Municipal. http://www.cabmphandbooks.com/

Stormwater Management Manual for Western Washington: Volume IV – Source Control BMPs. http://www.ecy.wa.gov/biblio/0510032.html

City of Los Angeles, CA. We Have a Mission…Preventing Stormwater Pollution. http://www.lastormwater.org/WPD/education/empltrnguide.htm

California Department of Transportation Construction Stormwater Training Program. http://www.dot.ca.gov/hq/construc/stormwater/swppp_training.html

City of Memphis, TN. Stormwater Pollution Prevention Training. http://www.cityofmemphis.org/images/Storm.ppt

North Central Texas Council of Governments. Municipal Employee Training Resources. http://www.nctcog.org/ENVIR/SEEclean/stormwater/program-areas/pollution_prevention/CD/Version_1/P2_Training_Materials.asp

Oregon Municipal Stormwater Toolbox for Maintenance Practices. Chapter 8: Educating Maintenance Staff About Stormwater Quality. http://www.oracwa.org/Pages/Chap8.pdf

References

Bannerman, R., D. Owens, R. Dodds and N. Hornewer. 1993. “Sources of Pollutants in Wisconsin Stormwater”. *Water Science and Technology*. 28:3-5, 241-259.

Berryman and Henigar. 2003. *Street Sweeping Study Report.* Prepared for City of Concord, California. Berryman and Henigar. San Diego, CA.

California Stormwater Quality Association (CASQA). 2003. *California Stormwater BMP Handbook: Municipal*. California Stormwater Quality Association. Livermore, CA.

Center for Watershed Protection (CWP) and R. Pitt. 2004. *Illicit Discharge Detection and Elimination Manual: A Guidance Manual for Program Development and Technical Assessments.* Center for Watershed Protection. Ellicott City, MD.

Center for Watershed Protection (CWP). 2006a. *Technical Memorandum 1. Literature Review. Research in Support of an Interim Pollutant Removal Rate for Street Sweeping and Storm Drain Cleanout Activities*. Center for Watershed Protection. Ellicott City, MD.

CWP. 2006b. *Technical Memorandum 2. Summary of Municipal Practices Survey. Research in Support of an Interim Pollutant Removal Rate for Street Sweeping and Storm Drain Cleanout Activities.* Center for Watershed Protection. Ellicott City, MD.

Brown, E.W. and D.S. Caraco. 2000. “Muddy Water In, Muddy Water Out”. *The Practice of Watershed Protection.* Eds. T. Schueler and H. Holland. Center for Watershed Protection. Ellicott City, MD.

Lager, J., W. Smith, R. Finn and E. Finnemore. 1997. *Urban Stormwater Management and Technology: Update and Users' Guide*. U.S. Environmental Protection Agency. EPA-600/8-77-014. Washington, DC.

Law, N.L., K. DiBlasi and U. Ghosh. 2008. *Deriving Reliable Pollutant Removal Rates for Municipal Street Sweeping and Storm Drain Cleanout Programs in the Chesapeake Bay Basin*. Prepared for the Chesapeake Bay Program. Center for Watershed Protection. Ellicott City, MD.

Maryland Department of the Environment (MDE). *MDE Spill Report Form.* MDE Spill Response Division. Baltimore, MD. Available Online: http://www.mde.state.md.us/assets/document/emergency/mdespillreport.pdf.

Mineart, P. and S. Singh. 1994. *Storm Inlet Pilot Study*. Prepared for Alameda County Urban Runoff Clean Water Program. Woodward-Clyde Consultants. Oakland, CA.

Partland, J. 2001. “A Clean Sweep to Swipe Pollutants”. *Stormwater.* 12(4). Available Online: http://www.forester.net/sw_0106_toc.html.

Pitt, R. and P. Bissonette. 1984. *Bellevue Urban Runoff Program. Summary Report. Characterizing and Controlling Urban Runoff Through Street and Sewerage Cleaning.* U.S. Environmental Protection Agency. EPA-600/S2-85/038. Washington, DC.

Sutherland, R.C. and S.L. Jelen. 1997. "Contrary to Conventional Wisdom: Street Sweeping can be an Effective BMP". *Advances in Modeling the Management of Stormwater Impacts*. *Volume 5*. Ed. W. James. Guelph, Canada.

U.S. EPA Office of Emergency and Remedial Response. 1990. *Hazmat Team Planning Guidance*. Office of Emergency and Remedial Response. U.S. Environmental Protection Agency. Washington, DC.

U.S. Fire Administration. 1999. *Guide to Developing Effective Standard Operating Procedures for Fire and EMS Departments.* Federal Emergency Management Agency. Washington, DC.

United States Environmental Protection Agency (U.S. EPA). 2000. *Stormwater Phase II Final Rule Fact Sheet 2.8: Pollution Prevention/Good Housekeeping Minimum Control Measure.* EPA-833-F-00-010. U.S. EPA. Office of Water. Washington, DC.

U.S. EPA. 2000. *Stormwater Phase II Final Rule Fact Sheet 2.6: Construction Site Runoff Control Minimum Control Measure.* EPA-833-F-00-008. U.S. EPA. Office of Water. Washington, DC.

Waschbush, R.J. 2003. *Data and Methods of a 1999-2000 Street Sweeping Study on an Urban Freeway in Milwaukee County, Wisconsin.* Open File Report 03-93. U.S. Department of the Interior. U.S. Geological Survey.

Wright, T., C. Swann, K. Cappiella and T. Schueler. 2005. *Urban Subwatershed Restoration Manual 11: Unified Subwatershed and Site Reconnaissance: A User's Manual*. Center for Watershed Protection. Ellicott City, MD.