

**Institutional Aspects of Urban
Runoff Management:**

**A Guide for Program Development
and
Implementation**

**A Comprehensive Review of the Institutional
Framework of Successful Urban Runoff
Management Programs**

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Framework of Successful Urban Runoff
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The authors would like to acknowledge the assistance and input provided by those individuals listed in the Introduction regarding their programs. As can be seen from Appendix A, the questionnaire was lengthy and required considerable time to complete. Thanks for your help.

Dedication

The Watershed Management Institute dedicates this book to all of the federal, state, regional, and local sediment and stormwater program staff whose lives are dedicated to attempting to protect public health, property, and resource values. Long hours, time away from family, and limited resources are unfortunately part and parcel of this effort, but these individuals willingly give of themselves to make our world more sustainable. Some times you feel alone in your efforts, but there are many people who are facing the same problems and program evolution and growth is happening.

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Copies of this book are available from the Watershed Management Institute

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Index

<u>Topic</u>	<u>Page</u>
Executive Summary	I
Introduction	i
Chapter 1 - Federal Programs Affecting Urban Runoff Management	1 - 1
Background	1 - 1
Section 319 Nonpoint Source Management Program	1 - 2
Section 402 NPDES Stormwater Permitting	1 - 4
Section 6217 Coastal Nonpoint Source Control Program	1 - 8
Other Federal Programs Influencing Urban Runoff Management	1 - 10
U.S. Environmental Protection Agency	1 - 10
U.S. Department of Agriculture	1 - 15
U.S. Department of the Interior	1 - 18
Federal Highway Administration	1 - 19
Army Corps of Engineers	1 - 19
National Oceanic and Atmospheric Administration	1 - 20
Chapter 2 - Synopsis of Municipal, County, Regional, and State Urban Stormwater Management Programs	2 - 1
Chapter 3 - Questionnaire Responses	
General Programs Issues	3 - 2
Are the erosion and sediment control and stormwater management programs integrated	3 - 2
The impetus for program implementation	3 - 4
Stormwater Management	3 - 6
The basic goal of the Stormwater Management Program	3 - 6
Peak discharge performance standards	3 - 8
Stormwater treatment performance standards	3 - 9

Stormwater volume performance standards	3 - 10
Basis of design criteria	3 - 10
Exemptions and Waivers	3 - 13
Practices favored	3 - 16
Design assistance and guidance availability	3 - 18
Management and source control practices	3 - 19
Are source controls encouraged	3 - 20
Land uses for which source controls are intended	3 - 21
Favored source control practices	3 - 22
Is detailed guidance available regarding source controls	3 - 23
Erosion and Sediment Control	3 - 24
Rationale or philosophy of the erosion and sediment control program	3 - 24
Performance standards	3 - 25
BMP design criteria, guidance, and preferred practices	3 - 26
Exemptions and waivers for erosion and sediment control	3 - 28
Program Authority and Implementation Structure	3 - 30
Program implementation structure	3 - 30
Project permitting procedures and applicability	3 - 33
Comprehensive review of projects	3 - 36
Are plan review checklists used?	3 - 37
Are the erosion and sediment control and stormwater management approvals required prior to other approvals?	3 - 38
Inspection Procedures	3 - 39
Are inspections required during construction?	3 - 40
What is the frequency requirements for inspections?	3 - 41
Is a public agency responsible for inspections?	3 - 44
Is the inspection agency also the review agency?	3 - 45

Is the inspection frequency and procedure adequate for erosion/sediment control?	3 - 45
Program Funding	3 - 47
Program funding for erosion, sediment, and stormwater control	3 - 47
Program Staffing	3 - 50
Is staffing for the erosion and sediment control program adequate?	3 - 51
Is staffing for the stormwater management adequate?	3 - 52
Program Educational Aspects	3 - 54
Are educational programs a program element?	3 - 54
Are any of the educational programs mandated by law or regulations?	3 - 54
What are the intended audiences of the educational programs?	3 - 55
How many individuals (total) and how often are the educational programs given?	3 - 57
Program Compliance and Enforcement	3 - 59
Are there civil penalty provisions in the program?	3 - 60
Are there criminal penalty provisions in the program?	3 - 60
Other available enforcement options	3 - 61
Are the penalty provisions adequate?	3 - 63
Are as-built certifications required for stormwater management?	3 - 64
Are final inspections required for stormwater management?	3 - 65
Maintenance of Stormwater Management Practices	3 - 66
Can you indicate the number of and types of practices constructed over the past two years?	3 - 66
Does the program require maintenance of completed stormwater management	3 - 68

structures?	
Responsible maintenance entities.	3 - 68
Are maintenance inspections done by a public agency?	3 - 69
Is there a dedicated funding source available for maintenance activities?	3 - 71
Are legal steps available in the event that maintenance is not accomplished?	3 - 72
Have legal steps ever been taken to facilitate needed maintenance	3 - 73
Program Coordination with Related Programs	3 - 73
Is there significant coordination between the erosion and sediment control program and the stormwater management program?	3 - 74
With what other programs is there significant coordination?	3 - 74
Are there conflicts with other programs which prevent or hinder effective program implementation?	3 - 77
Is there effective communication with federal agencies on related state and federal programs?	3 - 79
Program Evaluation and Evolution	3 - 80
Are there measures of program success?	3 - 80
What areas of improvement are needed in the program?	3 - 82
Are research projects underway and do they have widespread applicability?	3 - 84
Is monitoring a program component?	3 - 85
Does the program address retrofitting to reduce impacts from developed areas?	3 - 86
Are watershed-specific approaches being used?	3 - 87
General Items	3 - 88
Program history of respondents	3 - 88
Pitfalls to be avoided	3 - 89
Weaknesses which impede program implementation	3 - 92
Any additional thoughts of the individual respondent	3 - 94

Chapter 4 - Common Elements of Successful Urban Runoff Management Programs	4 - 1
General Institutional Framework Issues	4 - 2
Possible roles of various levels of government	4 - 2
Should the erosion and sediment control and urban runoff management programs be integrated?	4 - 8
Program goals	4 - 9
Stormwater management	4 - 10
Basic goals and performance standards	4 - 10
Design criteria for runoff BMP's	4 - 11
Exemptions, waivers, and variances	4 - 13
Design assistance and guidance	4 - 14
Management and source controls	4 - 15
Erosion and Sediment Control	4 - 17
Basic goals and performance standards	4 - 17
Design criteria	4 - 18
Exemptions and waivers	4 - 19
Design assistance and guidance	4 - 20
Program Implementation Issues	4 - 20
Project permitting procedures	4 - 22
Use of plan review checklists	4 - 24
Linkage with other approvals	4 - 23
Inspection procedures	4 - 25
Inspection agency relationship to review agency	4 - 28
Program Funding	4 - 29
General appropriations	4 - 29
Permit fees	4 - 30
Dedicated funding sources	4 - 31
Program Staffing	4 - 33
Program Educational Activities	4 - 38
Are educational programs mandated by law or regulation?	4 - 38

Intended audience and frequency for educational programs	4 - 39
Program Enforcement and Compliance	4 - 42
Civil penalty provisions	4 - 43
Criminal penalty provisions	4 - 44
Other available enforcement options	4 - 44
As-built certifications for stormwater systems	4 - 46
Final inspections of stormwater management systems	4 - 47
Maintenance of Stormwater Systems	4 - 47
Requiring maintenance of stormwater systems	4 - 48
Responsible maintenance entities	4 - 48
Public agency inspection of stormwater systems	4 - 49
Funding maintenance - the need for dedicated revenues	4 - 51
Legal steps to assure maintenance is done	4 - 52
Coordination with Related Programs	4 - 52
Coordination between the erosion and sediment control program and the stormwater management program	4 - 52
Coordinating urban runoff programs with other related programs	4 - 52
Avoid conflicts with other programs	4 - 53
Program Evaluation	4 - 54
Measures of program success	4 - 54
Research projects and monitoring	4 - 55
Program Evolution	4 - 59
Retrofitting to reduce impacts from developed areas	4 - 59
Watershed specific approaches	4 - 63
Conclusions	4 - 64

Appendix A - Sediment Control and Stormwater Management Program Questionnaire

Appendix B - Sediment and Stormwater Management
Program Summaries

City Programs

Alexandria, Virginia	B - 2
Austin, Texas	B - 7
Bellevue, Washington	B - 10
Fort Collins, Colorado	B - 19
Olympia, Washington	B - 24
Orlando, Florida	B - 30
Seattle, Washington	B - 35
District of Columbia	B - 40
Winter Park, Florida	B - 45

County Programs

Baltimore County, Maryland	B - 50
Clark County, Washington	B - 55
King County, Washington	B - 60
Kitsap County, Washington	B - 66
Maricopa County, Arizona	B - 72
Montgomery County, Maryland	B - 77
Prince George's County, Maryland	B - 82
Snohomish County, Washington	B - 87
Somerset County, New Jersey	B - 92
Washington County, Oregon	B - 97

Regional Programs

Denver Urban Drainage and Flood Control District	B - 102
Northeastern Illinois Planning Commission	B - 107
South Florida Water Management District	B - 112
Southwest Florida Water Management District	B - 118
Suwannee River Water Management District	B - 124

State Programs

Delaware	B - 130
Florida	B - 136
Maryland	B - 143
New Jersey	B - 148
Pennsylvania	B - 154
South Carolina	B - 160
Virginia	B - 166
Washington	B - 172

Executive Summary

This manual has been developed to assist those individuals who are charged with implementing urban control programs. The first three chapters provide background and program survey information which form the basis for recommendations which are presented in Chapter 4. Chapter 4 makes comprehensive recommendations for all aspects of urban runoff program implementation. Some of the more strongly made recommendations include:

General Institutional Framework Issues

- Cooperation and partnerships among all levels of government are essential for successful program implementation.
- The ideal approach to program implementation is for federal requirements to be the broad mandates which necessitate state, regional, and local participation.
- Integrating erosion/sediment control with stormwater management can help to achieve highly desired multiple benefits, avoid duplicative review processes, and reduce overall administrative and construction costs.
- To maximize public support and cost-effectiveness, programs need to be multifaceted, with program goals based on problems which are clearly recognized as important and interrelated by the general public and elected officials.
- Public support is more likely if the general public clearly understands that urban runoff control personally benefits them, either through protection of their lives, home, property, aquatic resources or quality of life.

Stormwater Management

- The basic performance standard should be to assure that post-development peak discharge rate, volume, and pollutant loading doesn't exceed pre-development levels.
- Practices to control runoff volume are limited to either infiltration practices or reuse practices, thus limiting somewhat where volume control can be achieved.
- Exemptions and waivers should be kept to a minimum and make a statement that all development must consider the urban runoff quality impacts as an essential component of site development.
- Training on the design, construction, operation, and maintenance of runoff quality control practices is an essential part of the much larger educational component of a successful urban runoff management program.
- A detailed design manual helps to assure a consistent policy across political boundaries reducing possible inequities. It also helps designers and contractors properly design and build BMP's.
- Source controls are an integral component of successful urban runoff programs which can not be considered short term in nature. Guidance materials are essen-

tial since most people do not understand how their every day activities affect water quality.

Erosion and Sediment Control

- A basic goal of erosion and sediment control programs should be to minimize off-site impacts by following a philosophy of first preventing erosion and then maximizing control of sedimentation onsite.
- BMP design criteria typically are based on a design storm. It is essential that long term rainfall records be analyzed to determine the appropriate design storm.
- The threshold size of site disturbance for when approval is needed should be relatively small. This emphasizes that erosion and sediment control are integral site development components and helps to minimize potential cumulative impacts of many smaller activities ongoing at any one time.
- Vegetative practices must include local considerations such as the types of plant materials and how they are best established and maintained.

Program Implementation Issues

- Delegation of program authority is an approach that has strong advantages. To minimize delegation problems, there must be a finite time period, followed by a review of program implementation performance, and a redelegation if warranted.
- The earlier in the design process that stormwater management requirements are considered, the more likely that the final design will meet program requirements and be approved expediently.
- Submittal of a completed checklist should be required by the plan review agency to ensure that the designer has gone through each item and included it as part of information submittal.
- Stormwater design and approval should be coordinated with wetland and floodplain protection programs, especially since these natural systems are an integral part of a watershed's natural runoff management system.
- It is unlikely that public agencies will ever have enough inspectors. Creating state "Certified" private inspectors can reduce the frequency of public inspections and increase compliance and program effectiveness.
- Stormwater practices need inspections during and after construction. Having a presence onsite at critical construction times helps avoid problems. Maintenance inspections are essential to assure continued functioning of stormwater management practices, especially water quality treatment practices.

Program Funding

- The three most common funding mechanisms are general appropriations, permit fees, and dedicated revenues, such as a stormwater utility fee.
- A major disadvantage of funding programs through permit fees is their direct dependence on the level of growth occurring at any one time.
- A major benefit of dedicated funding sources, such as a stormwater utility, is that,

- once established, they are not subject to the annual budget considerations of general appropriations.
- The general public must understand exactly which activities and projects will be funded, and how they will personally benefit or be affected by implementation of the fee.

Program Staffing

- By defining areas of importance, and the necessary resources which must be available when they are needed, a jurisdiction can better recognize the short and long term commitments that accompany approval of the program.
- Staffing for plan review must consider that design plans are rarely approved during the initial submission, with most projects needing at least two reviews before being approved.
- Many other programs, especially at the local level, have similar plan review and inspection requirements. Theoretically, staffing and funding resources of these programs can complement and assist in implementing erosion and sediment control and stormwater management programs.
- Creativity and innovation are cornerstones of urban runoff management programs, especially in overcoming resource limitations which can threaten the program's effectiveness.
- It is important to recognize areas where program implementation is weakest and develop innovative strategies to overcome these weaknesses.

Program Educational Activities

- Educational programs aimed at individuals directly involved in program implementation are essential. Relating the program's goals to outdoor, water related activities, which often are enjoyed by attendees, can lead to a more personal commitment.
- Experience indicates that more creative, highly visual, hands-on, educational programs are better received and achieve a higher level of learning.
- Educational programs aimed at the construction industry present a special challenge because of the constant change of individuals employed.
- Public education must be pursued at every opportunity and location where there is a receptive audience. Without public education, support for the program will not be broad based.

Program Compliance and Enforcement

- Unfortunately, there always will be some persons who try to circumvent or avoid their responsibilities. Compliance and enforcement mechanisms must be available to deal with these situations and to assure there is a level playing field.
- Programs with only one method of compliance and enforcement often can not properly address the many different situations that arise during the land disturbance and development process.

- The program should not rely on criminal penalties but rather on the variety of other tools which have proven effective. These include stop work orders, withholding occupancy permits or other permits, and performance bonds.
- An important aspect of the final inspection is to compare the as-built certification and record drawings to the approved design plans to ensure they are consistent.

Maintenance of Stormwater Systems

- Successful implementation of stormwater management practices requires attention to good design, proper construction, and long term maintenance. Nationally, the largest weakness of urban runoff control programs is assuring long term performance of BMP's.
- While government, utilities, and many commercial or industrial property owners will maintain their stormwater systems, those maintained by property owner associations are seldom maintained properly.
- It is recommended that runoff systems serving residential properties be dedicated to and accepted for maintenance by the government (hopefully with a stormwater utility!)
- Few property owner association representatives or maintenance staff for commercial or industrial operations have the knowledge to inspect or maintain runoff structures or practices. It is recommended that systems be inspected by a public agency at least annually.
- Not planning for maintenance costs in the initial program setup will create major financial problems in the future. Dedicated funding sources, such as stormwater utility fees, can help prevent this problem.

Coordination with Related Programs

- It is strongly recommended that erosion and sediment control and stormwater management programs be administered as integrated programs under the same urban runoff control program umbrella.
- Conflicts between programs will never be totally avoided, but they can be reduced through effective communication, coordination, and cooperation.

Program Evaluation

- Periodic evaluations are needed to measure program effectiveness and benefits. They can be used to help gain program support and to help it evolve into a more comprehensive program.
- One of the biggest weaknesses of urban runoff programs is the sparsity of data on BMP performance and on the ecological effects of intermittent discharges.
- When developing urban runoff control programs there is no need to "reinvent the wheel". Similarities among programs around the country are not coincidental, but a result of effective communication and technology transfer.
- Since monitoring programs are among the lowest priorities of urban runoff and environmental management programs, creativity is needed to increase collection

of information that can be used to evaluate environmental effects, or to assess the effectiveness of practices or programs.

Program Evolution

- Retrofitting presents many unique complex challenges - institutional, technical, and financial. Institutionally, retrofitting is best accomplished through watershed approaches which emphasize regional facilities and nonstructural practices.
- It is important that coordination and communication occur early in the planning of retrofit projects to avoid conflicts with other programs, jeopardizing both the project and relations with other agencies or programs.
- Even wet detention systems can be retrofitted to improve their water quality treatment effectiveness. A \$250 change to the outlet control and the Greenview Subdivision in Florida changed the system from a pollutant exporter to one with greater than 60% of the annual average loading.
- There is general recognition that program effectiveness can be improved through comprehensive watershed approaches, where all elements can be considered together to maximize benefits and minimize costs.

Conclusions

- Implementation of comprehensive urban runoff control programs which include erosion, sediment, and stormwater management is not a painless or quick process. Problems will occur, mistakes will be made. Learn from them.
- The big C's of watershed management:

- Comprehensive
- Continuity
- Cooperation
- Common Sense
- Communication
- Coordination
- Creativity
- Cash
- Commitment

Introduction

Institutional arrangements are critical in protection of water quality and aquatic resources.

As urban runoff management programs continue to increase in scope and responsibility, information on the scientific and technical aspects of these programs has grown accordingly. This is fortunate, for such information is vital to the development, implementation, and long term success of a new urban runoff management program. However, there are also significant institutional aspects of urban runoff management which must receive equal attention from program developers. Unfortunately, despite continued program growth at most levels of government, information on the institutional aspects are not as readily available. This publication helps address this imbalance. It provides stormwater program developers and implementers with a comprehensive presentation of vital institutional issues which must be addressed. The information is based on a detailed review and analysis of more than thirty successful municipal, county, regional, and state urban runoff management programs. Hopefully, summarizing this information in one document will help to minimize program development time and maximize a new program's potential for success.

The ultimate goal of any urban runoff management program is to minimize adverse impacts by managing the changes in stormwater quantity and quality which accompanies urbanization. However, this cannot be accomplished without having an effective, efficient, and comprehensive institutional foundation. There must be adequate legal authority, performance standards, design assistance and guidance, program funding and staffing, commitment to enforcement, comprehensive approaches to research, and program evaluation and evolution. One program element that will be stressed in the document is the value that all surveyed local, regional, and state programs place on education. This is crucial since citizen support for programs is influenced largely by their awareness of stormwater management. Other issues that are integral to long-term program success and evolution are watershed approaches, use of nonstructural and structural controls, research, monitoring, and retrofitting existing developments. All of these program elements must have a solid institutional foundation that must exist before any stormwater management practices are constructed.

The targeted audience for this publication are the many municipal, county, regional, and state agencies and personnel who are

charged with developing and implementing baseline urban runoff control programs. A baseline program is defined as one which addresses stormwater runoff impacts both during the short term construction phase of developments (through soil erosion and sediment control measures) and after construction is completed (through implementing structural and nonstructural stormwater management practices). This publication will also be useful to individuals responsible for the administration and continued growth of established baseline programs.

Finally, regardless of a program's status, it is important for everyone involved in the development, implementation, and evolution of an urban runoff management program to understand that they are not alone in their efforts. A common thread identified throughout all of the successful programs reviewed for this publication was the sizeable amount of available program information and the willingness of program staff to share it. As a result, no one should feel isolated in their efforts to address urban runoff problems. Instead, we should understand that there are many individuals and agencies throughout the country who are confronted with similar problems and who hope to achieve similar solutions.

Whether a stormwater discharge is a "point source" as defined by the NPDES storm water permitting program or a "nonpoint source", the problems created by these systems and their management is the same. Therefore, throughout this handbook certain terms will be used interchangeably. Primarily, these terms include urban runoff which will also be called urban stormwater or stormwater, and urban runoff control which will also be called stormwater management.

The foundation of this publication was the development and distribution of a detailed questionnaire (Appendix A). It was sent to municipal, county, regional, and state program managers for response. A total of 36 questionnaires were distributed with responses received from 32 agencies. The response rate is amazing considering the questionnaire's size and the level of detail that was requested. Each of the individuals took a substantial amount of time from their daily activities to complete the questionnaire. In addition, all respondents requested copies of the final document to assist them and provide a form of evaluation in the evolution of their program. These individuals were honest in their responses and their assistance is greatly appreciated.

The programs selected for review are recognized as being excellent examples of programs and program structures at various lev-

It is important for everyone involved in the development, implementation, and evolution of urban runoff management programs to understand they are not alone in their efforts.

els of government. Responses were received from nine cities, ten counties, five regional authorities, and eight states. It is recognized that there are good programs at the municipal, county, regional, or state level which were not included. The responses reflect programs that, for the most part, have existed for some time and which are located in various regions of the country. The average length of time that these programs have existed is almost 13 years. A lot can be learned from these programs.

The following agencies and individuals are acknowledged for their interest and time in completing questionnaires. Many received assistance from unnamed colleagues whose efforts are also greatly appreciated.

Cities

- Alexandria, Virginia - Warren Bell, P.E.
- Austin, Texas - Anne Scharlach
- Bellevue, Washington - Phyllis Varner
- Ft. Collins, Colorado - Kevin P. McBride, P.E.
- Olympia, Washington - Mark Blosser
- Orlando, Florida - William Chamberlin, II
- Seattle, Washington - Cheryl Paston
- Washington, D.C. - Timothy J. Karikari
- Winter Park, Florida - David Pearce, P.E.

Counties

- Baltimore, Maryland - Robert Wirth, P.E.
- Clark, Washington - Terry Keyes
- King, Washington - Lorin Reinelt
- Kitsap, Washington - David Dickson
- Maricopa, Arizona - Catesby Moore
- Montgomery, Maryland - Rick Brush
- Snohomish, Washington - Joan M. Lee
- Somerset, New Jersey - Joseph J. Skupien, P.E.
- Prince Georges, Maryland - Stan E. Wildesen
- Washington, Oregon - John Jackson

Regional Authorities

- Northeastern Illinois Planning Commission, Illinois - Dennis Dreher
- South Florida Water Management District - Richard Rogers

The program must have political support, which is translated into funding and other necessary program components, if it is to be effective.

Southwest Florida Water Management District	-	Charlie H. Miller
Suwannee River Water Management District	-	David W. Fisk
Urban Drainage and Flood Control District, Denver	-	Ben Urbonas, P.E.

States

Delaware Department of Natural Resources and Environmental Control	-	Robert Baldwin
Florida Department of Environmental Protection	-	Eric Livingston
Maryland Department of the Environment	-	Molly Cannon
New Jersey State Soil Conservation Committee	-	Hunter Birckhead, P.E.
New Jersey Department of Environmental Protection	-	Liz Rosenblatt
Pennsylvania Department of Environmental Resources	-	Barb Beshore
South Carolina Land Resources	-	Dave Jostenski
K. Flint Holbrook	-	
Virginia Department of Conservation and Recreation	-	James Edmonds
Washington State Department of Ecology	-	Helen E. Pressley

There are common threads to all of these programs which may provide assistance to other agencies in their deliberations when establishing an urban runoff control program.

There are an infinite number of possible approaches and program elements that can be considered when developing and implementing an urban runoff control program. Each have their own advantages and disadvantages. The importance and applicability of any approach or element must be evaluated for each situation. The bottom line is that almost any system will work if the individuals involved in the program have a commitment to, and believe in the importance of, the program. Regardless of the best of intentions, the program must have political support, which is translated into funding and other necessary program support components. There are common threads to all of these programs which may provide assistance to other agencies in their deliberations when establishing an urban runoff control program.

Issues, program elements, and institutional arrangements will be analyzed and discussed individually by jurisdictional level (cities, counties, regional authorities, states), and from an overall perspective. There are results that are very common to cities but

which are not necessarily true for counties, regional authorities, or states. The opposite is also true. The conclusions drawn for state programs are not necessarily accurate for regional or local programs. In many situations though, the results are applicable for the whole range of government agencies. Very clearly, these results are important to consider in terms of further efforts that should be undertaken because of their broad applicability or transferability.

Chapter 1 discusses various federal programs which may affect state, regional, county, or municipal urban runoff control programs. The three primary programs are the National Pollutant Discharge Elimination System (NPDES) Storm Water Permitting Program, the Section 319 Nonpoint Source Program, and the Coastal Zone Act Reauthorization Amendments of 1990. Additionally, there are several other EPA programs established in the Federal Clean Water Act that may influence stormwater management programs. These include Section 314 (Clean Lakes), Section 401 (Water Quality Certification), Section 404 (Navigable Waters), and Groundwater Injection Programs. The latter may significantly impact infiltration practice requirements. It is not the intent of Chapter 1 to exhaustively define all elements of various federal programs but simply to acquaint individuals with these important programs. If a reader desires additional information, the appropriate agency or program can be contacted for specific national or regional requirements.

Recommendations will be based on the cumulative experiences of many different individuals from different backgrounds and regions.

Chapter 2 presents a brief introduction to the existing local, regional, and state baseline urban runoff control programs which were reviewed during this project. Detailed "Sediment Control and Stormwater Management Program Summaries" for each of the 32 programs are included in Appendix B. Unfortunately, a discussion of programs with more comprehensive watershed components is beyond the scope of this document. There are many different approaches to program implementation and certain unique aspects of the individual programs will be highlighted and discussed.

Chapter 3 presents the results of the questionnaires. Many of the qualitative responses to narrative questions, such as pitfalls or program weaknesses, are presented verbatim. However, their sources are not attributed to provide anonymity to the individuals who were honest, at times painfully so, in their responses. Statistical analyses will also be provided wherever pertinent and quantifiable.

Chapter 4 highlights common factors contained in the state, regional, and local programs and presents recommendations for urban runoff management program implementation. There are a number of ways that a program can be set up. The recommendations are not intended to be considered as minimum necessary program elements, but rather to serve as a guide on issues which should at least be considered when establishing and implementing a program. The important aspect of this final chapter is that the recommendations are drawn from the cumulative experiences of many different individuals and regions of the country. Their expertise and experience can significantly assist others in initiation and implementation of urban runoff management programs.

Chapter 1

Federal Programs Affecting Urban Runoff Management

Background

Whether the goals of urban runoff and watershed management programs will be attained depends on the revision or "re-interpretation" of existing laws to modernize them and make their goals more consistent with later environmental protection laws.

Since passage of the Federal Clean Water Act in 1972, numerous federal programs that affect the management and protection of water resources have been implemented by a wide variety of federal agencies. Many of these programs have either a direct or indirect influence on the management of urban runoff, especially with respect to reducing the adverse effects of urban runoff on aquatic systems. Unfortunately, some of these programs, especially older ones, have legal authorities and goals which may impede the more recent multiple goals of urban runoff management to minimize or prevent adverse environmental impacts. For example, the Army Corps of Engineers' Section 205 Small Flood Control Program, implemented pursuant to the Flood Control Act of 1948, promotes the channelization and armoring of natural streams, creeks, and other waterways to increase their flood conveyance without consideration of the associated adverse environmental impacts on water quality, habitat, or riparian areas. Whether the multiple goals of urban runoff and watershed management programs will be attained partially depends on revision or "re-interpretation" of older laws to make their goals more consistent with laws emphasizing environmental protection. Success will also depend on how well current laws and programs are integrated into a comprehensive watershed management program.

This chapter briefly discusses many of the federal programs that can affect the management of urban runoff and other nonpoint sources of pollution. Three federal programs have the greatest influence on the management of urban runoff - the Federal Clean Water Act (CWA) Section 319 Nonpoint Source Management Program, the CWA Section 402 NPDES Stormwater Permitting Program, and the Coastal Zone Management Act Section 6217 Coastal Nonpoint Source Control Program.

SECTION 319 NONPOINT SOURCE MANAGEMENT PROGRAM

The major federal program for protecting surface and ground waters from nonpoint source pollution (NPS) is Section 319 of the Federal Clean Water Act (CWA). This program is the successor to the CWA Section 208 Areawide Water Quality Management program conducted in the late 1970s and early 1980s. Unlike the Section 208 program which primarily was a planning program, implementation is the primary objective of the Section 319 NPS program.

The 319 program requires each state to conduct statewide assessments to identify and assess waters impaired or threatened by nonpoint source pollution and to develop and implement a management program for these waters. EPA reviews and approves state assessment reports and management programs, provides technical assistance, and provides grants to states to help finance management program implementation and demonstration projects within targeted priority watersheds identified in the NPS management plan.

The NPS assessment report identifies water bodies in the state which, without additional action to control nonpoint sources, cannot reasonably be expected to maintain or attain their beneficial uses. The report identifies, on a watershed basis, the categories, subcategories, and specific nonpoint sources of pollution which contribute to this impairment. The assessment is updated in conjunction with the state's Water Quality Assessment Report required under Section 305(b) of the CWA.

The state NPS management program is based on the needs identified in the assessment report and describes the actions the state will take to manage and control NPS pollution. These programs typically encompass a wide variety of activities including planning, regulatory and non-regulatory programs, monitoring, demonstration projects and public education. Specifically, the state NPS management programs should contain and result in:

- The identification of best management practices (BMPs) for the control and reduction of specifically identified nonpoint sources of pollution and the improvement of water quality.
- The identification of NPS priority water bodies and their associated watersheds within which control programs and demonstration projects will be con-

The NPS Program requires each state to conduct statewide assessments to identify and assess waters impaired or threatened by nonpoint source pollution and to develop and implement a management program for these waters.

ducted.

- The implementation of a variety of programmatic actions throughout the state to prevent, minimize, or reduce nonpoint sources of pollution.
- The identification of federal programs and projects that the state wants to review for their consistency with the state's NPS management program and the establishment of a mechanism to conduct this review.
- A schedule containing annual implementation milestones and provisions for implementing BMPs at the earliest possible date.
- The maintenance and achievement of state water quality standards, the measure of success for all water quality management programs.

The program has been relatively well funded, with funding levels in FY- 90, 91, 92 and 93 of \$40, \$51, \$52.5 and \$50 million. Funding increased to \$80 million in FY94 and to \$100 million in FY95 and FY96. In a lesson learned from the Section 208 program, during which grant funds were used mainly for planning and development activities, Section 319 specifies that grants can be used only for the implementation of EPA approved state NPS management programs. Specifically, federal grant funds can be used to institutionalize the NPS program within a state; to implement NPS management programs within targeted watersheds; to install NPS control practices at demonstration sites allowing education of potential users about the controls and promoting their acceptance; and to conduct ground water NPS assessment and management programs.

The focus of Section 319 clearly is on the implementation of NPS control programs.

The focus of Section 319 clearly is on the implementation of NPS control programs. However, the program does not contain minimum national requirements for state NPS programs (i.e., all states will implement programs to require use of BMPs on construction sites or to treat runoff from new development), contains no national performance standards for BMPs, and lacks provisions for requiring enforceable policies. Consequently, institutionalization of state NPS programs has suffered because the national program has focused on implementation of demonstration projects to control NPS pollution within the priority watersheds.

However, the Section 319 program continues to evolve as states

and EPA gain experience in the development, refinement, and implementation of nonpoint source management programs and activities. In 1995, a States-EPA NPS Work Group was established to review the current program - its strengths, weaknesses, direction, policies, and guidance. Work group recommendations are helping to provide states with greater flexibility, improve the partnership between EPA and the states, to de-emphasize demonstration projects, to emphasize institutionalization of state NPS programs, and to continue the program's emphasis on implementation. Additionally, Congress continues to support the program with recommended appropriations increasing between 1996 and 2001.

SECTION 402 NPDES STORMWATER PERMITTING

The 1972 Federal Clean Water Act prohibits point source discharges of pollutants to waters of the United States unless authorized by a National Pollutant Discharge Elimination System (NPDES) permit. Initially, the focus of this permit program was on point source discharges of industrial and municipal wastewaters. However, as controls for these sources were implemented it became apparent that, to achieve the goals of the CWA, less traditional point sources of pollution such as storm water discharges from industrial activities and large urban centers also would have to be controlled.

In the 1987 amendments to the CWA, Congress created new requirements for storm water point sources by adding Section 402(p) to the CWA. This requires EPA to develop a comprehensive, phased program for regulating storm water discharges under the NPDES program. The development of this program presents unique challenges because of the large number of individual discharges, the diffuse nature of the sources, their cumulative environmental effects, the lack of proven control techniques for already developed areas, and limited federal, state and local resources.

Phase 1 of the program covers major industrial and municipal sources. EPA is currently assessing other potential sources to be covered under Phase 2. In November 1990, under Phase 1 of the program, EPA implemented NPDES storm water regulations for:

- storm water discharges associated with industrial activities falling within one of eleven industrial categories defined by Standard Industrial Classification (SIC) Codes, including construction sites disturbing five or more acres of land.
- discharges from large municipal separate storm

Development of the NPDES storm water program presented unique challenges because of the large number of individual discharges, the diffuse nature of the sources, and the lack of proven control techniques in already developed areas.

The NPDES storm water permit program directly affects over 800 municipalities and 47 counties across the country.

sewer systems (MS4s) serving a population of 250,000 or more, and for discharges from medium MS4s serving a population of between 100,000 and 250,000.

- discharges which are designated by EPA or a NPDES delegated state as needing a NPDES permit because the discharge contributes to a violation of a water quality standards or is a significant contributor of pollutants to waters of the United States.

MUNICIPAL PROGRAM REQUIREMENTS - The NPDES storm water permit program directly affects over 800 municipalities and 47 counties across the country. The municipal permit application process includes two parts. Part 1 is submitted 12 to 18 months after notification by EPA or a delegated state (depending upon whether the municipality is classified as a large or medium MS4). Part 2 is completed within 12 months after submission of the Part 1 application.

The Part 1 application requirements include:

- Mapping the municipal storm water management system including the identification and location of all major and minor outfalls, landfills, hazardous waste storage, transfer and disposal sites, industrial discharges, publicly owned lands, major structural controls, and waters of the United States.
- Identifying sampling locations to conduct field screening of storm water discharges to locate and identify illicit connections and non-stormwater discharges.
- Summarizing the municipality's existing legal authority to regulate or control discharges into the municipal storm water system and to identify deficiencies in legal authority.
- Identification of major storm water outfalls serving specific land uses. These will be sampled to characterize the storm water discharges through storm event sampling. A detailed sampling program to be undertaken during the Part 2 application process is described in Part 1.
- Description of existing storm water management programs including efforts to control illicit discharges,

to address pollutants in storm water, and to maintain and operate the storm water system.

- Identification of current storm water management expenditures and analysis of the community's fiscal resources available to complete Part 2 of the application.

Part 2 of the application consists of a storm water management program which is a series of activities the municipality will undertake over the next five years to manage storm water and reduce the pollutant loading discharged from the MS4. This part of the application includes:

- Analysis and summary of the sampling data obtained from the storm water outfall characterization program, including calculation of annual and seasonal loadings.
- Development and implementation of a program to eliminate illicit connections and to continue identifying and eliminating them.
- Development and implementation of new or expanded programs to reduce the pollution loading discharged from the MS4 to water bodies. This includes a wide variety of activities including public education; inspections and control of discharges into the MS4; requirements for erosion, sediment and storm water controls at new developments; enhanced operation and maintenance programs; and a monitoring program to determine the effectiveness of these activities.
- A strategy and time table to enhance existing legal authorities to give local governments adequate authority to implement the activities in their storm water management program.
- A schedule containing annual implementation milestones for the activities set forth in the storm water management program.
- Identification of the fiscal resources available over the next five years to implement the community's storm water management program.

New and expanded programs are required and must include public education, inspections and control of discharges, requirements for urban runoff control from new developments, enhanced operation and maintenance programs, and monitoring to determine program effectiveness.

STORMWATER ASSOCIATED WITH INDUSTRIAL ACTIVITY On September 9 and 25, 1992, EPA issued general permits for storm water discharges associated with industrial and construction activities. A general permit authorizes a discharge after a Notice of Intent is submitted to the regulatory agency provided all its requirements are implemented. These general permits cover the majority of the estimated 125,000 industries and 10,000 construction sites per year that are required to get permits. In November 1993, EPA published draft general permits for 25 different sectors of industrial activities providing more industry specific storm water management requirements. Final multi-sector general permits will be implemented in 1995.

The storm water general permits for industrial activities require the development and implementation of a stormwater pollution prevention plan which includes:

- development of a pollution prevention team.
- description of sources on the site expected to contribute pollutants to runoff.
- implementation of source control practices such as good housekeeping, preventive maintenance, spill prevention and response procedures, site and equipment inspections, and employee training.
- implementation of BMPs to prevent erosion, minimize sedimentation, and manage runoff.
- monitoring of storm water discharges and the implementation of annual site compliance evaluations.

The NPDES storm water regulations represent a very comprehensive program for controlling urban and industrial storm water runoff.

The NPDES storm water regulations represent a very comprehensive program for controlling urban and industrial storm water discharges. Unfortunately, fiscal and staffing resources for the program at both the federal and state level have been inadequate, especially for training on approaches and techniques that can be used to reduce the pollutant loading from storm water discharges. As with the control of all wet weather discharges, funding also is needed for research on the design and effectiveness of BMPs, for determining the environmental effects of intermittent discharges, for developing sediment assessment and quality guidelines, for refining biological community assessment techniques for use in individual states, and for developing water quality standards applicable to wet

weather discharges. Most importantly, funding is needed to construct BMP demonstration projects, especially within communities affected by the regulations, to educate citizens and increase support for local stormwater management programs.

SECTION 6217 COASTAL NONPOINT SOURCE CONTROL PROGRAM

Section 6217(g) of the Coastal Zone Management Act Reauthorization Amendments (CZARA) of 1990 requires states with existing coastal zone management programs to establish NPS programs in coastal areas. The coastal NPS program must be approved by EPA and by the National Oceanic and Atmospheric Administration (NOAA). The program will be incorporated into existing state NPS management programs developed pursuant to Section 319 of the CWA and state coastal zone management programs developed pursuant to Section 306 of the CZM Act. The purpose of Section 6217 is to restore and protect coastal waters from NPS pollution. The program is limited to controlling nonpoint source pollution within the watersheds of coastal water bodies. The affected coastal area boundary is determined individually for each state.

The program contains two unique aspects. First, it requires the implementation of certain management measures (BMPs) and establishes national guidance for these measures, including some minimum performance levels. Management measures are defined as economically achievable measures for the control of the addition of NPS pollutants from existing and new sources, which reflect the greatest degree of pollutant reduction achievable through the application of the best available NPS pollution control practices, technologies, processes, siting criteria, operating methods, or other alternatives. Secondly, the program originally required the implementation of enforceable policies to assure that the management measures would be implemented. However, voluntary approaches are acceptable provided there is a mechanism to obtain implementation if they are not successful in protecting water quality.

The program is administered jointly by EPA and NOAA. EPA is primarily responsible for specifying management measures for controlling NPS pollution in coastal areas while NOAA is responsible primarily for programmatic requirements. The management measures guidance document (commonly referred to as the “g” guidance) is an excellent compendium of information about BMPs used to control nonpoint sources. For each management measure, the following information is discussed:

The purpose of Section 6217 is to develop and implement a program that supports the implementation of management measures for NPS pollution that will restore and protect coastal waters

The program is limited to controlling nonpoint source pollution within the watersheds of coastal water bodies.

Two unique keys to this program are the establishment of minimum national guidance for management measures including some performance standards and the requirement for enforceable policies.

- a description of the categories of activities and locations for which the management measure and its associated BMPs may be applicable.
- a listing of the pollutants addressed and the expected pollutant reductions achievable.
- a description of the water quality benefits of implementation.
- a description of costs.
- minimum performance standards are established for certain BMPs including urban runoff controls for new development which are to be designed to achieve 80 percent average annual loading of total suspended solids.

To avoid loss of up to 30 percent of their federal coastal zone management and NPS management grants, states must undertake the following actions:

- Modification, if necessary, of the state coastal zone boundary to assure that the watershed areas contributing to coastal waters are included.
- Implementation of the “g” guidance management measures and/or additional state-developed BMPs to control NPS pollution in impaired or threatened coastal waters.
- Development of voluntary approaches and “enforceable policies” and mechanisms to assure implementation of all of the management measures.
- Development of a technical assistance program to local governments and the public for implementing management measures.
- Coordination of existing CWA programs such as Section 319, basin planning pursuant to Section 303, and the Section 320 National Estuary Program.

OTHER FEDERAL PROGRAMS INFLUENCING URBAN RUNOFF MANAGEMENT

U. S. Environmental Protection Agency - Federal Clean Water Act

The objective of the Federal Water Pollution Control Act, commonly referred to as the Clean Water Act, "is to restore and maintain the chemical, physical, and biological integrity of the Nation's water." The Act directs the U. S. Environmental Protection Agency (EPA) to undertake many initiatives and implement many programs to accomplish the Act's objective. Many of these programs are implemented cooperatively with state and local governments, native American tribes, the private sector and citizens. Following is a brief description of programs that may influence the management of urban runoff.

Section 104: RESEARCH, INVESTIGATIONS, TRAINING AND INFORMATION

Section 104 requires the establishment of national programs for the prevention, reduction and elimination of pollution. Program activities include research, national water quality monitoring, special water quality studies, investigations of pollution control techniques, watershed management planning, and pilot and demonstration projects to implement NPDES-related activities, especially those related to the control of urban runoff and combined sewer overflow (CSO) discharges.

Special programs that are funded through Section 104 include:

State Wetlands Program

The State Wetlands Program is designed to increase the ability of state programs to protect wetland resources. Since wetlands are the "kidneys" of our watersheds, performing many valuable functions to help reduce urban runoff impacts, their protection is extremely important environmentally and economically. Program funds can be used to develop new state wetland protection programs or to refine existing programs, assist states assume the Section 404 program, help states develop state wetland conservation plans, and for watershed protection demonstration projects.

Program activities under Section 104 include research, national water quality monitoring, special water quality studies, investigations of pollution control techniques, river corridor watershed management planning, and pilot and demonstration projects to implement NPDES related activities.

Wetlands Protection Program

The Wetlands Protection Program provides funds for river corridor/watershed management planning and for activities in targeted watersheds such as advance wetland identification, public education, and section 404 enforcement.

Section 106, GRANTS FOR POLLUTION CONTROL PROGRAMS

Section 106 provides grant funds for the administration of programs for the prevention, reduction, and elimination of water pollution. This is the primary federal grant funding source for state water quality management programs. Eligible activities include nearly all aspects of the prevention and abatement of surface and ground water pollution (planning, monitoring, permitting, enforcement, training, public education, technical assistance).

Section 303, WATER QUALITY STANDARDS AND IMPLEMENTATION PLANS

Section 303 requires states to develop, adopt and enforce water quality standards that will protect, maintain and restore the chemical, physical and biological integrity of all waters. In establishing water quality standards, States define the water quality goals for their waters by designating beneficial uses for water bodies and adopting water quality criteria to protect these designated uses. Water quality standards provide the regulatory and legal basis for point and nonpoint source water-quality based controls beyond those required by the Act's uniform minimal technological requirements. Water quality standards must be reviewed regularly and, if necessary, which is very relevant to the management of urban runoff and other nonpoint sources. Accurately evaluating the ecological effects of these intermittent pollutant discharges requires new strategies such as sediment monitoring and especially biological community monitoring, since it includes assessment of physical habitats. The importance of these new strategies is seen by EPA's emphasis on revising biological criteria. Unfortunately, basic research on the ecological effects of these repeated intermittent discharges is needed before numerical criteria and standards can be established for all situations.

Section 303(e) requires states to implement a continuing water quality planning process and to develop water quality manage-

Water Quality Standards provide the regulatory and legal basis for point and non-point source water-quality based controls beyond those required by the CWA's uniform minimal technical standards.

ment plans. An important element of this watershed management approach is the Total Maximum Daily Load (TMDL) process, authorized in Section 303(d). States must identify waters that do not meet or are not expected to meet applicable water quality standards with technology-based controls only. For these “water quality-limited waters” a TMDL establishes the total allowable pollutant loadings and the pollution reductions necessary to attain water quality standards for a water body. The TMDL thereby provides a basis for more stringent water quality based controls for pollutants when technology based controls are inadequate to achieve state water quality standards. It also allows for the allocation of allowable point and nonpoint source loadings and the implementation of appropriate controls for all sources.

Section 314, CLEAN LAKES PROGRAM

Section 314 establishes requirements for state lake management programs, for the establishment of projects and programs to control pollution sources to lakes, and to protect and restore the quality of lakes. States which establish lake management programs become eligible for grant funds that can be used for identification and classification surveys of all publicly-owned lakes; state lake water quality monitoring and assessment programs; public education; and lake restoration projects. Lake restoration projects typically include three phases: Diagnostic/Feasibility Study; Restoration/Protection Implementation Program; and Post-Restoration Monitoring.

Section 320, NATIONAL ESTUARY PROGRAM

The National Estuary Program (NEP) builds upon the lessons of the Chesapeake Bay and Great Lakes Initiatives, which use a geographic, basin-wide environmental management approach. The goals of the NEP are to identify nationally significant estuaries, protect and improve their water quality, and enhance their living resources. Estuaries are selected for the NEP based on their potential to include environments of significant national concern and the demonstrated commitment by state and local governments and citizens to protect these valuable resources. Currently, 28 estuaries are part of the NEP.

The NEP authorizes the development of Comprehensive Conservation and Management Plans (CCMP), usually over a five year period. The CCMP is developed by a management committee that involves Federal, state, regional and local

The Total Maximum Daily Load (TMDL) process provides a basis for more stringent water quality based controls for pollutants when technology based controls are inadequate to achieve state water quality standards.

The National Estuarine Program strives for open, consensus building approaches to define program goals and objectives, identify problems, and design pollution prevention/control and resource management strategies.

governments, affected industries, scientific and academic institutions, and citizens. Management conferences strive for an open, consensus-building approach to defining program goals and objectives, identifying problems, and designing pollution prevention/control and resource management strategies. While NEPs are not set up specifically to address urban runoff, demonstration projects and other activities to control urban runoff generally are a part of the NEP action plan for most estuaries.

Section 320 does not provide funding for the implementation of approved CCMPs although other CWA funds (ie, 319, Title II and VI) may be used.

Section 404, PERMITS FOR DREDGED OR FILL MATERIAL

Section 404 establishes a regulatory program to control the discharge of dredged or fill material into navigable waters (wetlands) to assure that such discharges comply with environmental requirements. This program is administered by the Army Corps of Engineers and the EPA. The Corps has the primary responsibility for the permit program. EPA develops the environmental guidelines by which permit applications are evaluated, reviews proposed permits, may veto permits with unacceptable adverse environmental effects, determines the jurisdictional limits of waters of the United States, and interprets statutory exemptions. Enforcement authority is shared between EPA and the Corps. The numerous stormwater management functions performed by wetlands makes their protection and restoration very important to the success of urban runoff management programs.

TITLE VI STATE WATER POLLUTION CONTROL REVOLVING FUNDS (SRF)

The SRF program authorizes EPA to make capitalization grants to states for the purpose of establishing a water pollution control revolving fund to provide assistance in the construction of publicly owned treatment works, for implementing a Section 319 NPS management program, or for developing and implementing a Section 320 CCMP. Also, Section 604 (b) requires each state to reserve one percent of the State Revolving Loan Fund grant for water quality management planning activities required by Section 205(j) and 303(e). Eligible activities include projects to determine the nature, extent and causes of water quality problems; to identify cost-effective and acceptable point and

nonpoint source controls; and to develop implementation plans.

Federal Safe Drinking Water Act

Several laws have been enacted that address different issues related to ground water protection and management. The Safe Drinking Water Act regulates the injection of wastes into deep wells and establishes the Wellhead Protection program. Additionally, the Surface Water Treatment Rule of this Act outlines requirements for the protection of surface waters which are used for drinking water supply.

Section 1421, UNDERGROUND INJECTION CONTROL

Section 1421 requires the establishment of federal and state programs to protect ground waters from the subsurface emplacement of fluids. These programs establish regulations that govern the construction and operation of injection wells to assure that the injected fluid remains in the injection zone and does not contaminate ground waters. Class V injection wells are used to dispose of urban runoff in many locations, especially in closed basins. BMPs should be used to treat the runoff before it is discharged into the injection well. This section authorizes grants to states to fund all types of activities implemented as part of a state's program.

Section 1428, WELLHEAD PROTECTION PROGRAM

Section 1428 requires states to develop systematic and comprehensive programs to protect ground waters that supply wells and wellfields contributing drinking water to public water supplies. As part of a Wellhead Protection (WHP) program, states must delineate wellhead protection areas for each well or wellfield used for public water supply. Contaminant sources within the wellhead protection area must be identified, a management plan developed to prevent contamination of the water supply in that area, and standards must be established for locating new wells so as to minimize the potential for contamination of the water supply. The WHP program requires the participation of all levels of governments. Local governments are especially important because of their land use decision authority.

PROTECTION OF SURFACE WATER SUPPLY SOURCES

The Surface Water Treatment Rule promulgated on June 29,

Contaminant sources within a wellhead protection area must be identified, a management plan developed to prevent contamination of the water supply, and standards established for new wells to minimize contamination potential.

Coordination and integration of urban runoff management programs with agricultural conservation programs is very important.

1989 requires owners of public drinking water systems using surface water sources to establish and maintain effective watershed control programs as one condition of avoiding water filtration requirements. These watershed control programs are designed to reduce the need for water treatment by protecting surface water supply sources from urban runoff and other nonpoint pollutants. The watershed control program must characterize the watershed hydrology and land ownership; identify watershed characteristics and activities detrimental to water quality; and identify, monitor, and control activities that may have an adverse effect on source water quality.

U. S. Department of Agriculture (USDA)

While this handbook focuses on urban runoff management issues, many local governments have outlying agricultural areas contributing pollutants that adversely affect receiving waters and which are discharged to runoff conveyance systems operated by local governments. Coordination and integration of urban runoff management programs with agricultural conservation programs is extremely important.

For over 50 years, the USDA has been implementing programs that potentially can reduce the effects of nonpoint sources coming from agricultural and forest lands. Passage of the 1985 Food Security Act initiated a large redirection of monetary and human resources towards soil conservation and indirectly towards control of agricultural runoff and nonpoint source pollution. Title XII of this Act has multiple objectives including conservation of the nation's soil resources, reduction of surplus commodities, wetland protection, and reduction of off-site impacts from sediment including deterioration of water quality. Title XII created the Conservation Reserve, Highly Erodible Land Conservation, and Wetland Conservation Programs.

Recently, the USDA launched a Water Quality Initiative Program to provide farmers and ranchers the educational, technical, and financial means to respond voluntarily and independently to on-farm environmental concerns, especially NPS ones, and to related State water quality management program requirements. By 1995, USDA is to have identified areas where the agricultural threat to water quality is most serious and to have taught farmers and ranchers in those areas how to use agricultural chemicals and manage farm wastes in ways that are safe to the environment, yet economically practical. These methods will reduce the loss of agricultural wastes and chemicals that leach into ground water or run off to surface water.

Federal agricultural conservation programs provide farmers with technical, financial, and educational assistance for adopting farming practices that reduce erosion and water quality degradation. Agencies directly involved include the Natural Resources Conservation Service (NRCS) (formerly the Soil Conservation Service), the Forest Service, the Farm Service Agency (formerly the Farmers Home Administration and the Agricultural Stabilization and Conservation Service), and the Cooperative Extension Service. Typically, the NRCS provides technical assistance in planning and installing BMPs; the FS provides technical assistance for woodland management; the FSA provides financial assistance (cost sharing) for BMP implementation; and the CES provides educational support.

Natural Resources Conservation Service (NRCS)

As part of the USDA's Water Quality Initiative, the NRCS is providing increased technical assistance for selected agricultural watersheds or aquifer-recharge areas called "Hydrologic Unit Areas" (HUAs). NRCS also is supporting demonstration projects to encourage the use of effective and efficient conservation practices that will help benefit water quality. In FY90 and FY91 74 HUAs and 16 demonstration projects were funded.

Resource Conservation and Development Program (RC&D) encourages and improves the capability of state and local entities in rural areas to plan, develop and implement programs, typically in targeted critical areas.

Soil and Water Conservation provides technical assistance to the public through total resource planning and management to improve water quality, natural resources, and reduce pollution sources. NRCS also has been publishing detailed soil surveys for each county in the country providing a wide variety of useful natural resources management information.

Watershed Protection and Flood Prevention (Small Watershed Program; PL-566 Program) provides technical and financial assistance to state agencies and local governments in the development and implementation of plans to protect, develop, and use the land and water resources in small watersheds. Recently, this program has become more broadly oriented with greater emphasis on protecting and restoring water quality, especially from problems related to flooding, erosion, sedimentation, and use/disposal of water.

Federal agricultural conservation programs provide farmers with technical, financial, and educational assistance for adopting farming practices that reduce erosion and water quality degradation.

Forest Service

The Forest Service is responsible for managing approximately 191 million acres of public lands. Congress has directed that these lands are to be managed for multiple use purposes including timber, range, recreation, minerals, wildlife, fish, soil and water. The Forest Service has implemented, in cooperation with States, a nonpoint source management program to assure that land management activities on forest lands use appropriate best management practices to minimize water quality effects. Additionally, the Watershed Improvement Program targets over 35,000 acres annually, treating those lands adversely affected by past uses. A major objective of this program is improvement of water quality and watershed conditions.

Farm Service Agency

Agricultural Conservation Program (ACP) is designed to control erosion and sedimentation and to encourage voluntary compliance with federal/state requirements to solve point and nonpoint pollution. The program provides cost-sharing incentives to individuals for conservation practice implementation. Water quality improvement recently is receiving special emphasis.

Conservation Reserve Program (CRP) is intended to return certain agricultural lands which are highly erodible or otherwise critical in protecting and restoring water quality (i.e., wetlands) to a conservation use, typically as forests. Farmers who participate in the program agree to establish and maintain a soil-conserving cover on the land for at least ten years during which no harvest or grazing may be conducted on the land. Farmers receive an annual per acre rental payment in addition to cost share funds for establishment of BMPs to control erosion, establish conservation cover and protect water quality. Compliance is checked first by verification of BMP installation and subsequently by spot checks.

Highly Erodible Land Conservation (HELIC) includes two programs that mandate the loss of USDA program benefits to farmers who convert highly erosive land to row crop production or who produce row crops on highly erosive land without an approved conservation plan.

- **Conservation Compliance** applies to land where annually tilled crops were grown at least once be-

Soil and Water Conservation provides technical assistance to the public through total resource planning and management to improve water quality, natural resources, and reduce pollution sources.

tween 1981-85 and it now applies to all highly erodible land in annual crop production. Eligibility for USDA program benefits are lost if the farmer does not have a conservation plan, approved by the NRCS and the local Soil and Water Conservation District, which sets forth the BMPs that need to be used to minimize erosion and sedimentation. The conservation plan must have been prepared and approved by January 1, 1990 with all required BMPs installed by January 1, 1995.

- **Sodbuster** is designed to discourage conversion of highly erodible land for agricultural production. Farmers who plant annually tilled crops on highly erodible grassland or woodland lose eligibility for USDA program benefits unless the land is planted in accordance with an approved conservation plan.

Swampbuster is intended to discourage conversion of wetlands for agricultural purposes by making farmers ineligible for USDA program benefits if wetlands are converted after December 23, 1985. This helps to preserve the valuable runoff management benefits of wetlands.

Wetlands Reserve Program (WRP) is intended to restore and protect farmed wetlands or converted wetlands. Farmers receive direct payments and conservation planning and technical assistance to install necessary restoration practices on those areas that they agree to maintain under a conservation easement. These ditched and drained wetlands can be restored by their incorporation into basin stormwater master plans. As surrounding areas urbanize, the pretreated urban runoff can be directed into the wetlands.

U. S. Department of the Interior

National Water Quality Assessment Program, administered by the Geological Survey (USGS), addresses a wide range of major water quality issues, with special emphasis in the next few years on pesticide impacts on water resources. The program will include nationwide surface and ground water quality monitoring and assessment.

Water Data Program, administered by the Geological Survey, consists of four water quality monitoring networks the most important of which is the National Stream Quality Accounting

The Forest Service has implemented, in cooperation with states, a nonpoint source management program to assure that land management activities on forest lands use appropriate best management practices to minimize water quality effects.

Network (NASQAN). Data on stream flow and height, lake stage and storage, ground water levels, well and spring discharge and the quality of surface and ground waters is collected and stored in WATSTORE.

Federal State Cooperative Program establishes a partnership for water resources investigations between the USGS and state and local agencies. This program is the foundation for much of the planning, development and management of the nation's water resources.

Coastal Wetlands Planning, Protection and Restoration Program, administered by the Fish and Wildlife Service, provides funds for the acquisition of coastal lands or waters and for restoration, enhancement or management of coastal wetland ecosystems. Projects must provide for the long term conservation of these lands and waters.

The **Land and Water Conservation Program**, administered by the National Park Service, was established to create and maintain a national legacy of high quality recreation areas. The program provides funding for federal acquisition of authorized national park, conservation and recreation areas and to state and local governments to help them acquire, develop and improve outdoor recreation areas.

Federal Aid Highway Program funds may be used for planning, research, and development (including BMP's), restoration, roadside beautification, wetland mitigation, and erosion and sediment controls.

Federal Highway Administration

The **Federal Aid Highway Program** assists state agencies in the development and improvement of an integrated, interconnected transportation system. Funds may be used for planning, research and development (including BMPs), restoration, roadside beautification and wetland mitigation. The program provides funding for erosion and sediment controls needed to minimize highway construction impacts but not typically for the treatment and management of highway runoff. However, the Surface Transportation Program, established under the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA), authorizes funding for highway urban runoff quality controls and for mitigating damage to ecosystems, habitat and wildlife.

Army Corps of Engineers

Civil Works Projects are a specific line-item congressional appropriation in the biennial Water Resources Development Act. These projects help communities address a variety of water resource problems including flood control, coastal and shoreline

erosion, environmental restoration and water quality management. Projects must include mitigation of unavoidable environmental damages and must also consider environmental restoration through opportunities created with projects.

The following programs have great potential to adversely affect aquatic systems and to impede the management of urban runoff to protect or restore water quality:

Small Flood Control Projects, pursuant to Section 205 of the Flood Control Act of 1948, authorizes the Corps to reduce flood damages through projects not specifically authorized by Congress. However, the Corps is restricted to making improvements to natural water courses, typically structural ones such as bank hardening or channelization. The adverse environmental, riparian, and habitat impacts of these channelization projects are not addressed since the program can not consider watershed urban runoff improvements.

Snagging and Clearing for Flood Control, pursuant to the Flood Control Act of 1937, allows the design and construction of flood control measures which typically increase drainage and decrease water quality.

National Oceanic and Atmospheric Administration

Coastal Zone Management Program - The Coastal Zone Management Act of 1972 allows states to prepare and implement comprehensive management programs for coastal resources which balance competing demands on resource protection, protection of public health and safety, provision for public access, and economic development. As an incentive to states, the Act provides financial and technical assistance during the planning and administration of programs that meet minimum federal standards. The Coastal Zone Management Act Reauthorization Amendments of 1990 reaffirms our nation's commitment to improved management of coastal resources by enhancing and expanding the resources and provisions of the Act. These amendments reinstate grants to coastal states which have not yet developed coastal zone management programs and require certain coastal states to implement coastal nonpoint source control programs as previously described.

National Estuarine Research Reserve System allows establishment and management of a national system of reserves representing different coastal regions and estuarine types. The

The Coastal Zone Management Act Reauthorization Amendments of 1990 reaffirmed our nation's commitment to improved management of coastal resources.

reserves serves as field laboratories and as public education centers.

National Marine Sanctuary Program allows identification of areas of the marine environment of special significance and provides authority for comprehensive and coordinated conservation and management of these areas. Program provides for research and monitoring activities and for public education.

Information Sources

U.S. Environmental Protection Agency. 1992. Protecting Coastal and Wetlands Resources: A Guide for Local Governments. EPA 842-R-92-002. Office of Water. Washington D.C.

U.S. Environmental Protection Agency. 1992. Guidance Specifying Management Measures for Sources of Nonpoint Pollution of Coastal Waters. Office of Water. Washington, D.C.

U.S. Environmental Protection Agency. 1993. Guide to Federal Water Quality Programs and Information. EPA 230-B-93-001. Office of Policy, Planning and Evaluation. Washington D.C.

U.S. Environmental Protection Agency. 1993. Watershed Protection: Catalog of Federal Programs. EPA 841-B-93-002. Office of Water. Washington D.C.

Chapter 2

Synopsis of Municipal, County, Regional, and State Urban Stormwater Management Programs

It is especially important for individuals developing or implementing a program to talk to experienced staff at other programs.

Learn from their mistakes.

Build upon their successes.

The data analysis in Chapter 3 and the recommendations in Chapter 4 are based on information obtained from the questionnaire responses for each of the individual urban runoff control programs. Detailed "Sediment Control and Stormwater Management Program Summaries" for each of the 32 programs reviewed for this project are included in Appendix B. The program summaries are presented alphabetically within the following categories: cities, counties, regional authorities, and states.

The individual synopses provide a detailed picture of each urban runoff control program, with a focus on their institutional and technical framework. For each program, information is presented on its initial organization, goals, performance standards, design criteria, practices, funding, staffing, inspection, enforcement, maintenance, and program evolution. Also included is a listing of available publications along with information on how to contact the program staff. It is hoped that this summary of individual programs will increase communication between staff at urban runoff control programs around the country, thereby facilitating the transfer of information about both the institutional and technical aspects of this rapidly evolving field.

It is especially important for individuals developing or first implementing a program to talk to experienced staff at other programs. Learn from their mistakes. Build upon their successes. There are too many important new issues, processes, and BMP's in this field to spend time reinventing wheels. To help this technology transfer continue, the Watershed Management Institute will prepare summaries of other urban runoff control programs if the information is provided. The questionnaire to provide the program information is included as Appendix A. The format of the program summaries lend themselves to a looseleaf notebook with each one a separate fact sheet. New fact sheets could be added as information is received.

The program summaries are presented in the following order:

<u>CITY PROGRAMS</u>	<u>PAGE NUMBER</u>
Alexandria, Virginia	B - 2
Austin, Texas	B - 7
Bellevue, Washington	B - 10
Fort Collins, Colorado	B - 19
Olympia, Washington	B - 24
Orlando, Florida	B - 30
Seattle, Washington	B - 35
District of Columbia	B - 40
Winter Park, Florida	B - 45
<u>COUNTY PROGRAMS</u>	
Baltimore County, Maryland	B - 50
Clark County, Washington	B - 55
King County, Washington	B - 60
Kitsap County, Washington	B - 66
Maricopa County, Arizona	B - 72
Montgomery County, Maryland	B - 77
Prince George's County, Maryland	B - 82
Snohomish County, Washington	B - 87
Somerset County, New Jersey	B - 92
Washington County, Oregon	B - 97
<u>REGIONAL PROGRAMS</u>	
Denver Urban Drainage and Flood Control District	B - 102
Northeastern Illinois Planning Commission	B - 107
South Florida Water Management District	B - 112
Southwest Florida Water Management District	B - 118
Suwannee River Water Management District	B - 124
<u>STATE PROGRAMS</u>	
Delaware	B - 130
Florida	B - 136
Maryland	B - 143
New Jersey	B - 148
Pennsylvania	B - 154
South Carolina	B - 160
Virginia	B - 166
Washington	B - 172

Chapter 3

Questionnaire Responses

It is very important that we learn from past efforts.

We do not need to recreate wheels.

We should not repeat previous mistakes which may be universal in their applicability and implications.

The major goal of this publication is to offer recommendations on the essential elements of a successful urban runoff management program. However, remember that any two individuals likely will differ on what they consider essential elements for controlling urban runoff. Accordingly, the recommendations presented in this publication are based on the historical experiences of individuals and programs that have struggled with the many issues, decisions, and actions that must be taken to implement an urban runoff control program. As seen from their questionnaire responses, many of the individuals and programs have historical perspectives spanning several decades. If flood control activities and experiences are considered, some of the surveyed programs have been active for over 30 years.

There is a lot of history in these programs - and a lot to learn from their experiences, both successful and unsuccessful. They have taken actions which at the time seemed good, but which required revision after actual implementation. Examples of these actions may include exemptions which are overly restrictive or are too broad, or requiring a specific design approach, which through greater experience may be inappropriate for a given program goal. It is very important that we learn from these efforts. We do not need to recreate wheels. We should not repeat previous mistakes which may be universal in their applicability and implications. Many of these programs have common elements which may be considered as "standard" for an urban runoff control program. Other programs have unique components which may have limited applicability due to local institutional, political or funding conditions. However, these may be excellent for use elsewhere if only others become aware of them.

This chapter will summarize and analyze the individual responses to the questionnaire for a variety of important urban runoff control program issues. They will be considered generally based on all responses, and more specifically by categories such as cities, counties, regional authorities, and states. Some of the issues are broad enough to be applicable to all institutional levels of program implementation. While others are more relevant when considered at a specific level of program implementation.

The questionnaire is specific to program implementation issues.

While BMP design information was also submitted by the respondents, the primary intent of this document is to provide information on institutional issues and program strategies. Most importantly, the reader must decide on the appropriateness and applicability of specific issues. If a program component or activity, even though essential or desired, is not going to be acceptable for political or institutional reasons, then it is vital to recognize this limitation and to build a program structure that works without this component, at least for the time being.

Responses were received from 32 urban runoff programs around the country representing nine cities, ten counties, five regional authorities, and eight states. Of the five regional authorities, three are in Florida and they operate very differently than the other two. Unlike Florida's water management districts, the Northeastern Illinois Planning Commission and the Urban Drainage and Flood Control District of Denver are not involved in daily implementation of erosion and sediment control and stormwater management for land development activities. Instead, they provide technical assistance and guidance to local jurisdictions which are responsible for directing program implementation.

Issues

1. General Program Issues

1a. Are the Erosion and Sediment Control and Stormwater Management Program Integrated?

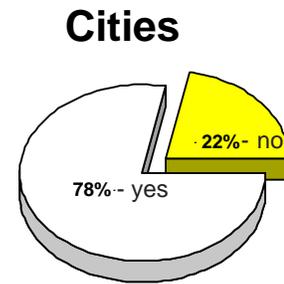
There are many issues and activities common to erosion and sediment control programs and to urban stormwater management programs. These include administrative issues (staffing, plan review and approval, fees, enforcement), technical issues (performance standards, design criteria, safety, liability), and inspections (which can be greatly enhanced by having a single inspector knowledgeable about erosion/sediment controls and stormwater controls). A good example of the interrelationship of these two program components is the construction of stormwater practices while the site is unstabilized. Often permanent stormwater management systems are used during construction as sediment control basins. However, some stormwater practices, such as infiltration practices or vegetated swales, are very sensitive to sediment entry during the construction phase. Good communication between these two program components reduces conflicts that may arise with respect to site control practices. More importantly, good communication or program integration can reduce program costs, in-

Responses were received from 32 urban runoff programs around the country representing nine cities, ten counties, five regional authorities, and eight states.

crease staff productivity, help assure proper performance of BMPs, and enhance program effectiveness.

Cities

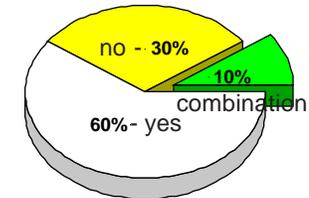
The two program components are either integrated or administered by the same staff in seven cities (78%). Of the two cities with separate programs, the programs in Bellevue, Washington were integrated until recently, when they were separated.



Counties

Counties

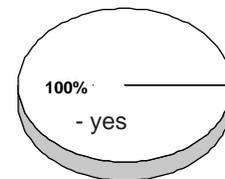
The two programs are integrated in six counties (60%). In Prince Georges County the plan review for erosion and sediment control is done by the local Soil Conservation District, while inspection and enforcement are done by the County. Programs in three counties (30%) are separate. The Somerset County, N. J. program only addresses stormwater management as State law assigns soil erosion and sediment control to the Soil Conservation Districts.



Regional Authorities

Regional Authorities

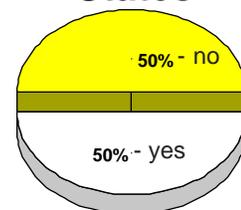
The erosion/sediment control and stormwater management programs are integrated in all five regional authorities (100%).



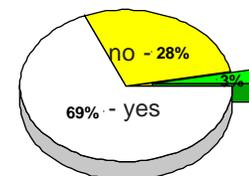
States

States

The programs are integrated in four states (50%), but are separate in the other four states.



Overall Statistics



Are the two programs integrated?

Close coordination between the erosion and sediment control program and the stormwater management program is generally recognized as being essential for effective site control during construction.

Overall Statistics

The erosion/sediment control and urban runoff programs in 22 jurisdictions (68%) are integrated, while they are administered separately in nine jurisdictions (28%). The Prince Georges County program (3%) involves a combination of local entities with the local soil conservation district doing plan review, and the local government doing inspection and enforcement.

1b. The Impetus for Program Implementation

Cities

Seven cities (77%) list water quality concerns as an important reason in program implementation, with six cities (66%) listing flooding and channel erosion. Ground water concerns are cited by four programs (44%), while impetus for two programs (22%) are requirements by other entities, such as the NPDES storm water program or state programs. Several programs cite the protection and/or preservation of a specific resource, such as the Edwards Aquifer (Austin, Texas), aquatic habitat (Olympia, Washington), stream protection (Seattle, Washington), or the Winter Park Chain of Lakes (Winter Park, Florida). Cities cite an average of four separate reasons for their program's implementation.

Counties

Flooding and water quality are important impetuses for program implementation in all ten of the counties (100%). Channel erosion is an important reason in nine counties (90%). Programs in six counties (60%) are required by other jurisdictions, while the programs in four counties (40%) cite ground water protection or recharge concerns. Aquatic habitat protection and wetlands protection (30%) are listed by three counties, and fisheries issues are an impetus for two county programs (20%). Counties cite an average of 4.6 reasons for their program's implementation.

Regional Authorities

Flooding is cited by all five regional authorities (100%) as a stimulus for program implementation, while four programs (80%) also list water quality. Resource protection is included as a program impetus in three programs (60%) - all Florida

Seven cities and all ten counties list water quality as an important reason for program implementation

Six cities and all ten counties list flooding as an important impetus for their program.

water management districts. Three programs list channel erosion (60%) as a program impetus, and ground water issues are included by two programs. Specific resources to be protected included wetlands (Northeastern Illinois Planning Commission, Suwannee River WMD) and lakes (NIPC). Only the South Florida WMD cites stormwater treatment requirements imposed by another entity as the impetus for program implementation, even though its statutory authority clearly lists this as a responsibility of the district. These responses indicate that regional programs are established primarily to address specific local or regional concerns, as opposed to city or county programs which may be implemented in response to requirements imposed by federal, state, or regional entities. Regional authorities cite an average of 4.6 reasons for implementing their program.

States

All eight states list water quality protection (100%) as a program stimulus, while flooding is also an impetus in five programs (62%). Channel erosion is an important concern in three programs (37%), and being required by others also is cited by three programs. Other specific reasons for program implementation include ground water (Maryland), sedimentation (Maryland), wetlands (New Jersey), and fisheries and shellfish (Washington). States cite an average of 3.1 reasons for their program's implementation.

Overall Statistics

In general, the stimulus for establishing state programs (3.1 reasons/program) appears to be more narrowly focused than for regional and local programs, which seem to be more broadly based and created to address more diverse issues. County and regional programs average 4.6 reasons/program, slightly more than the 4.4 for city programs. It is very important to recognize that most successful urban runoff control programs typically have multiple goals and objectives, trying to address several of the adverse impacts associated with urbanization. This is important because it helps to build broader support and consensus for implementing urban runoff control programs. While the objectives are often mutual, special expertise and resources may be required to properly address each one, a very important consideration when program budgets and resources are considered. It must be recognized that each ob-

It is very important to recognize that most successful urban runoff control programs typically have multiple goals and objectives, trying to address several of the adverse impacts associated with urbanization.

jective often requires a separate program component, with its own funding and resource needs. This is one reason why successful stormwater management programs usually evolve, becoming more comprehensive and complex over time.

2. Stormwater Management

2a. The Basic Goal of the Stormwater Management Program

The basic goal of the stormwater management program is directly related to the initial impetus for the program. However, this question focuses on specific issues instead of common goals or reasons for program implementation such as protection of health, well-being, or property. As expected, program goals are as varied as the programs. It should be noted the program goals are often very numerous, taking a page or more in a program's legal authority documents. Therefore, statistics are not really indicative of the breadth of a program's goals, or the issues associated with program development and implementation.

Cities

The city urban runoff control programs list many highly diverse program goals, reflecting the many different impacts that have arisen locally in association with urbanization. However, there are some common threads in the responses. Six of the nine programs (66%) list protection of citizens, property, and the public interest as a goal. This should not be surprising since one of the primary purposes of government is the protection of the public's health, safety, and welfare. Other goals, such as water quality or flooding protection, are cited less frequently. Thus it appears that the implementation of any city program must consider public *protection* as a key program element.

Counties

While there are some slight differences between program goals cited by cities and counties, *protection* is also a prominent goal of county programs. However, the object of protection shifts from the general to specifics, with protection of resources or environmental quality important. Another important goal of county programs is *maintenance* - of surface water quality, waterways, and environmental quality. This shift in focus may be related to the lower population density of counties when compared to cities. Many cities have developed so densely that natural environmental goals often are not realistic. The

Stormwater program goals are as varied as the programs.

It should be noted that program goals are often very numerous, taking a page or more in a program's legal authority documents.

Many cities have developed so densely that natural environmental goals often are not realistic, and the runoff associated with increased urbanization has caused significant impacts felt by many residents, such as flooding or water pollution.

runoff associated with increased urbanization has caused significant impacts felt by many residents, such as flooding or water pollution. Counties, with less development and lower population densities, may experience similar but more localized problems that generally affect fewer residents. They also generally have more extensive natural resources which are more in need of protection or maintenance, not restoration.

Regional Authorities

The regional programs do not appear to have a common set of goals that reflect a generic list of items (flooding, water quality, aquatic resources) that are important local or regional needs or issues in the establishment of these programs. Typically, regional stormwater management programs or authorities are created to address urbanization issues or needs extending beyond normal county or city boundaries. Since urban runoff effects are associated with the cumulative impacts of all of the land use changes within a watershed, regionalization is an effective strategy for solving stormwater problems. A good example is the Urban Drainage and Flood Control District of Denver, whose goals are to protect the lives and property of citizens from regional floods and more localized flash floods. This very clear mandate arose from concerns associated with conditions specific to the Denver region. Another approach is taken by the Northeastern Illinois Planning Commission, whose primary role is to provide technical assistance to the region's local governments and developers. With respect to stormwater management, the NIPC is encouraging and assisting local governments to implement programs with regionally consistent standards.

The three Florida water management districts (South Florida, Southwest Florida, and Suwannee River) represent a fairly unique institutional arrangement with very broad water resources planning, management, and regulatory responsibilities. As set forth in Chapter 373, Florida Statutes, the construction of stormwater systems shall not be harmful to water resources or inconsistent with the District's objectives. To achieve this goal, consideration is given to their impact on water quality, fish and wildlife, wetlands, floodplains, recreation, navigation, and to the public's health, safety, and welfare. The programs of the WMDs are much more regulatory than those of the other two regional authorities. Their approach may not be possible in other regions of the country due to a state's statutes and institutional framework. How-

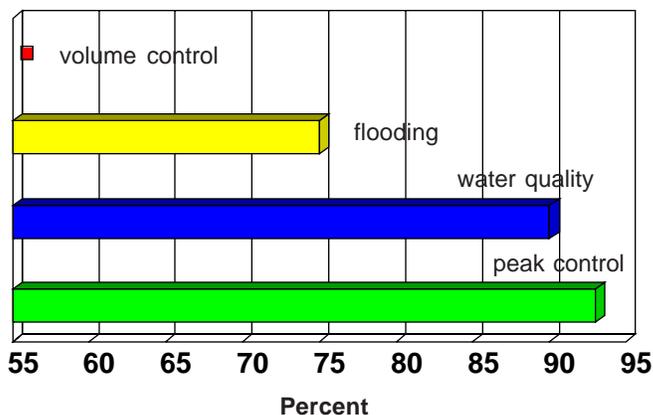
ever, Florida's stormwater program institutional framework, which establishes a partnership between the Florida Department of Environmental Protection, the state's five water management districts, and its cities and counties merits consideration wherever possible.

States

While all of the state programs mention goals which are specific to their programs, several common goals exist in all of these programs: prevention, management, and protection. Prevention of additional water quantity or quality impacts from runoff associated with urbanization is being recognized as an important strategy essential to either protection or management efforts. With respect to urban runoff control, prevention of water quality or quantity impacts from land use changes is much more effective and cost-effective than other strategies. Management typically is stated with respect to limiting the post-development impacts of stormwater runoff, especially the peak discharge rate. Protection goals are not stated in terms of human protection, but rather in terms of resource protection such as protection of shellfish beds or fish habitats (Washington). While almost all programs stress the need for education, only Delaware's state program includes education as a specific program goal.

Several common goals exist in all of these state programs: prevention, management, and protection.

Basic Goal of the Stormwater Management Program



2b. Peak discharge Rate Performance Standards

Traditionally, to provide flooding protection and minimize downstream impacts, urban stormwater programs have focused on man-

Typically, the performance standard is to limit the post-development peak discharge rate to pre-development rates for a single specified storm.

aging the post-development peak discharge rate. Specific performance standards and design criteria to control the post-development peak rate are established in 30 of the programs (94%). The Florida DEP program relies upon water management district or local requirements to manage peak rate, while the Pennsylvania program requires compliance with local or watershed specific peak rate criteria, if they have been established.

Typically, the performance standard is to limit the post-development peak discharge rate to pre-development rates for a single specified design storm. Eight of the programs (27%) limit peak rates for a single storm event, usually the 25-yr, 24-hr storm but occasionally the 100-yr event is used. As concern about channel erosion has increased, programs have started to limit the post-development peak rate for multiple storms. Recent research has shown that bankfull flow occurs during the 2-yr storm and limiting peak rate for this event helps to maintain channel stability. These recent scientific findings have been implemented by 22 of the programs (73%), with 20 of them requiring control of the 2-yr storm in addition to a larger storm for flood protection. In most programs, the larger storm is a 10-yr, 24-hr storm, with 25-yr or 100-yr storms used less frequently. The Suwannee River WMD requires control of the "critical duration storm" which is defined as the storm creating the largest difference in pre- and post-development peak rates. This requires analysis of all storms from a 2-yr, 24-hr to a 100-yr 24 hour storm.

2c. Stormwater Treatment Performance Standards

Before effective design criteria can be established for specific stormwater treatment practices, a minimum level of treatment needs to be specified. This treatment performance standard can be narrative such as "discharges will not violate water quality standards" or quantitative such as "reduction of post-development loadings". Over the years, many of the programs have implemented load reduction performance standards, usually for annual loadings but occasionally for seasonal loads. Examples of this approach may be for 80% reduction of suspended solids on an annual basis, or more specific suspended solids loading limits during spawning seasons. Performance standards have been selected due to the highly variable nature of precipitation events, storm inter-event times, land uses, pollutant accumulation and washoff rates, and runoff pollutant characteristics, and the difficulty of incorporating these variables into another type of standard. Another reason is because of the questionable applicability of current water column chemistry standards to intermittent,

wet weather discharges.

Seventeen of the 32 urban stormwater programs (53%) have performance standards for the treatment of runoff. Thirteen of these programs specify a reduction in runoff loading, with 11 programs requiring stormwater management systems to reduce annual post-development pollutant loading by 80%, typically for total suspended solids. Alexandria's performance standard is no increase in loading for new development, and a decrease in current loading by 10% for redevelopment projects. The performance standard in Washington County (OR) is 65% reduction in total phosphorus loading. Within Austin's Barton Springs watershed, the performance standard is no increase in loading for 13 parameters. Four programs use a narrative performance standard, either no adverse water quality impacts (Austin, NIPC) or meet water quality standards (Montgomery County, Prince Georges County). Interestingly, an additional nine programs require stormwater to be treated before discharge. These programs do not have a performance standard but use a design criteria which specifies a design storm or minimum runoff treatment volume. Six of the nine programs are located in Washington State and use the *Stormwater Management Manual for the Puget Sound Basin*, which specifies treatment of the 6-month, 24-hr standards

2d. Volume Performance Standards

Reflecting the relative newness of the importance of controlling runoff volume, only seven programs (22%) have specific performance standards for this important runoff characteristic. Only three of these programs (Clark Co., Maricopa Co., and SRWMD) require the post-development volume to not exceed pre-development volume on all sites. Three programs (Orlando, Kitsap Co., SWFWMD) require volume control in closed basins only (those without an outlet). Olympia (WA) requires maintaining the 100-yr volume on site only if soil conditions provide a percolation rate of greater than six inches per hour.

2e. Basis of Design Criteria

To achieve the program's goals, nearly all urban runoff control programs establish performance standards and design criteria for the various BMPs used in the jurisdiction. Performance standards establish the desired goal such as the maximum peak discharge rate, minimum treatment level, or allowable volume of runoff. Design criteria provide guidance to the regulated public and practitioners on how to design stormwater systems that will achieve

17 of the 32 urban stormwater programs (53%) have performance standards for the treatment of runoff.

To achieve the program's goals, nearly all urban runoff control programs establish performance standards and design criteria for the various BMP's used in the jurisdiction.

the program's desired level of performance. When reviewing the statistics presented in this section, **the reader is cautioned to remember that the urban runoff control programs analyzed are not representative of the nation's programs which primarily are still flood control oriented (drainage programs)**. Rather, they tend to represent a highly skewed sampling of successful programs that address both the flood control and water quality impacts of urban stormwater.

Cities

Eight of the nine city programs (88%) list peak discharge control and water quality concerns as a basis for their design criteria. Additionally, four of the cities (44%) say they use volume control (reducing the total volume of stormwater runoff) as a basis for the program's design criteria. As expected, seven of the eight cities using peak discharge control cite flooding as an impetus for program implementation.

Counties

All ten counties (100%) cite peak discharge control as a basis for their design criteria. Nine counties (90%) list water quality, while seven counties (70%) include volume control as a basis for their program's design criteria.

Regional Authorities

All five regional authorities (100%) list peak discharge control and water quality control as the basis for their program's design criteria. Volume control is cited by four of the five authorities (80%).

States

Six of the eight states (75%) list peak discharge control and water quality treatment as a basis for their program's design criteria. Interestingly, Pennsylvania cites only peak discharge control while the Florida DEP lists only water quality, with peak discharge control a responsibility of the regional water management districts. Volume control is cited as a basis for design criteria by only three of the states (37%), all of which also list peak discharge control and water quality treatment.

Limiting peak discharges from land development has long been used as a method to reduce downstream impacts associated with increased discharge rates of stormwater runoff.

Overall Statistics

Reflecting the long traditional focus of urban runoff programs on flood protection, 93% of the programs use peak discharge control as a basis for design criteria. Limiting peak discharges from land development has long been used as a method to reduce downstream impacts associated with increased discharge rates of stormwater runoff. This also reflects the importance of flood control as an impetus for program implementation (75% of the programs).

Considering the skewed sampling of urban runoff control programs, it is not unexpected that 28 of the 32 programs reviewed (87.5%) use stormwater treatment as a basis for their design criteria. This corresponds closely with the 90% of the programs which list water quality as an impetus for their program. Reflecting the multiple objectives of urban stormwater management programs, nearly every one of the programs emphasizing stormwater treatment also use peak discharge control as a basis for their design criteria. By using both peak discharge control and stormwater treatment as a basis for design criteria, these programs can more effectively achieve multiple program goals including minimizing channel erosion and protecting downstream habitats and water resources.

It is not surprising that volume control is not as frequently used as a basis for program design criteria. Only recently has the importance of the total volume of stormwater runoff been recognized as an important contributor to downstream flooding, water quality degradation, and channel erosion. Programs that limit or otherwise control the increased volume of stormwater runoff can most effectively reduce the potential downstream impacts resulting from increased urbanization. However, reducing runoff volume presents many problems given the current state-of-the-art for stormwater management practices. Runoff volume can be reduced only by infiltration or by reuse of stormwater. A common problem cited by several programs is the difficulty in assuring the long-term performance of infiltration practices. Additionally, stormwater reuse is an innovative practice which currently is being used in Florida but for which little long term performance information exists. Therefore, due to its complex nature, volume control is much easier to state as a goal than to implement. However, given the importance of volume control, research on the design, operation, and maintenance of BMPs which effectively reduce runoff volume should be a priority.

By using both peak discharge control and stormwater treatment as a basis for design criteria, programs can more effectively achieve multiple program goals including minimizing channel erosion and protecting downstream habitats and water resources.

2f. Exemptions and Waivers

The large number of projects disturbing land or creating a storm-water discharge implies a need for exempting or waiving requirements for certain projects. The exemption or waiver may be from permitting, from plan review approval, or even from the program's design criteria or other requirements. Exemptions and waivers are integral to program implementation, since they reduce needed program resources. A major issue associated with this concept is identifying what threshold is reasonable. Too many exemptions and waivers can seriously undermine program implementation and effectiveness. Therefore, to overcome potential problems, it is essential to strike a balance between over and under-regulation.

Cities

All nine city programs have exemptions and waivers for certain types of projects, with none of them requiring approval for every type of development or land disturbing activity.

Seven of the nine cities (77%) list single family homes as being eligible for exemptions or waivers. Typically, this is restricted to homes that are not part of a subdivision. These exemptions for homes often are limited only to stormwater management requirements, not erosion and sediment control during construction. However, Ft. Collins exempts them from erosion and sediment control but not from stormwater requirements. Another common exemption is based on the amount of disturbed area, with projects below a specified threshold qualifying for an exemption or waiver. The City of Alexandria exempts projects less than 2,500 square feet, while Washington D.C. uses 5,000 square feet as its threshold.

All of the city programs exempt agriculture and forestry projects, reflecting the urban nature of these jurisdictions and the lack of agriculture or forestry within their boundaries. Seattle, Washington specifically exempts State Department of Transportation projects. Whether this is a common exemption for local programs is unknown, but it is assumed that state projects require local permits where state or regional agencies do not impose erosion, sediment, or stormwater control requirements.

Counties

All ten county programs include exemptions and waivers for

All nine city programs and all ten county programs have exemptions and waivers for certain types of projects.

certain types of land disturbing activities with no programs requiring approval for all activities.

Nine of the ten counties (90%) provide exemptions or waivers for agricultural activities. King County (WA) exempts agricultural activities from erosion and sediment control but requires stormwater management practices such as limiting animal density and animal access to streams. Forestry activities are exempt or waived in seven of the ten programs (70%). A major concern with forestry exemptions is that tree cutting often is a first step in urban development at a particular site. Several programs address this concern by specifying that forestry operations are eligible for waivers or exemptions only if they are not being done in conjunction with development activities.

Single family home construction is exempt in six counties (60%), but with a number of restrictions. A common restriction is that single family home construction is exempt only if it is not part of a larger plan of development such as a subdivision. Another common restriction for single family home construction is a limit on the amount of disturbed area before formal approval of either erosion and sediment control or stormwater management is needed.

One common theme in both city and county program exemptions and waivers is the use of a disturbed area threshold. Five counties (50%) use a maximum disturbed area below which approval is not required. In all of these programs, the disturbed area limitation is very small, generally less than 5,000 square feet. It is apparent from the small size of the disturbed area threshold that these programs consider the need for stormwater management controls at development sites to be vital. This represents an important fundamental principle of urban runoff management - managing the cumulative effects of all land uses within a watershed.

Regional Authorities

The responses to this question reflect the differing nature of the regional authorities. The Urban Drainage and Flood Control District of Denver, which does not approve development proposals, lists exemptions and waivers as not being applicable. Instead, within this region, they are appropriate at the local government level. The Northeastern Illinois Planning Commission recommends local government programs provide exemptions and waivers for agriculture and forestry.

One common theme in both city and county program exemptions and waivers is the use of a disturbed area threshold, generally less than 5,000 ft².

Florida's water management districts use several different exemptions, at least from the permitting process. The SRWMD and the SWFWMD provide noticed exemptions for agricultural operations conducted in compliance with a site specific Conservation Plan which includes certain minimum BMPs. The SFWMD permits all agricultural activities except those few using a closed water management system. All of the districts exempt single family home construction that is not part of a larger plan of development. They also exempt developments below a certain size or amount of impervious surface from stormwater quantity requirements, but not from stormwater treatment.

States

The high proportion of agriculture and forestry exemptions should be expected since this project focuses on urban runoff management programs.

All eight state programs provide exemptions and waivers for agricultural activities in their programs. Seven of the eight states list exemptions or waivers for forestry activities (87%). Florida exempts agriculture if it is performed in compliance with a site-specific conservation plan, while forestry operations are exempt if they are conducted in accordance with the requirements of the state's Silviculture BMP Manual. The high proportion of agriculture and forestry exemptions should be expected since this project focuses on state urban runoff management programs. As reflected by the reasons for program implementation and by their program goals, these programs focus primarily on minimizing the impacts of runoff associated with land development and urbanization, not agricultural or forestry activities.

Single family homes are exempt or waived in all eight states, but with certain restrictions. Florida DEP limits the exemption to homes that are not part of a larger plan of development, with subdivisions having a control plan for the entire development. Five of the state programs have a disturbed area threshold below which single family homes are exempt. These limitations are variable, with no consistent pattern (Delaware and Maryland - 5,000 square feet; Pennsylvania - 10,000 square feet; New Jersey and Washington - one acre for stormwater management only). Maryland's program exempts single family home construction on lots with a minimum size of two acres.

Several state programs also authorize local ordinances to provide exemptions or waivers different from those specified by the state. Utility projects are specifically discussed in the Dela-

ware and South Carolina programs, with Delaware exempting utility projects less than 5,000 square feet and South Carolina exempting utilities operating under a certificate of environmental compatibility.

Overall Statistics

All agencies involved in the day-to-day review and approval of stormwater management allow exemptions and waivers for certain activities. General statistics probably are not appropriate, since certain exemptions or waivers are not included in areas where they are not appropriate (i.e., city programs not mentioning agriculture or forestry). However, there are some common concepts used with respect to exemptions and waivers. Most of the jurisdictions (71%) provide exemptions or waivers for single family homes. But these often have restrictions or limitations, such as disturbed area, lot size, or not being a part of a larger subdivision. Fourteen programs (43%) specify a minimum area of disturbance before requiring formal approval of stormwater management. Only two programs, both at the state level, specifically address utility construction. There is no doubt that utility construction can have a significant impact on erosion of lands and delivery of sediment to receiving waters, and therefore needs to be addressed. However, it appears that this land disturbing activity often is not regulated or required to implement erosion and sediment controls.

2g. Practices Favored

Best Management Practices (BMPs) commonly are defined as control techniques used for a given set of conditions to provide water quantity and water quality enhancement at a minimum cost. Therefore, it is not unexpected that the practices favored by the stormwater management programs vary considerably without any consistent pattern. Instead, preferred practices reflect local conditions and past experience with their long term performance.

Cities

A slight majority of city programs (56%) indicate a preference for specific stormwater management practices. The remaining city programs (44%) do not favor any particular practice.

As expected, among the city programs favoring a specific practice, the preferred BMP(s) is related to the program's location,

Among the city programs favoring a specific practice, the preferred BMP(s) is related to the program's location, experiences, and objectives.

Eight of the ten county programs (80%) favor certain practices, with six of them preferring infiltration of runoff if site conditions are appropriate.

experiences, and objectives. The Austin (TX) program, which has long advanced the state-of-the-art in sand filter systems, favors detention in conjunction with filter basins to treat runoff and protect its aquifer and surface waters. Olympia's program establishes a hierarchy of preferred treatment practices including constructed wetlands, wet ponds, biofilters, sand filters, and detention vaults. The District of Columbia program stresses infiltration practices, but like the program in highly urbanized Alexandria (VA), approves more sand filter installation because they take up less space or can be installed underground. The program in Winter Park (FL) stresses the use of surface water retention to help recharge the ground water and reduce runoff volume.

Counties

Eight of the ten county programs (80%) favor certain practices, with six of them preferring infiltration of runoff if site conditions are appropriate. Two programs (25%) prefer the use of wet or dry detention basins. Other practices favored by county programs include source controls, biofiltration, constructed wetlands, and sand filter systems.

Regional Authorities

All five of the regional programs (100%) cite a preference for certain types of stormwater management practices, namely detention or retention. The SWFWMD and the SRWMD also allow the use of detention with filtration and cite Florida's Silviculture BMP Manual for forestry activities. Infiltration of runoff was not listed as a preference by any of the regional authorities, although the rules of all three Florida WMDs provide incentives (lower treatment volume) for retention facilities.

States

Five of the eight state programs (62%) specify a preference for certain stormwater management practices. Additionally, South Carolina's rules include design criteria for certain practices. Florida's, Maryland's and Washington's programs prefer infiltration of runoff where site conditions are appropriate. Extended wet ponds are preferred practices in Delaware and New Jersey, and in Florida if site conditions are inappropriate for infiltration. The programs in Delaware and Florida also promote the use of swales and filters, along with constructed wetlands.

Overall Statistics

Specific urban runoff control practices are cited in 23 of the jurisdictions (71%). In 13 programs (56%), infiltration of runoff is the preferred first option in controlling urban runoff if site conditions are appropriate. Detention practices, either wet or dry, are a preferred practice in 13 programs (56%). Other specific practices such as biofiltration, constructed wetlands, and filters also are listed by some programs. It is important to note that many programs list a hierarchy of preferred practices depending on the specific conditions found at a development site. This hierarchy typically is related to site conditions such as soil type and water table elevation, rainfall characteristics, vegetation growing season, and experience by the program in the successful long term operation and maintenance of certain practices.

2h. Design Assistance and Guidance Availability

The design of stormwater management practices, especially those used to treat urban runoff, is a relatively new field which is evolving rapidly. Sand filtration systems and constructed wetlands are but two examples of relatively new BMPs which are still undergoing testing to optimize their treatment effectiveness. Much work remains to be done to maximize BMP water quality benefits, even on designing wet detention systems, probably the most common practice used throughout the country. Many practitioners with responsibility for designing practices do not have access to the numerous research reports on BMP design and performance, have the time to study this highly technical information, or have a lot of experience in this field.

To reduce the burden on the regulated public, and to minimize the time needed for plan approval and permit issuance, 91% (29) of the urban runoff control programs are providing guidance and technical assistance to practitioners. Often design criteria and guidance is specified within a program's regulations, especially when the program first begins. Ten of the 29 programs (34%) providing guidance currently do so only within their regulations. Later, as the program evolves and obtains resources, more detailed BMP handbooks often are developed and published. Twenty of the programs providing guidance (69%) have either published BMP handbooks, or are using one prepared by a regional or state program. Finally, many programs conduct workshops or seminars, often in association with professional associations, to help edu-

It is important to note that many programs list a hierarchy of preferred practices depending on the specific conditions found at a development site.

cate the regulated community about designing, constructing, maintaining, and operating effective stormwater management practices.

With respect to the individual programs reviewed for this project, the following summary is provided on their use of BMP guidelines:

- Eight of the city programs provide guidance with half of them doing it within their regulations and the other half using BMP manuals. Of those using manuals, all of the city programs have published a manual except Winter Park (FL) which uses the Florida DEP BMP manual.
- All ten county programs provide guidance on designing practices with only four of them relying upon their regulations. Of the six programs using manuals, the three programs in the Puget Sound region use the manual developed for their area by the state.
- All five regional programs use manuals to provide guidance on designing practices. The SWFWMD relies upon its Basis of Review Handbook, publishes explanatory technical memoranda, and uses the Florida DEP manual.
- Among the state programs, only Pennsylvania and Virginia do not provide guidance on the design of practices. Pennsylvania's program defers to specifics within voluntary local watershed plans while Virginia is still developing its stormwater program requirements, especially for treating urban runoff. The other four state programs have published BMP handbooks to assist practitioners and the regulated public.

Source controls are seen as an essential component of successful stormwater management programs. There is increasing recognition that treating runoff with today's BMPs can only be effective to a certain extent.

2i. Management and Source Control Practices

Urban runoff management practices can be broadly categorized into two groups or tool boxes: structural controls and nonstructural controls. Structural controls, such as retention, detention, or filters, are used to help mitigate the adverse water quantity and quality impacts associated with urban runoff. Nonstructural controls, such as minimizing impervious area, routing runoff to pervious areas, or public education, are used to prevent or reduce the urban runoff pollutants. Source controls, which reduce pollutants at their source of potential introduction into urban runoff, are a major category of nonstructural controls. Source controls include covering of material handling areas where pollutants may wash off into receiving systems. They can also include personal ac-

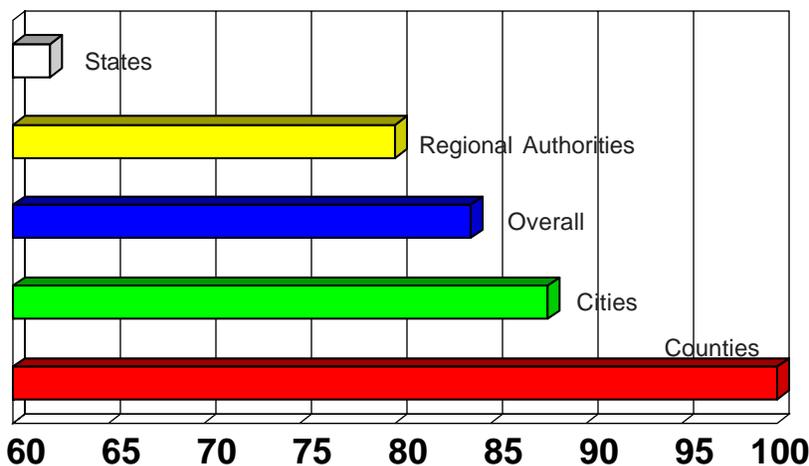
tions related to lawn fertilization. Source controls are actions, generally inexpensive and common sense, which can provide significant water quality benefits by their implementation.

2i(1). Are source controls encouraged

As seen below, the vast majority of programs (27) encourage the use of source controls. There is increasing recognition that treatment of runoff, using today's practices, can only be effective to a certain extent. Source controls are seen as an essential component of successful stormwater management programs. They can be incorporated in new developments as part of the site planning process to help protect important site features such as natural depressional areas, wetlands, or steep slopes, or used to minimize the increase in urban runoff peak discharge rate, volume, and pollutant loading. Equally important, source controls represent a cost-effective way to reduce runoff pollutants from already developed land uses, especially in highly urbanized areas where land is either too expensive or simply unavailable for traditional BMPs. Additionally, when implemented at businesses, source controls can not only reduce urban runoff pollution but also reduce costs and improve profits by reducing the use of certain materials or by increasing their reuse and recycling. Even homeowners can save money, time, and labor by using source controls such as natural landscaping which needs little or no fertilizers, pesticides, or water.

Source controls can not only reduce urban runoff pollution, but also reduce costs and improve profits by reducing the use of certain materials or by increasing their reuse and recycling.

Percentage of Programs Encouraging Source Controls



2i(2). Land uses for which source controls are intended

Cities

Source controls are encouraged for all land uses in seven of the programs (77%), perhaps reflecting the knowledge that these nonstructural controls can reduce runoff pollutants from already developed areas where structural BMPs are not feasible. Some of the city programs encourage or require source controls on specific land uses such as commercial and industrial, automotive, those discharging to natural areas (wetlands), and multi-family dwellings. Single family homeowners education is not stressed in only two of the programs.

Counties

Seven county programs (70%) encourage source controls on all land uses. Source controls at construction sites is specified by two of the programs, while individual programs focus on getting specific land uses such as urban, agricultural, industries, and businesses to use source controls.

Regional Authorities

Each of the four regional authorities emphasizing source controls target different land uses. The Northeastern Illinois Planning Commission stresses source control in existing developed areas. The Southwest Florida WMD emphasizes agriculture, while the Suwannee River WMD targets industrial and commercial sites. The Denver Urban Drainage and Flood Control District encourages all land uses to use source controls.

States

Of the six state programs which emphasize source controls, four (66%) encourage them on all land uses. South Carolina's program targets truck stops, industrial sites, large commercial sites, and multi-family units. Pennsylvania's stresses agricultural activities in their source control efforts.

Overall Statistics

Nineteen of the programs (59%) encourage source controls on all land use activities. Industrial or commercial activities are targeted for the use of source controls by 21% of the programs, while only three programs encourage their use on agriculture.

19 of the programs(59%) encourage source controls on all land use activities.

2i(3). Favored source control practices

Cities

The types of source controls favored by city runoff programs is as varied as the programs, their land uses, and the types of problems they face. The favored practices include:

- capture and recycling of oils, lubricants, fuels, antifreeze
- integrated pest management, chemical storage, home owners education, household waste
- education
- enforcement
- pollution prevention, wetlands and habitat protection and restoration
- source control through maintenance agreements with other city agencies
- covering vehicle maintenance areas, berms around barrels, disposal of waste
- recycling, street sweeping
- surface water management

Counties

County programs encourage the use of the following source controls:

- limit impervious areas, protection of stream buffers, source control
- as contained in the Puget Sound Manual for specific industries and businesses (2 responses)
- erosion control, housekeeping, less toxic products
- chemical use, roof for storage/work areas, maintenance of facilities
- education for fertilizer/pesticide use, disposal of waste, protection of riparian areas
- material handling, covering, proper plumbing
- material protection and storage, spill prevention, pesticide and fertilizer control
- identified as part of NPDES program through stormwater pollution prevention planning
- erosion control, water quality practices, wetland ponds, swales

The types of source controls favored by the urban runoff control programs are as varied as the programs, their land uses, and the types of problems they face.

Regional Authorities

The four regional programs encourage the use of the following source controls:

- littoral zones must be vegetated
- the Soil Conservation Service BMPs for irrigation management, nutrient and pesticide management
- no discharge of industrial waste, containment plan
- minimize directly connected impervious areas, good house-keeping

States

Source controls promoted by the five state programs include:

- hazardous waste collection, fertilizer and pest controls, minimize impervious areas
- agriculture conservation plans, tilling practices, animal waste management
- covering potential sources, sequencing, trash handling
- minimize impervious surfaces, curbing, wetland impacts
- as detailed in design manual for specific industries and businesses (State of Washington)

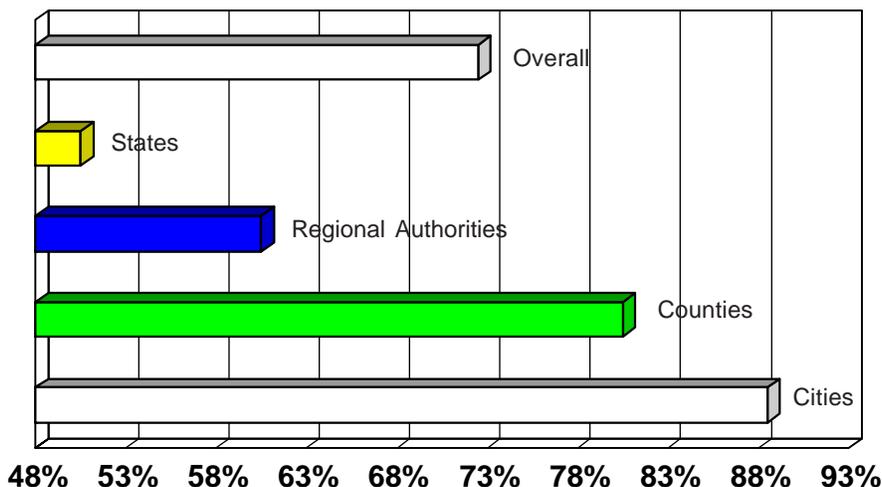
2i(4). Is detailed guidance available regarding source controls?

As seen from the above listing of preferred practices, there is a wide disparity among programs as to what constitutes source control, and which source control activities should be stressed. However, what is important is that benefits of source controls is widely acknowledged and that they are encouraged by most of the programs. Equally important, 72% of the programs provide guidance on the use and implementation of source controls. Since source controls are a relatively new concept in urban runoff management programs and they are unfamiliar to many people and businesses, providing guidance is essential to their successful use. Additionally, since source controls can help individuals reduce "Pointless Personal Pollution" by modifying their daily activities they are really best implemented voluntarily, not by mandating compliance, especially without clear guidance and long term public education programs.

Benefits of source controls are widely acknowledged and they are encouraged by most of the programs.

72% of the programs provide guidance on the use and implementation of source controls.

Percentage of Jurisdictions having Guidance Available



3. Erosion and Sediment Control

3a. Rationale or Philosophy of the Erosion and Sediment Control Program

Cities

"Prevention", of erosion and the transport of sediment, sedimentation, or water quality impacts, is the rationale for the program in four cities (44%). Minimizing erosion is the philosophy of three programs (33%). The intent of both of these philosophies is to reduce adverse impacts resulting from land disturbing activities. First by preventing soil movement (erosion control) and then by minimizing soil movement (sediment control). This dual approach is the most effective way to achieve the desired goals of protecting the environment and the public safety.

Counties

Four basic philosophies are reflected by county programs. Prevention of either erosion or sedimentation is stressed by three programs (30%), while the goal of another three is to protect receiving waters or downstream properties. Two programs (20%) stress minimization of erosion, while two other programs strive to reduce sedimentation. Protecting and maintaining public health, safety, and general welfare is the general goal of most programs. This is not unexpected since this is one of the principal roles of government programs.

In general, the majority of programs are directed towards first preventing erosion and then minimizing sedimentation, with treatment being a final mechanism at reducing the impacts from land disturbing activities.

Regional Authorities

The rationale of regional programs includes prevention (two programs), protection (one program), and minimization (one program). The goal of the Northeastern Illinois Planning Commission program is to provide technical assistance to local governments and the development community on effective regulations, programs, and practices to minimize impacts. This reflects their primary purpose as an advisory and technical assistance agency rather than an implementation agency. Interestingly, the SFWMD only considers erosion and sediment control as a compliance component of its stormwater permitting program. This may reflect the area's conditions (very flat, sandy soils) and the agency's origins as a drainage entity, not a water quality agency.

States

Four state programs (50%) stress minimization of soil loss or impacts as a program goal. Controlling erosion and then preventing sedimentation is the primary philosophy of the other four programs.

Overall Statistics

Prevention is the basic philosophy of 13 programs (41%), while ten programs emphasize minimization (31%). Protection of downstream waters or properties is the rationale for four programs (12%), and two programs stress reduction of impacts. In general, the majority of programs are directed towards first preventing erosion and then minimizing sedimentation, with treatment being a final mechanism to reduce the impacts from land disturbing activities. This is an important philosophical distinction. It is much harder to treat the adverse impacts of site erosion than it is to prevent erosion in the first place.

It is much harder to treat the adverse impacts of site erosion than it is to prevent erosion in the first place.

3b. Erosion and Sediment Control Performance Standards

Prevention, minimization, protection, and reduction are all excellent goals for an erosion and sediment control program. However, to be implemented and achieved, the goals should be translated into a specific performance standard. Surprisingly, only ten programs (31%) have adopted a specific performance standard. These are summarized below:

Ft. Collins -	Erosion rate during construction must not exceed 115% of the historic rate, while post-development rate must not exceed the historic rate.
Orlando -	Limit off-site sedimentation to pre-development amounts.
Winter Park -	Uses the state standard of retain sediment on-site, or not exceed 29 NTU above background.
King County -	Retain sediment on-site with discharges < 5 NTU. (National Turbidity Units)
Washington County -	No visible/measurable (< 1 cf) off-site erosion or visible silty runoff.
SFWMD, SWFWMD - SRWMD, FLA DEP	Retain sediment on-site, or not exceed 29 NTU above background.
South Carolina -	80% removal, or 0.5 mg/L settleable solids concentration at peak of 10-yr, 24-hr design storm, whichever is less.

3c. BMP Design Criteria, Guidance, and Preferred Practices

To assure that the program's goals or performance standards are met, specific design criteria should be developed for each management practice. Additionally, to assist practitioners properly design, construct, and maintain the management practices, guidance should be provided. Generally, this guidance is provided in a design manual or handbook. Erosion and sediment control programs have been implemented around the county since the early 1970s. Over 20 states have programs and most of these have developed and published erosion and sediment control handbooks. Many of these handbooks have been developed in cooperation with the Natural Resources Conservation Service (formerly the SCS). Additionally, many state handbooks have used information from those of other states, with the Virginia and Maryland manuals being used as a start for many others. Consequently, the types of practices used to prevent erosion and to minimize sedimentation around the country do not vary greatly. However, the practices which are favored in specific locations and the sizing of certain practices such as sediment basins and traps do change depending on local factors such as rainfall, soil types, and slopes.

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BMP Design Criteria and Guidance

With the exception of Maricopa County, which does not have an erosion and sediment control program, all of the programs use a design manual or handbook in which design criteria are specified for specific management practices. Of the nine city programs, all but Alexandria and Winter Park, which use their state's manual, have published their own guidance. Only two county programs have developed their own manuals, with four programs in Washington relying on the *Puget Sound Manual*, and the others using the manuals of their state programs. The three Florida water management districts use the Florida DEP manual while both the Northeastern Illinois Planning Commission and the Denver Flood Control District use their own guidance manuals. All nine state programs have published design handbooks or manuals.

Preferred Practices and Sediment Basin Design

The erosion and sediment control handbooks of all of the programs contain essentially the same practices. However, certain practices are used more frequently. The table below lists the nine most preferred practices by program level.

Interestingly, seasonal limits on the amount of disturbed area are used only in Washington state, although many other locations have seasonal variations in rainfall including a distinct dry and wet season.

Sediment basins and traps are included in every erosion and sediment control manual. Sediment traps typically are used for small drainage areas, usually less than five acres. Sediment basins, which often become part of the permanent storm-water management system, generally are used when the contributing drainage area is over five acres. Their design volume varies greatly around the country again reflecting differences in rainfall patterns. The design volume is specified in one of two ways. Either by a design storm (12 programs) or by a specific volume of runoff from the contributing area (18 programs). Of those programs using a design storm, ten specify that sediment basins must hold the 10-year, 24-hour storm, while two programs use the 2-year storm. Bellevue's program requires a basin to capture the runoff from a 10-year if the site is less than five acres or located more than one quarter mile from a water body or wetland. Basins on sites larger than five acres or less than one quarter mile away must capture the

Design volume for sediment basins is determined by either a design storm approach or by a specific volume of runoff from the contributing area.

runoff from a 2-year storm. Sediment basins constructed in the other 18 jurisdictions must be sized to hold a specified volume, generally either 1800 cf/acre of drainage area (8 programs) or 3600 cf /acre (7 programs). Only five programs use a different design volume for sediment traps than for sediment basins. Four of these use the *Puget Sound Stormwater Management Manual* which specifies a 2-yr design storm for traps as opposed to a 10-yr design storm for basins.

Most Preferred Practices Table

BMP	CITY	COUNTY	REGIONAL	STATE	ALL
Stage clearing	2	4	3	5	14
Seasonal disturbed area limits	2	4	0	1	7
Gravel construction entrance	8	6	4	7	25
Silt Fence	10	9	5	8	32
Straw bale	4	7	0	1	12
Temp/permanent vegetation	9	9	5	8	31
Inlet protection	6	3	3	2	14
Slope protection	5	3	3	3	14
Diversions	2	1	0	3	6

3d. Exemptions and Waivers for Erosion and Sediment Control

Cities

Four programs (44%) specifically exempt agricultural activities, while forestry is exempt in three (33%). Single family home construction is exempt in three programs (33%), but usually with limitations such as following a standardized small parcel plan or only if the house is not part of a subdivision. Three programs exempt projects disturbing less than a specified amount of area. This threshold varies from 2,500 square feet in Alexandria to as little as 50 square feet in the District of Columbia, which also uses a monetary threshold of less than \$2,500. Two programs (Austin and Seattle) specifically ex-

empt state projects, while there are no exemptions in either Bellevue or Winter Park.

Counties

Agriculture is exempt in eight programs (80%), while forestry is exempt in three (33%). Single family home construction is exempted by only two programs (20%). Four programs (40%) do not require erosion and sediment control approval on projects disturbing less than a specified area. Projects disturbing under 5,000 square feet are exempt in three programs, while Clark County exempts only projects with under 2,000 square feet of disturbance.

Only the program in Washington County (OR) has no exemptions for erosion and sediment control.

Regional Authorities

Three regional programs (60%) exempt both agriculture and forestry activities. However, the SRWMD and the SWFWMD require compliance with an approved Conservation Plan for farming, and with the state's Silvicultural BMP Manual for forestry. These two Florida water management districts also exempt single family homes which are not part of a subdivision. Two programs (40%) exempt projects disturbing less than a specified area (5,00 square feet for the Northeastern Illinois Planning Commission, and 5 acres for the Urban Drainage and Flood Control District of Denver). The South Florida Water Management District does not exempt any projects, but they consider erosion and sediment control as a minor compliance activity associated with their stormwater program.

States

Agriculture is specifically exempted in all eight state programs (100%), although Florida's program requires the farm to implement the BMPs contained in an approved Conservation Plan. Six programs (75%) exempt forestry, with Florida requiring compliance with the state's Silviculture BMP Manual. The construction of single family homes, especially those which are not part of a subdivision, is exempt in three programs (38%). Five programs (62%) exempt projects from erosion and sediment control if they disturb less than a specified area which ranges from 5,000 square feet (Delaware, Maryland, New Jersey), to 10,000 sf (Virginia), to the NPDES threshold of five acres

Agriculture, forestry, single family homes, and minimum disturbed area limitations are the most common form of exemptions and waivers for erosion and sediment control.

(Pennsylvania).

Overall Statistics

Agriculture is exempt in 23 programs (72%), reflecting the emphasis on controlling urban runoff in most of the programs reviewed. Forestry is exempt in 15 programs (46%). Nine programs (28%) exempt the construction of single family homes, while 13 programs (41%) have a disturbed area limit before erosion and sediment control is required. Only four programs (12%) do not have any exemptions for erosion and sediment control.

4. Program Authority and Implementation Structure

4a. Program Implementation Structure

This question reexamines why the program exists. Was it created in response to regional or local issues, or because of mandates imposed by a higher level of government? It also examines institutional relationships among various levels of government involved in program implementation. Unless carefully coordinated and integrated, a program can be adversely impacted by overlapping authorities, such as federal, state, regional, and local requirements. Obviously, the more levels of authority, the greater the potential for conflicting requirements, making it more difficult to meet all requirements. Additionally, this can create duplicative permitting and other program requirements. Since resources for stormwater management programs are scarce, duplication needs to be avoided to maximize benefits. Where multiple levels of authority are involved in program implementation, special care must be taken to coordinate and assure the involved entities have complimentary roles.

Program flexibility is another important component which can be adversely impacted by increased levels of program authority. Generally, the fewer entities involved in program implementation, the greater flexibility a program has in daily implementation and long term evolution. Urban runoff management presents many unique, site specific challenges that are best met if a program has flexibility and uses creativity.

Cities

Within the city programs, the federal NPDES program is implemented by the states except in Florida. Excluding the federal

Unless carefully coordinated and integrated, a program can be adversely impacted by overlapping authorities.

Generally, the fewer entities involved in program implementation, the greater flexibility a program has in daily implementation and long term evolution.

NPDES program, only two city programs (22%) implement their program using only local requirements (Austin, Ft. Collins). The programs in five cities (55%) involve compliance with two levels of requirements, with only two of these programs implementing all requirements at the local level. The other three programs involve at least two level of government, the city and either the state or a regional entity. In Alexandria, three levels of program requirements are imposed (state, regional, local), but implementation is by the city alone. Olympia's program includes requirements imposed by five levels of authority (state - regional, state - local, regional - regional, regional - local, and local - local), but program implementation is done by Olympia and by the Puget Sound Water Quality Authority. On average, practitioners within cities must implement stormwater requirements imposed by 3.2 levels of authority, with an average of two authorities involved in program implementation.

Counties

The federal NPDES program requirements are implemented by the states in all ten counties. Excluding NPDES, only the Clark County program (10%) is implemented only with local requirements. Seven programs (70%) involve complying with two levels of requirements, usually state and local. However, these requirements are implemented by the county programs. King County's program (10%) includes requirements imposed by three levels of authority, but implementation is performed at the county level. On average, practitioners within the counties must implement urban runoff requirements imposed by 3.1 levels of authority. However, program implementation involves only one entity, the county.

Regional Authorities

In two of the regional authority jurisdictions the federal NPDES program is implemented by the state, while in the three Florida WMDs it is implemented by EPA. Excluding NPDES, the NEIPC program (20%) involves implementation of regional criteria by local governments. The SRWMD program (20%) implements state and regional criteria at the regional level, reflecting the rural nature of the governments within its service area. The Denver regional program involves regional and local requirements and implementation, although the District directly regulates relatively few activities. Both the SFWMD and the SWFWMD programs involve four levels of program

requirements which are implemented either by the District or by a local government which has been delegated permitting responsibility, typically for smaller projects. On average, practitioners within these regional programs must implement urban runoff requirements imposed by 3.8 levels of authority. However, program implementation typically involves only one or two entities, the regional authority and/or a local government.

States

At the state level, most stormwater management programs allow implementation by various levels of authority depending on the states legal institutional framework. Nearly all state programs allow delegation of permitting to local governments. This allows urban runoff control approval to be integrated with the local land use approval process. It also allows the state program to focus on statewide issues such as BMP research, refinement of BMP design criteria, implementation of monitoring programs to assess program effectiveness, targeted watershed programs, and education and training.

The federal NPDES program is implemented by the states, except in Florida. South Carolina's program involves implementation of state requirements by the state or by a delegated local program. Programs in Delaware, Maryland, and Washington impose state and local requirements, with implementation done by the state and by delegated local programs. Two state programs (Florida and Pennsylvania) include state, regional, and local requirements, with implementation involving a mixture of state, regional, and local authorities, depending on the location, and sometimes on the type of project. New Jersey's program imposes state requirements which are implemented by either a state, regional, or local authority. It also includes regional requirements which are implemented by regional entities. Additionally, local governments may impose their own local requirements.

On average, practitioners within state programs must implement urban runoff requirements imposed by 4.4 levels of authority. Program implementation may involve two to four levels of authority. Obviously, coordination and integration of program requirements is essential when states implement stormwater programs.

Nearly all state programs allow delegation of permitting to local government. This allows urban runoff control approval to be integrated with the local land use approval process.

Overall, urban runoff control programs involve the imposition of requirements from 3.4 levels of authority.

Urban runoff control programs use a variety of "permits". Typically, these are classified into three major types:

noticed exemptions

general permits

individual permits

Overall Statistics

Only five programs (16%) involve requirements for urban runoff control that are established and implemented by a single level of authority. Requirements in fifteen programs (47%) are set by two levels of authority, but plan approval is performed by one entity in all but two programs. Three levels of urban runoff requirements are imposed on practitioners within four programs (13%), with implementation involving three entities in two of the programs. Two programs (6%) involve four levels of requirements, with plan approvals needed from two entities. Five different levels of requirements are imposed in two programs, with implementation involving either two or three entities. Overall, urban runoff control programs involve the imposition of requirements from an average of 3.4 levels of authority. Fortunately, implementation of these multiple requirements is performed by a single entity in 20 programs (63%) and by two entities in eight programs.

4b. Project Permitting Procedures and Applicability

The procedures used by a program to review and approve development proposals and their corresponding erosion, sediment, and stormwater management plans are extremely important in determining a program's comprehensiveness and effectiveness. There are several mechanisms that can be used to assure that program requirements are met. In some programs, the review and approval of urban runoff control plans are part of the overall development review process, with no specific erosion/sediment or stormwater management permit issued. In other programs, an erosion/sediment control and/or stormwater management permit must be issued before other approvals, such as a grading or building permit, are issued. The submittal requirements also can vary greatly. Some programs require detailed site plans showing the location of all BMPs, grade changes, buildings, etc., along with the submittal of detailed engineering drawings, specifications, and calculations. Other programs may require only some of this information, or as little as a general site plan.

Urban runoff control programs use a variety of "permits". Typically, these can be classified into three major types - noticed exemptions, general permits, and individual permits. Often noticed exemptions and general permits are equivalent, just different nomenclature.

Noticed exemptions usually are used for the approval of small,

relatively benign activities such as the addition of a small amount of impervious surface, forestry activities conducted in accordance with a BMP manual, or the construction of a single family house. Noticed exemptions typically require the program authority to be notified a specified number of days before an activity begins. Compliance with certain minimum standards and the use of certain BMPs is often a condition of using the noticed exemption. Generally, projects approved via noticed exemptions are not reviewed by the program's staff. Inspections usually are the responsibility of the site engineer or contractor.

Many programs, including the NPDES stormwater program, use general permits. Often these are allowed for projects which are under a specified threshold, such as project size, disturbing less than a certain amount of area, or constructing less than a certain amount of impervious surface area. General permits almost always require the use of specified BMPs, the preparation of site plans with BMP locations and sequencing shown, and adherence to other program requirements such as inspection frequency, design criteria, or design storms. Typically, general permits place the responsibility for complying with the program's requirements on the individual being regulated, especially their engineer. Often an engineering certification that the plan meets the general permit's requirements is required, along with an as-built certification when the project is completed. Failure to comply with the general permit's criteria leads to enforcement action, and sometimes the need to obtain an individual permit. The submittal requirements for general permits, and the review of these materials, varies greatly depending on a program's staff resources. Inspections usually are the responsibility of the site engineer or contractor. However, many programs conduct inspections on projects that have received general permits.

Individual permits are used by most programs as part of their implementation procedures. In some programs, all projects receive an individual permit. In most programs, individual permits are used on projects which are either large, highly impervious, close to water bodies, or with difficult site conditions which increase the potential for off-site damage. Nearly all programs using individual permits require the submittal of detailed site plans, construction plans, engineering drawings, standards and specifications, calculations, and any other information needed to evaluate the project's urban runoff controls. This information undergoes a formal review and evaluation by the permitting authority to ensure that proper site planning, erosion and sediment control, and stormwater management is accomplished. Individual permits often include very spe-

In most programs, individual permits are used on projects which are either large, highly impervious, close to water bodies, or with difficult site conditions which increase the potential for off-site damage.

Since most programs have limited staff, more than one mechanism often is used to approve urban runoff control plans.

cific BMP construction sequencing, inspection requirements, and requirements for the program authority to be advised of any site problems. Projects receiving individual permits often are a priority for inspections by the program's staff.

Since most programs have limited staff resources, and because of the wide variety of institutional frameworks, more than one mechanism often is used to approve urban runoff control plans. Many programs use a combination of noticed exemptions or general permits along with individual permits. Projects with a greater potential for off-site damage receive greater scrutiny. The type of procedure used also may reflect the degree of emphasis that is given to erosion/sediment control or stormwater management.

Cities

Eight of the city programs (88%) use their development approval process to review and approval urban runoff control plans. Only Bellevue and Orlando (22%) issue an individual permit specifically for the erosion, sediment, and stormwater management plan.

Counties

The development review process is used in five county programs (50%) for the approval of urban runoff controls, with Somerset County SWCD issuing a separate erosion and sediment control permit. The other five programs (50%) use individual permits. Four of these programs issue separate permits for erosion/sediment control and for stormwater management. Maricopa County does not regulate erosion and sediment control program, relying on the state NPDES program.

Regional Authorities

The three Florida water management districts (60%) use a combination of permits (noticed exemption, general permit, individual permit), depending on project size. The permit includes erosion, sediment, and stormwater management requirements, along with wetlands protection. The local governments within the NEIPC area use a variety of mechanisms to approve urban runoff control plans. Local governments within the Denver Urban Flood Control District also use several mechanisms to approve stormwater management control plans, when required. Erosion control is regulated by the State NPDES program, while the District does review certain large scale

flood control projects.

States

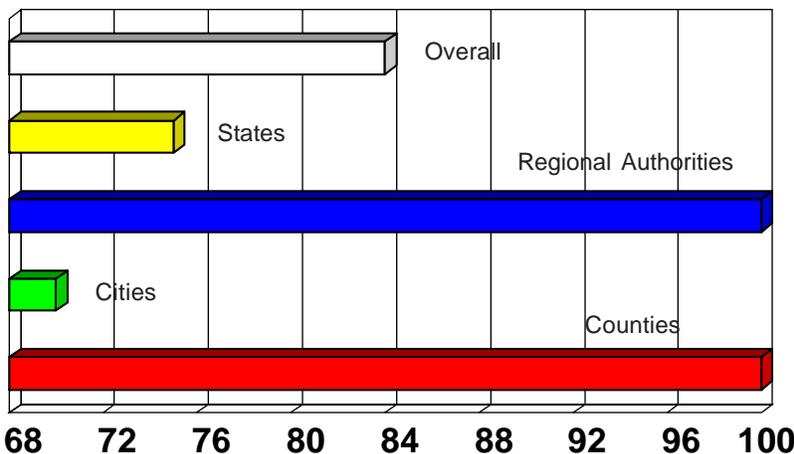
Four of the state programs (50%) use general and individual permits for both erosion/sediment control and stormwater management. Two programs (25%) use individual permits that cover erosion, sediment, and stormwater control, with Florida also using general permits for most projects. The Pennsylvania NPDES program uses general and individual permits for erosion/sediment control, with stormwater regulated only by some local governments. Erosion and sediment control plans are certified in the New Jersey program, which uses its Coastal Area Facilities Review Act for stormwater management.

Overall Statistics

The development review process is used by 13 programs (41%), all local governments, to approve urban runoff control plans. One state program also uses this process for erosion and sediment control. Separate erosion/sediment control and stormwater management permits are issued by nine programs (28%), with general permits used in four of these for erosion and sediment control approval. Seven programs (22%) combine erosion, sediment, and stormwater control into one permit, with general and individual permits used in four of these programs.

4c. Comprehensive Review of Projects

Percentage of Jurisdictions Conducting a Comprehensive Review of Projects



The previous question (4b) considered the process by which urban runoff control plans were approved. A second important component of the approval process is whether the information submitted gets reviewed and to what extent. This is especially true when an individual permit is required.

4d. Are Plan Review Checklists Used?

Checklists facilitate project review by local or regional jurisdictions which are implementing federal or state requirements and design criteria.

Plan review checklists provide a third important component of the approval process. With a checklist, it is often easier for an individual to know explicitly what must be submitted. This is much easier than trying to interpret regulations or a manual of criteria or practices. Checklists can help the consultants and developers be sure that all necessary information is submitted the first time, preventing unnecessary delays in the review process. They can help the plan review staff perform a quick review of the submittal package to be sure that all required information is included. Checklists also facilitate project review by local or regional jurisdictions which are implementing federal or state requirements and design criteria.

Cities

Four city programs (50%) do not use a checklist. Of the other four programs, three use a checklist for erosion/sediment control and for stormwater management, one uses one only for erosion and sediment control, and one program only uses a checklist for stormwater management. In one city not using a checklist, the plan review items are contained in the local design manual. In another program, they are listed in the rule.

Counties

Six county programs (60%) use a checklist for erosion/sediment control and stormwater management. One program (10%) only uses a checklist for stormwater management. Three counties (30%) do not use checklists to assist in plan approval submittals.

Regional Authorities

The Northeastern Illinois Planning Commission is not involved in the actual review or approval of individual projects. It recommends checklists but their use varies among local jurisdic-

tions. Four regional authorities (80%) use a plan review checklist for stormwater management. Only two regional programs (40%) have a checklist for erosion and sediment control.

States

Six state programs (75%) use a checklist for approving both erosion/sediment control and stormwater management plans. Pennsylvania uses a checklist for erosion and sediment control, but use of one for stormwater varies with local governments. Washington is the only state program (12%) that does not use plan review checklists.

Overall Statistics

A checklist is used for erosion/sediment control and stormwater management in 17 programs (55%). Four programs (13%) only use one for stormwater, while a checklist is used only for erosion and sediment control in two programs (6%). Eight programs (26%) do not use checklists to facilitate review and approvals.

4e. Are the Erosion and Sediment Control and Stormwater Management Approvals Required Before Other Approvals?

A key tenet of successful urban runoff control programs is their linkage to other land development programs, especially at the local level. Except for the Washington state program, all programs (97%) require approval of urban runoff controls before other permits are issued or before land clearing begins. Urban runoff plans must be approved in 29 programs (91%) before other development approvals, such as grading or building permits. Florida's program encourages local governments to not issue building or clearing permits until a stormwater permit is issued. The types of approvals that are necessary after approval of either erosion and sediment control and stormwater management are listed in the following breakdown of jurisdictions.

Cities

Building permits can't be issued in eight cities (88%) before approval of the erosion and sediment control or stormwater management plans. Six cities (66%) require urban runoff controls to be approved before issuing grading permits, while five programs (55%) issue both building and grading permits afterwards. Only Winter Park (11%) coordinates zoning approvals to approval of the urban runoff control plan.

A key tenet of successful urban runoff control programs is their linkage to other land development programs, especially at the local level.

Counties

Issuance of building and/or grading permits is contingent on approval of urban runoff control in nine programs (90%). Snohomish County requires approval prior to the initiation of construction. Other approval processes contingent on approval of urban runoff controls include site and subdivision approval, zoning approval, clearing, concept plan approval, and preliminary approval process. To see which approvals are coordinated with urban runoff controls, see the individual program summaries.

Regional Authorities

Two regional programs (40%) require erosion and sediment control and stormwater management approval prior to obtaining building or grading permits. All of the Florida WMDs require approval prior to the initiation of construction. They also encourage local governments to not issue building, clearing, or grading permits until the stormwater permit is issued. Within the area served by the Denver UFCD and the NEIPC, approval depends on the local government.

States

Six programs (75%) require erosion/sediment control and stormwater management approvals be obtained prior to the issuance of local building permits. Grading permits are also subject to this limitation in five states (63%). Pennsylvania's program (12%) also ties zoning approval to erosion and sediment control approval. Florida's program requires approval before land clearing begins, while the State of Washington does not have a required approval process at the state level. Six states (75%) listed two or more approvals that are contingent on the issuance of the erosion and sediment control and stormwater management approval.

Overall Statistics

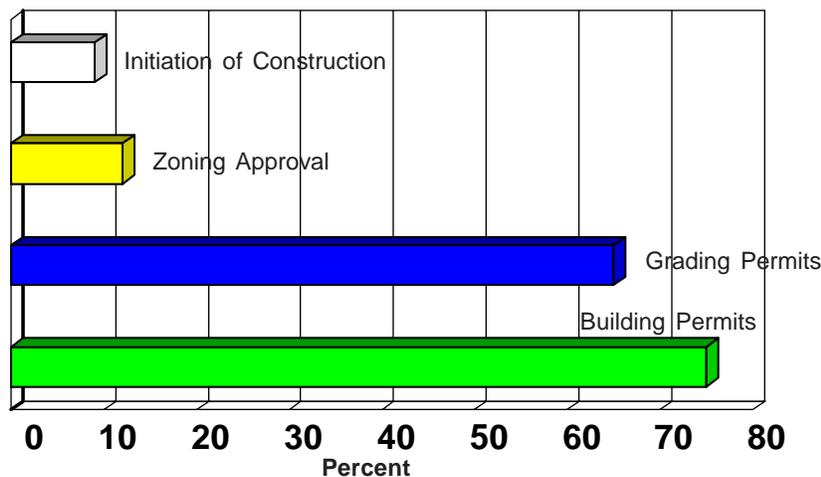
The overall statistics are shown on the bar graph on the following page.

5. Inspection Procedures

The approval of urban runoff control plans is only an initial pro-

Urban runoff control plans must be approved in 29 programs (91%) before other development approvals, such as grading or building permits.

Sediment and Stormwater Approval Required Prior to Other Approvals



gram component of assuring effective implementation of erosion, sediment, and runoff controls. Inspection is the most important component to assure proper construction, operation, and maintenance of controls, both temporary and permanent. Inspections must be conducted on-site, by qualified individuals, who understand the intricacies of properly locating, constructing, maintaining, and operating the many different BMPs used to control erosion, sedimentation, and runoff. Successfully implementing the approved control plan in the field is very difficult, especially for erosion and sediment control because of changing site conditions. Proper field implementation requires special technical expertise, and a significant commitment of time and resources by both the contractor/developer and the regulatory entity. While the permittee often will be responsible for periodic inspections, the program authority also must conduct periodic inspections. The program must commit adequate staff resources to ensure a visible site presence. This represents a statement to the construction industry, by the jurisdiction, of the need to implement the required practices and ensure that they are properly maintained throughout the life of the project.

5a. Are Inspections Required During Construction?

This is a basic policy decision where the jurisdiction either does or does not commit to a structured overview of the construction, maintenance, and operation of erosion, sediment, and stormwater controls.

The program must commit adequate staff resources to ensure a visible site presence. This represents a statement to the construction industry, by the jurisdiction, of the need to implement the required practices and ensure that they are properly maintained throughout the life of the project.

Cities

Seven programs (77%) require inspections during construction. Two programs (22%) do not require inspections.

Counties

All ten county programs (100%) require inspections during construction of urban runoff controls.

Regional Authorities

Neither the NEIPC nor the Denver UFCD implement regulatory programs. The three Florida WMDs require inspections for the construction of stormwater management facilities. They also require inspections of erosion and sediment controls, but to varying extent. The Denver UFCD will inspect runoff facilities when it reviews the plans or constructs it.

States

All eight state programs require inspection of erosion and sediment controls, with two programs relying heavily on NPDES requirements. Six states (75%) require inspection of stormwater management facilities. In the other two states (PA, WA), inspection of runoff controls is at the discretion of local governments.

Overall Statistics

Stormwater management practices are inspected during construction in 26 programs (87%). Erosion and sediment controls must be inspected during construction in 28 (93%) programs. Only the programs in Ft. Collins and Seattle do not require inspections for either erosion and sediment control or stormwater management.

An integral part of the inspection process is how often inspections are considered necessary.

5b. What is the Frequency Requirement for Inspections?

An integral part of the inspection process is how often inspections are considered necessary. During the construction process, site conditions can change rapidly and assurance of adequate site control may necessitate frequent site visits by the inspector. This implies that inspections of erosion and sediment controls need to be made more frequently than of runoff controls. This is

reflected in the difference in responses for inspection frequency of erosion and sediment controls and stormwater management systems. Most interesting is the large variation in responses, especially when there is a specific time interval of inspection. Surprisingly, relatively few programs base inspection frequency on the occurrence of rain although implementation of the NPDES program has increased the use of this important concept.

Cities

The most common inspection frequency is "as needed" or "daily". Inspection of erosion, sediment, and stormwater controls is recommended "as needed" in three programs. Three programs recommend "daily" inspection of erosion and sediment controls, with two recommending this for runoff systems. Only Olympia's program recommends inspections after rain events. In general, inspection frequency requirements are highly variable as seen from the following responses:

- daily
- as needed
- as required by construction
- daily for erosion/sediment control; stormwater as needed
- as time allows
- at various stages of construction
- no frequency

Counties

Inspections are recommended "as needed" for erosion and sediment controls in three programs (30%), and for stormwater controls in four. Three programs (30%), all in Maryland, specify an inspection frequency of approximately two weeks for erosion and sediment controls. They also recommend that runoff controls be inspected "daily" or "at key phases", with a final inspection at the end of construction, which also was required by two other programs as well. Individual responses included:

- 15 days for erosion and sediment control; daily inspections by the engineer-in-charge for stormwater management
- varies for both
- two to three times during the project for erosion and sediment control; at sign off for stormwater management

Surprisingly, relatively few programs base inspection frequency on the occurrence of rain.

- as required by the NPDES permit for erosion and sediment control
- project specific with no set time frame
- twice monthly for erosion and sediment control; daily at critical times for stormwater management during construction
- at necessary times
- as required and as necessary
- 14 days for erosion and sediment control; key milestones for stormwater management

Regional Authorities

Florida's three water management districts require stormwater systems to be inspected "as needed" by the project engineer. The SRWMD will send a staff person to inspect all site controls on a monthly or bimonthly basis depending on the type and location of the project. The other two WMDs inspect sites when staff resources allow or randomly. Florida's NPDES construction general permit requires inspections by the permittee on a weekly basis or after each 0.25" rain. Inspections within the areas served by the NEIPC and the Denver UFCD are scheduled and conducted by local governments.

States

Three programs (38%) require erosion and sediment controls to be inspected "as needed", while five programs require this for runoff systems. Three states (37%) require inspections of erosion and sediment controls every two weeks. Four programs (50%) require inspections after rain storms, although two of the programs rely upon the NPDES regulations for this requirement. Specific recommendations include:

- once every two weeks, more if possible
- as needed per the design for stormwater management
- as determined by the soil conservation district for erosion and sediment control; throughout the life of the project for stormwater management
- individual sites monthly for erosion and sediment control; stormwater management varies with local jurisdictions
- weekly or after each 0.5 inch rainfall
- 48 hours after a runoff event
- no frequency requirement; only regular inspections

Effectiveness of inspection requirements is determined largely by the person performing the inspection.

Nearly every program requires periodic inspections by the site engineer or other construction personnel.

Overall Statistics

The most common inspection frequency requirement is "as needed" which is used by 12 programs for erosion and sediment controls, and by 15 programs (50%) for stormwater practices. Only six programs (20%) require inspections every two weeks, at least for erosion and sediment controls. Eight programs (27%) require inspections after a rain storm, but this is a condition of NPDES general permits in five programs.

5c. Is a public agency responsible for inspection?

The effectiveness of inspection requirements is determined largely by the person performing the inspection. Nearly every program requires periodic inspections by the site engineer or other construction personnel. Ideally, the permitting authority will conduct inspections, at least periodically. This represents a statement to the construction industry, by the jurisdiction, that implementing required practices and assuring that they are properly maintained throughout the life of the project is important to the community. Unfortunately, budget and staffing constraints often make this unfeasible. Consequently, the effectiveness of a program often suffers because inspections are not conducted by the regulating authority. A fact which becomes quickly known to the development community. That's an important reason why some very innovative and successful programs have developed training and certification programs for private inspectors.

Cities

All seven programs that require inspections also conduct period inspections using their own staff resources.

Counties

Seven programs (70%) use their staff to conduct inspections of erosion, sediment, stormwater controls. In one program, staff from an agency different than the permitting entity conducts erosion and sediment control inspections. Baltimore County's program (10%) requires public agency inspection for erosion and sediment control only, with inspections performed by an agency not involved in plan review and approval. Maricopa County (10%) only uses its staff to inspect stormwater management systems, with erosion/sediment controls inspected by site engineers per the NPDES permit requirements.

The permitting agency should conduct periodic inspections.

This makes a statement to the construction industry, by the agency, that implementing required practices and assuring they are maintained is important to the community.

Regional Authorities

Florida's three water management districts all require inspections by site engineers, with District staff conducting random inspections at the SFWMD and SWFWMD. The SRWMD sends inspectors to sites monthly or bimonthly depending on the location and type of project. Both the NEIPC and the Denver UFCD recommend that local governments be involved in site inspections.

States

Five programs (62%) use their staff to inspect erosion, sediment, and runoff controls. In two programs, the permitting entity inspects erosion and sediment controls, but stormwater systems inspections are done by site engineers or at the discretion of local governments. Only Washington's program (12%) does not require public agency inspection.

Overall Statistics

23 programs (77%) require inspections of erosion, sediment, and permanent runoff controls to be performed by staff from a public agency, almost always the agency involved in plan approval. Four programs (13%) require public agency inspection for either erosion and sediment control or stormwater management, but not for both. Only one jurisdiction (3%) does not require public agency inspection for either erosion and sediment control or stormwater management.

23 programs (77%) require inspections of erosion, sediment, and permanent runoff controls to be performed by staff from a public agency, almost always the plan approval agency.

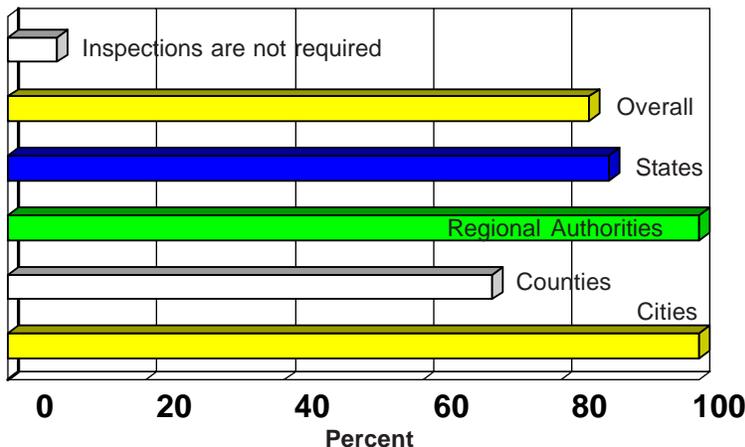
5d. Is the Inspection Agency also the Review Agency?

Communication between the plan approval agency and the inspection agency is crucial. Having both functions within one agency facilitates communication and coordination between the two program elements.

5e. Is the Inspection Frequency and Procedure Adequate for Erosion and Sediment Control?

The effectiveness of inspection requirements depends on the procedures, the frequency of inspection, the qualifications of the inspector, and on whether a public entity conducts inspections at some time during the construction process. This question mainly examines the program's policies and procedures for inspecting

Inspection Agency is also the Review Agency



erosion and sediment controls. We also have included an analysis of the commitment of program resources to inspections. However, whether program staffing is adequate is a separate issue discussed later.

Cities

Five programs (55%) feel that their inspection frequency and procedures are adequate, while three (33%) do not. In all three of these programs, the number of inspectors is very low, ranging from one part time person in Olympia to two inspectors in Washington D.C.

Counties

Only four (40%) programs believe they have adequate inspection frequency and procedures for effective erosion and sediment control. In these programs, inspectors comprise from 27% to 75% of the staff. The importance of adequate inspection procedures is seen in the other five programs (50%). The number of inspectors in these programs ranges from 7 to 25 and comprise from 25% to 85% of the program's staff. One county (10%) does not regulate erosion and sediment control.

Regional Authorities

All three Florida water management districts feel that they have adequate inspection frequency and procedures, but two of them stated that work load largely determines program effectiveness. These two agencies only have 10 and 22 inspectors

The effectiveness of inspection requirements depends on the procedures, the frequency of inspection, the qualifications of the inspector, and whether a public entity conducts inspections at some time during the construction process.

representing 7.5% to 21% of their staff. The SRWMD which serves a largely rural area only has four inspectors, but this represents 30% of their staff.

States

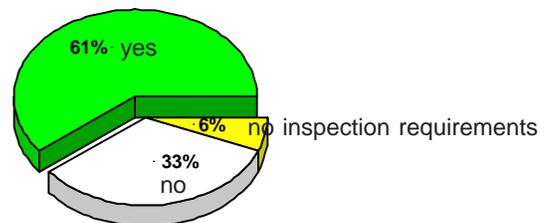
Six programs (75%) believe they have adequate inspection frequency and procedures for erosion and sediment control. All of these programs have a fairly large number of inspectors (10-42) which make up form 31% to 65% of their staff. Since implementation of the NPDES general permit, Florida's program has improved procedures, but only has three inspectors representing 12% of their staff. Washington's program staff believe they may have adequate inspection frequency and procedures, but they have only one part time inspector.

Overall Statistics

Only 18 (61%) of the programs believe their inspection frequency and procedures assure adequate erosion and sediment control. Ten programs (33%) do not have adequate inspection frequency and procedures, while one program's inspection frequency and procedures may be adequate. Two jurisdictions (6%) do not have inspection requirements or authority.

Only 18 (61%) of all the programs believe their inspection frequency and procedures assure adequate erosion and sediment control.

Are Inspection Frequency and Procedures Adequate for Erosion and Sediment Control



6. Program Funding

Program funding is obviously the foundation of a successful urban runoff control program. Inadequate funding is the primary reason we have inadequate stormwater infrastructure and ineffective urban runoff programs. Traditionally, these programs have been paid for out of the "general fund", which is used by all levels of government to fund most programs and services. When competing at budget time against public health (emergency medical

services), safety (police, fire), or welfare (social services), urban runoff control programs usually are a low priority and do not receive adequate funding. Consequently, stormwater management often is termed "the orphan infrastructure", with funding driven by the latest crisis, usually a major flood. This section examines the sources of funding for the urban runoff control programs. When they are separate budget entities, funding for erosion/sediment control and stormwater management programs is discussed separately. However, these two program components are combined in many programs, as are their funding and staffing. When considered in conjunction with the program staffing section which follows, some obvious conclusions can be drawn about the ability of the various funding methods to provide essential program resources.

Cities

Funding for the erosion, sediment, and stormwater control components is combined in five programs (56%). Four of these programs use a combination of funding sources with all of them having a stormwater utility fee, and three supplementing this with permit or inspection fees. Only Alexandria (VA) relies solely on general appropriations to fund its program. In the four cities where erosion and sediment control is a separate budget entity, two programs use a combination of funding sources (stormwater utility fee, inspection fee, permit fee, general fund). The other two programs fund their erosion and sediment control component from either the general fund (DC) or permit fees (Bellevue).

Stormwater is a separate budget entity in four cities (44%). Bellevue and Austin use a combination of stormwater utility fees and permit fees, with Austin's program also receiving general funds. Ft. Collins also has a stormwater utility, while the District of Columbia's stormwater program is funded by a grant from the Chesapeake Bay program. Overall, seven of the nine programs (78%) have implemented a stormwater utility fee, while five programs (56%) charge permit fees.

Counties

Funding for the erosion, sediment, and stormwater control components is combined in three programs (30%). Two of these programs use a combination of funding sources including permit fees, while one uses the general fund. In five programs

Inadequate funding is the primary reason we have inadequate stormwater infrastructure and ineffective urban runoff programs.

All but one county program is funded, in part, through permit fees.

Stormwater management, in is a separate budget entity in seven county programs.

(50%), erosion/sediment control is a separate budget entity. Two of these programs fund their program from permit fees. The other three also obtain funding from permit fees in combination with either stormwater utility fees or road department funds.

Stormwater management is a separate budget entity in seven programs (70%). One county relies only on permit fees. All of the rest use a combination of funding sources, with four charging stormwater utility fees. Washington County (OR) has a system development charge in addition to stormwater utility and permit fees.

Overall, all programs except Baltimore County (90%) are funded, in part, through permit fees. Baltimore County's program is funded by general appropriations, which also is used to partially fund three other programs. Three counties have implemented stormwater utilities, while two more have set up special taxing districts. Another county is in the process of implementing a utility fee. Other funding sources include inspection fees, state grants, road department, and capital improvement program.

Regional Authorities

Funding for erosion, sediment, and stormwater control is combined at the three Florida water management districts. Their programs are funded primarily by ad valorem property taxes, which are supplemented by permit fees. The SRWMD also receives a general appropriation from the Florida legislature because its rural tax base does not provide sufficient revenues. The Denver UFCD does not have an erosion and sediment control program. It funds its stormwater program with a special taxing district charge. Within the NIPC area, local governments implement their programs using general funds and permit fees.

States

Funding for erosion, sediment, and stormwater control is combined in four state programs (50%). All of them use a combination of funding mechanisms, primarily permit fees and general appropriations. Funding for erosion and sediment control programs in the other four states comes from a combination of general appropriations and permit fees, with two states also charging a plan review fee. Two of the stormwater programs

in the other four states are funded by general appropriations, while the other two rely on a combination of general funds plus permit and/or plan review fees. Overall all eight programs use general appropriations, which is to be expected at the state level. Six programs (75%) charge permit fees. No state program relies totally on permit fees, meaning tax payers subsidize implementation of these programs. Stormwater utilities and special taxing districts are not used at the state level to fund urban runoff control programs.

Overall Statistics

Funding for erosion, sediment, and stormwater control is combined in 15 programs (47%). Two of these programs are funded by general appropriations, while 13 use a combination of funding sources, primarily permit fees (12), general funds (6), and stormwater utility fees (5). Erosion and sediment control is funded separately in 13 programs (41%). One program is funded by general appropriations and two by permit fees. Eight are funded by a combination of sources, with all of them using permit fees and five getting general funds. Stormwater is a separate budget entity in 15 programs. Two programs rely on general appropriations, while one program apiece is funded by permit fees, grants, or stormwater utility fees. A combination of funding sources is used in 10 stormwater programs. Of the 43 program budgets (combined and separate), only five are funded solely by general appropriations, while 32 use a combination of sources. Permit fees are used in 32 programs to at least partially fund their program, with 20 programs including general appropriations. Stormwater utilities have been established in 12 local governments.

7. Program staffing

The effectiveness of an urban runoff control program depends largely on a stable funding source. This allows the program to obtain adequate resources, especially staffing, and be able to provide them, and the regulated community, with proper training and education. Another important benefit of a dedicated funding source is that it provides the program with stability, especially of its staff. This can help to assure staff continuity, leading to well trained and experienced personnel.

Of the 43 program budgets (combined and separate), only five are funded solely by general appropriations, while 32 use a combination of sources, primarily permit fees and general funds.

Stormwater utilities have been established in 12 local governments.

7a. Is Staffing for the Erosion and Sediment Control Program Adequate?

Cities

Erosion and sediment control programs have adequate staff resources in only four cities (44%). Staff in the two programs with integrated erosion, sediment, and stormwater control are 14 (7 inspectors) and 33 (18 building inspectors) persons. In the two programs with separate erosion and sediment control programs, they have 8 (3 inspectors) and 16 (7 inspectors) persons. In the five programs with inadequate staff, the number of staff ranges from 0.4 to 4 (0.2 to 2 inspectors). Three of the city programs (75%) with adequate staffing are funded by a dedicated source, either permit fees or a stormwater utility.

Counties

Only four programs (40%) have adequate staffing for their erosion and sediment control program. Staff levels range from 3 (1 inspector) to 12 (8 inspectors) in the three counties with a separate erosion and sediment control program. The integrated erosion, sediment, and stormwater program in Prince Georges County has 20 persons (17 inspectors), and is the only one of these programs (25%) that has a dedicated funding source - a special taxing district.

Regional Authorities

Only the three Florida water management districts implement erosion and sediment control programs, with these a component of their stormwater program. All three of these regional authorities have adequate staffing and they all have a dedicated funding source. These programs are funded by the District's ad valorem taxing authority (1 mil per \$1000 property value) and, to a lesser degree, by permit fees.

States

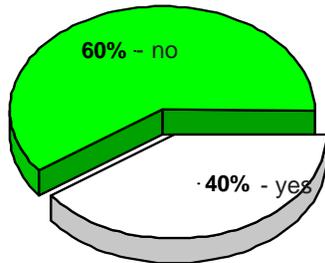
Only the State of New Jersey (12%) stated that it has adequate staffing for their erosion and sediment control program. Their program is implemented by State Department of Agriculture and local Soil Conservation Districts. The program has 91 positions, with 42 inspectors and 26 clerical. General appropriations fund the Dept. of Agriculture program while the SCDs are funded primarily by certification fees.

Overall Statistics

60% of the programs (18 of 30) *do not have adequate staffing* for erosion and sediment control! These percentages are troubling indeed. Obviously, there is not a serious commitment to make these programs effective and to assure that the desired benefits are obtained. However, this is not surprising since only 12 local governments have a stormwater fee. Seven of the adequately staffed programs (58%) have a dedicated funding source - a stormwater utility fee, special taxing district, or ad valorem tax.

60% of the programs do not have adequate staffing for erosion and sediment control.

Percentage of Jurisdictions having Adequate Staffing for Erosion and Sediment Control



7b. Is Staffing for the Stormwater Management Program Adequate?

Cities

Six programs (66%), two with integrated erosion, sediment, and stormwater programs, have adequate staffing for their stormwater management program. In the four separate stormwater programs, staffing ranges from 0.6 to 66 persons, with 0.2 to 8 being inspectors. Five of these programs (83%) have a stormwater utility, with Alexandria's program funded from general appropriations.

Counties

Five programs (50%), two with integrated erosion, sediment, and stormwater programs, have adequate staffing for their stormwater management program. In the three counties with separate stormwater programs, staff resources range from 7

to 170 persons, with 2 to 7 inspectors. Three of these programs (60%) have a stormwater utility which partially funds their program. Additionally, four of these programs (80%) charge a permit fee. Only King County, which has a stormwater fee, relies to some degree on general appropriations.

Regional Authorities

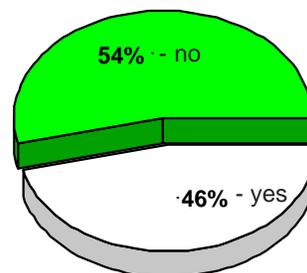
All four regional entities which implement stormwater programs have adequate staffing and dedicated funding sources. The Denver UFCD pays for its program from its special stormwater tax which is imposed in 36 cities. The three Florida WMDs all use a combination of funding mechanisms including permit fees, ad valorem taxing, and, within the SRWMD, general legislative appropriations.

States

Not one state has adequate staffing for stormwater management. All of the state programs rely to a large extent on general appropriations, and obviously they are not too successful. They must compete at the state legislature with many other important programs, environmental and social. Additionally, six state programs (75%) charge permit fees, either through their own permitting authority or associated with NPDES storm water permits. One of the state's responded "the program is barely functional - we need more of everything". A dedicated funding source, such as a stormwater utility or special taxing district, is an essential missing funding mechanism at the state level. Florida's program has suggested small fees on concrete, asphalt, fertilizer, and pesticides, but this concept has never even been debated at the legislature.

Overall Statistics

Percentage of Jurisdictions having Adequate Staffing for Stormwater Management



While staffing for stormwater programs is much better when compared to erosion and sediment control programs, less than 50% of the stormwater management programs are adequately funded.

While staffing for stormwater programs is much better than compared to erosion and sediment control programs, less than 50% of the stormwater management programs are adequately staffed. Obviously, staffing deficiencies adversely affect program effectiveness. This is especially true with respect to stormwater treatment since many BMPs are relatively new. They present special challenges in implementation and in training, research, and monitoring to develop new BMPs or refine current ones. These staff deficiencies do not bode well for successful implementation on a widespread basis.

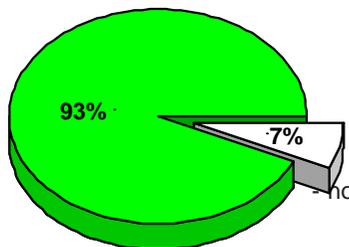
8. Program Educational Aspects

There is growing awareness and recognition that there must be a strong educational component if erosion, sediment, and stormwater control programs are going to be effective and gain acceptance from the regulated community and the general public. The responses to this question demonstrate that almost all of the jurisdictions view education as being integral to overall program success.

8a. Are Educational Programs a Program Element?

Educational programs are an element of nearly every one of the urban runoff control programs. Significantly, *the importance of an education element is recognized at all levels of government.* Question 8c discusses the audiences that these programs attempt to reach.

Are Educational Programs a Program Component



8b. Are any of the Educational Programs Mandated by Law or Regulation?

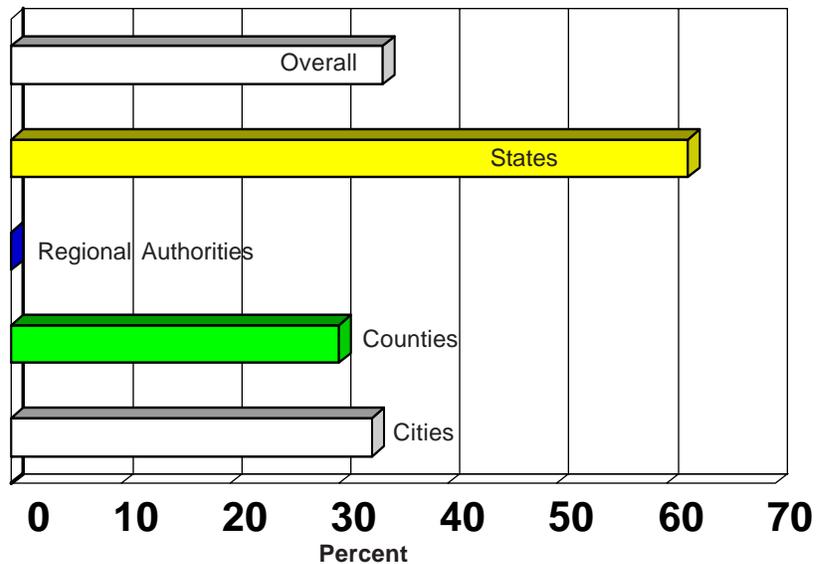
The importance of education programs is demonstrated by the 11

Educational programs are an element of nearly every one of the urban runoff control programs. Significantly, the importance of an education element is recognized at all levels of government.

(34%) programs which mandate this element in law or regulation. However, 93% of the programs have an education element. This clearly demonstrates the importance that implementing staff place on education in erosion and sediment control and stormwater management. The importance of education in a successful program is further emphasized by their inclusion as a program element when so many of the programs are not adequately staffed. Staff time is extremely valuable, yet nearly every programs uses its staff to conduct educational activities, clearly demonstrating the importance of this program element.

Experience has shown that all segments of the community must be educated about the need for, and the benefits of, urban runoff control programs.

Educational Programs Mandated by Law or Regulation



8c. What are the Intended Audiences of the Educational Programs?

Experience has shown that all segments of the community must be educated. The general public, elected officials, and the regulated public must be educated about the need for, and the benefits, of the urban runoff control program. They need to understand that reducing Pointless Personal Pollution requires all of us to be part of the solution. Practitioners, whether the regulated public or the implementing staff, must be educated so they can design, review, construct, inspect, maintain, or operate effective erosion, sediment, and stormwater controls. The questionnaire listed five specific target audiences - contractors, consultants, general public, developers, and inspectors - along with "other", where additional details were requested.

Cities

The general public is the intended audience for educational efforts in eight programs (88%), while seven (77%) target contractors. Five programs (55%) have educational programs directed at site developers and consultants. Educational programs for inspectors are conducted in four cities (44%).

Counties

Contractor education programs are conducted in all ten programs, with nine (90%) targeting consultants and the general public for education. Eight programs (80%) have educational programs for inspectors, while seven (70%) provide site developers with educational programs. Some county programs specifically mentioned boards and commissions as target audiences.

Regional Authorities

Four regional authorities (80%) conduct educational programs for consultants and developers, while three (60%) have educational programs for contractors. Inspector education occurs in two programs (40%). Surprisingly, only the SRWMD (20%) provides educational programs for the general public. Other targeted audiences include local government officials, elected officials, and governmental engineers.

States

Educational programs for contractors and consultants are conducted in all eight programs, while seven (87%) provide education for developers and inspectors. General public education programs are conducted by five states (62%), with four (50%) programs conducting educational programs for local government officials. Since state and regional programs depend to such a large extent on local implementation, it is not surprising that they conduct education programs for local officials.

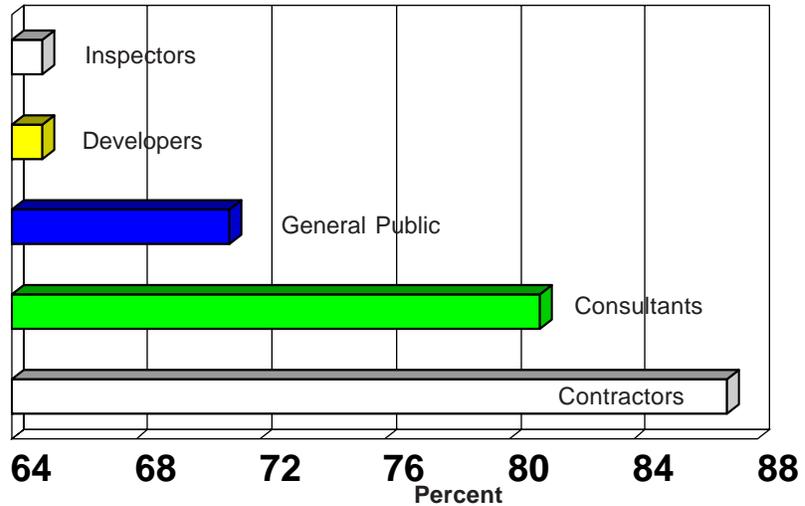
Overall Statistics

The most important conclusion is that educational programs must target many different audiences. The responses clearly show that the programs not only recognize the importance of education, but the need to conduct and tailor educational pro-

The most important conclusion is that educational programs must target many different audiences.

grams for a wide range of very different audiences, each with their own interests and needs.

Target Audience for Educational Programs



8d. How Many Individuals Attend and How Often are the Educational Programs Given?

Programs not only recognize the importance of education, but the need to conduct and tailor educational programs for a wide range of very different audiences, each with their own interests and needs.

The recognition that the educational element must target a wide range of different audiences is essential. However, the success of the educational efforts depends largely on how many people attend and learn. Educational programs and activities must be given at a frequency, time, and location that is convenient for the target audience. Given the inadequacy of staff resources in most programs, and the responses to the immediate previous questions, there is a concern that these efforts may be sporadic and not offered frequently enough. This question examines how well the education element is institutionalized within the urban runoff control program. Is there a schedule for presenting educational programs? How many individuals attend each program? Does the program even track the frequency of educational activities and the number of attendees? As noted, there are several different target audiences and programs must be tailored and conducted for each one. If the program conducts educational activities for diverse target audiences, but the number of individuals reached is limited, then the activities probably aren't conducted frequently enough or in the right locations. If the program does not know the frequency or audience size for its education activities, this indicates that the educational programs are not institutionalized enough to be effective, especially if staffing for the entire program

is not adequate.

Cities

Eight programs (89%) conduct educational programs, with only three (38%) unable to provide information on the number of individuals for which education was provided. Only one program (12%) provided information on how often educational programs were held. The responses on the numbers of individuals attending are summarized below:

- hundreds
- 300+
- thousands
- approximately 100
- 300 total/given twice per year

Counties

Five programs (50%) could not provide information on how many people attend education activities. Additionally, no program provided information on how frequently educational efforts were presented. The responses on the numbers of individuals attending are summarized below:

- hundreds
- 100
- 60/year for stormwater management
- 160 per year
- 100 contractors, developers; 5,000 at schools

Regional Authorities

Only three regional authorities (60%) provided information on how many individuals attended education programs. Only the NEIPC, an organization with a primary focus on training and technical assistance, provided information on the frequency of their programs. The responses on the numbers of individuals attending are summarized below:

- 10 - 20 seminars/year
- 60 -200 individuals/year
- 100 -150 individuals/year

States

Interestingly, all eight programs provided information on the

If the program does not know the frequency or audience size for its education activities, this indicates that the educational programs are not institutionalized enough to be effective.

Only four programs could provide this information.

number of individuals attending educational activities. However, only two programs (25%) provided information on the frequency of these efforts, with several states stating that the frequency varies. The responses on the numbers of individuals attending are summarized below:

- hundreds
- approximately 6 times/year; thousands
- hundreds (erosion and sediment control)
- thousands (erosion and sediment control)
- hundreds (stormwater management)
- 4 - 8 times/year; 600 individuals
- 600 individuals

Overall Statistics

It may perhaps be unwise to infer too much from the responses to this question, since educational efforts to reach certain audiences are often sporadic and a response such as "as needed" does occur in the questionnaire responses. However, only four programs (12%) provided information on the frequency of activities. This indicates that educational programs have not been entirely institutionalized yet. While all programs recognize that educational programs are needed, it appears that they are not a high priority when compared to other program needs and functions. Given the inadequate staffing of most programs, this is not to be unexpected.

9. Program Compliance and Enforcement

While education to train the regulated public, and gain their understanding and support, is crucial for successful program implementation, there must also be a compliance and enforcement component. Education can help contractors or developers understand how a practice or strategy is implemented properly, but the potential for poor implementation still remains. Additionally, some developers and contractors will be tempted to save the costs associated with BMP implementation, hoping that neither rain nor an inspection occurs. In many situations, a physical presence is necessary. Inspection and enforcement are especially important during construction when site conditions change rapidly. Erosion and sediment controls may be installed correctly but experience has shown that they are seldom checked after storms or maintained regularly. Enforcement to assure proper site implementation and program compliance is an essential element of any program.

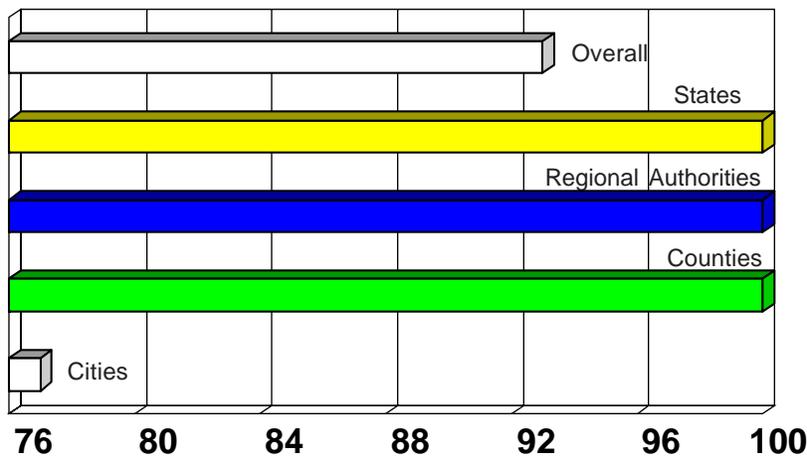
There are a variety of penalty and enforcement provisions available for erosion and sediment control and stormwater management programs. These include civil penalties, generally fines, and criminal penalties which typically include jail in addition to fines. Other commonly used enforcement tools include stop work orders, withholding occupancy permits, withholding other permits, revoking or suspending permits, and revoking performance bonds.

9a. Are there civil penalty provisions in the program?

Of all 32 programs reviewed, only two city programs do not have civil penalties. This is a very clear statement that civil penalty provisions are an important tool to help assure compliance with the requirements of erosion, sediment, and stormwater management programs.

There must be a compliance and enforcement component to ensure adequate site implementation.

Percentage of Programs having Civil Penalty Provisions

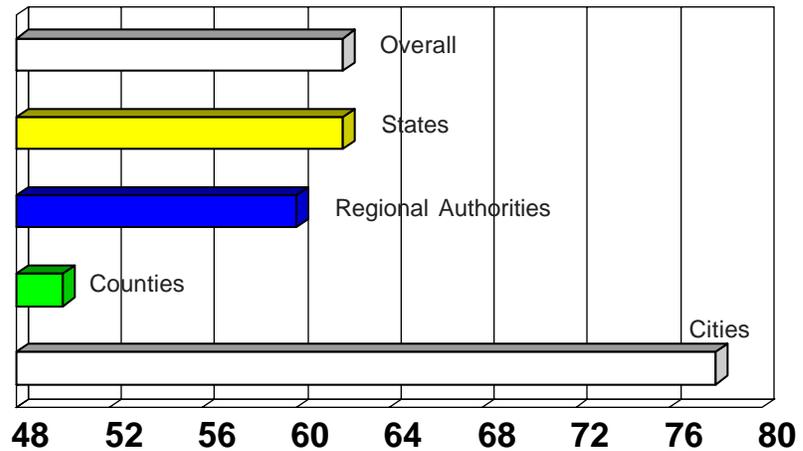


9b. Are there criminal penalty provisions in the program?

Unlike civil penalties, criminal penalties are not as universal with only 62.5% of the programs having them. Both city programs which do not have civil penalties do have criminal ones, but two other programs do not. Interestingly, New Jersey's program has criminal penalties for stormwater management violations but not for erosion and sediment control, while Pennsylvania's program is the reverse.

Civil penalties are used in 30 of the 32 programs, but only 20 of the programs have criminal penalties.

Percentage of Programs having Criminal Penalty Provisions



Individuals who implement urban runoff control programs recognize the need for enforcement options other than through the civil or criminal justice system.

9c. Other available enforcement options

Individuals who implemented urban runoff control programs recognize the need for enforcement options other than through the civil or criminal justice system. Enforcing environmental laws is a low priority for almost all of our overcrowded justice systems. Additionally, site conditions changes so rapidly, and damage from off-site sedimentation or stormwater discharges can occur so quickly, that site compliance is more readily achieved through the use of other enforcement options. The questionnaire included options of halting construction (stop work order), withholding occupancy permits, and withholding other permits. A fourth option allowed a program to name other enforcement options they used which might have broader use elsewhere. Experience has shown that a stop work order is the most effective tool to obtain site compliance.

Cities

All nine programs (100%) have the ability to halt construction. The option to withhold occupancy permits is available to eight programs (88%), while three (33%) can withhold other permits until the violation is corrected. Other tools used by city programs to gain compliance with their program's requirements include:

- counseling and technical assistance
- may require an applicant to submit an engineer's

- report or analysis
- trafficking of sediment into public land is a police offense

Counties

All ten programs (100%) have the authority to halt construction. Withholding occupancy permits is used by eight programs (80%), while seven (70%) can withhold other permits. Three programs (30%) can require forfeiture of security or performance bonds. Other tools used by county programs to gain compliance with their program's requirements include:

- monetary fines
- court order
- any other available legal or equitable relief
- tax lien on property after county performs corrections

Regional Authorities

All regional authorities (100%) have the ability to halt construction. Withholding occupancy permits can be used by two programs (40%), while only the NIPC recommends to its local governments that they withhold other permits. Other tools used by regional programs to gain compliance with their program's requirements include:

- performance bonds
- administrative and legal procedures involving a notice of violation, then a consent order; quick enforcement is rare unless done voluntarily
- other code enforcement options

States

Seven programs (88%) have the ability to halt construction. Five programs (62%) can withhold occupancy permits, while other permits can be withheld in six (75%). Other tools used by state programs to gain compliance with their program's requirements include:

- bond revocation; lien on property
- oversight of local programs; can withhold state monies to that program
- civil and criminal options only

- issue notice of violation, then a consent order
- revoke permits

Halting construction and withholding occupancy permits are the most widely used enforcement options.

Withholding other permits is used to a lesser extent.

Overall Statistics

All programs (97%) except Washington State have the authority to halt construction. Withholding occupancy permits is available to 23 programs (72%), while 17 (53%) can withhold other permits. Five programs (16%) use the forfeiture of some form of security as an enforcement option.

9d. Are the Penalty Provisions Adequate?

If program implementation is to be effective, it is critical that there exist adequate enforcement and compliance tools, including penalty provisions. The response to this question provides an overall qualitative evaluation of the adequacy of the options discussed in items a, b, and c above. Additionally, there is a difference in effectiveness evaluation between the erosion and sediment control and stormwater management components. Assuring compliance with erosion and sediment control is more of a day-to-day activity, with rapidly changing site conditions. On the other hand, permanent stormwater management practices usually are evaluated for compliance at project completion.

Cities

The penalties are adequate to assure site compliance in six programs (66%), including four combined erosion, sediment, and stormwater control programs. The Olympia program has effective penalties for stormwater management but not for erosion and sediment control, while the opposite is true in Bellevue. The Austin and Washington D.C. programs do not have effective penalties for either erosion/sediment control or stormwater management

Counties

Except for Washington County, all of the programs (90%) have penalty provisions that are adequate for stormwater management. Of the nine counties with erosion and sediment control programs, only the Washington and Clark County programs do not believe their penalties assure site compliance.

Regional Authorities

All five regional programs (100%) have penalty provisions that assure site compliance for stormwater management. Only Florida's three water management districts (60%) believe their erosion and sediment control penalty provisions are adequate.

States

Six programs (75%) believe their penalty provisions for erosion and sediment control are adequate. Only four programs (50%) feel their penalties for stormwater management assure site compliance.

Overall Statistics

The penalty provisions for stormwater management are adequate to assure site compliance in 24 programs (75%). Erosion and sediment control penalties are adequate in 22 programs (71%). It should be remembered that having adequate penalty provisions does not necessarily mean that they are used. Earlier responses indicate that many programs have inadequate staffing, especially inspectors. Even with adequate penalty provisions, the program will not be very effective in assuring compliance with its requirements if site's are not inspected regularly.

In general, most jurisdictions feel that their penalty provisions for both erosion and sediment control and stormwater management are adequate.

9e. Are As-Built Certifications Required for Stormwater Management Systems?

As-Built Certifications, which also are known as record drawings, are a very valuable tool to assure that stormwater management systems are constructed properly. This is a submittal by a design professional to the regulatory authority certifying that the actual construction of the stormwater practices has been done in accordance with the approved plan and its specifications. It does not replace the need for inspection by the jurisdiction's inspector. However, it is an effective tool to ensure proper construction by placing responsibility on the site's design professional, usually a registered professional engineer. As-built plans are also extremely useful for maintenance and repair activities.

Cities

Seven programs (78%) require As-Built Certifications for all stormwater management practices. In the two other programs,

As-Built Certifications for stormwater management systems can't replace the need for inspection by the program's inspector, but it can be an effective tool to ensure proper construction.

both in Florida, as-built certifications are required by the state program which is implemented by the water management district.

Counties

Seven programs (70%) require As-Built Certifications for all stormwater management practices. Montgomery County's program (10%) requires As-Built Certifications for ponds only.

Regional Authorities

Florida's three water management districts (60%) require As-Built Certification for all stormwater management systems. Within the Denver UFCD, local governments may require them for ponds. Local governments within the NEIPC area also may require them.

States

Only three programs (37%) require As-Built Certifications for all stormwater management practices. Delaware's program requires them for infiltration practices only. In four programs (50%) they are required at the option of the local government.

Overall Statistics

Within 22 jurisdictions (69%), As-Built Certifications are submitted for all stormwater management practices. One additional program (3%) requires them only for ponds, while another (3%) requires them only for infiltration practices. Requirements for an As-Built Certification are at the option of local governments in six of the 13 state and regional programs.

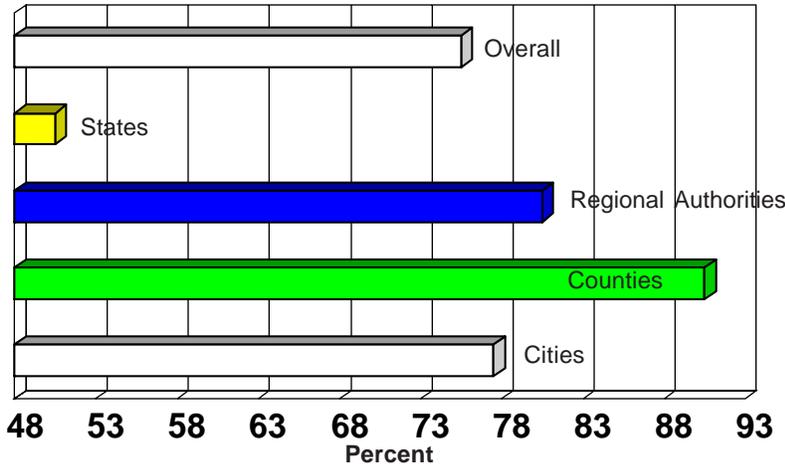
9f. Are Final Inspections Required for Stormwater Management Systems?

Another tool to assure proper construction of permanent stormwater management practices, including their structural integrity, is to require a final inspection. This often is performed before release of any performance bond, issuance of a Certificate of Occupancy, or acceptance by the entity responsible for long-term operation and maintenance. It needs to be recognized that the site developer may not be the eventual site owner or responsible operation and maintenance entity. A final inspection can prevent the ultimate owner from inheriting a poorly constructed system

and help reduce future problems. Final inspections should be done while the contractor responsible for construction of the

A final inspection can prevent the ultimate owner from inheriting a poorly constructed system and help reduce future problems.

Final Inspections Required for Stormwater Management



stormwater practices is still on-site along with construction equipment that might be needed to correct mistakes.

10. Maintenance of Stormwater Management Systems

The effectiveness of a stormwater management program depends largely on how well and how safely the stormwater practices work over time. This is especially true with respect to practices that are used to reduce stormwater pollutants. Assuring long-term performance and safety requires a comprehensive maintenance component. This needs to include record keeping, inspections, establishing a responsible entity for maintenance, a funding mechanism, and legal steps in the event that a maintenance problem or default occurs.

10a. Can you Indicate the Number of and Types of Practices Constructed Over the Past Two Years?

The intent of this question is to determine how many agencies have tracking procedures to record the number and type of practices installed. A program with an effective tracking system will have an easier time assuring that practices are inspected periodically and that the responsible maintenance entity is doing its job. A geographic information system can be a very effective tool to help map the location of all stormwater systems, and establish a data base on the type of BMP, date of construction, date of last inspection, and maintenance activities.

Cities

Six programs (66%) provided information on the number and type of stormwater management practices constructed in 1992 and 1993.

Counties

Five programs (50%) provided information on the number and type of stormwater management practices constructed in 1992 and 1993. Additionally, Kitsap County indicated that one wetland was constructed in 1993.

Regional Authorities

Only two of Florida's water management districts (40%) provided information on the number and type of stormwater management practices constructed in 1992 and 1993. The Denver UFCDD indicated that "several" wet detention systems and "many" extended dry detention systems had been built.

States

Four states (50%) provided information on the number and type of stormwater management practices constructed in 1992 and 1993. Maryland's program implemented a very comprehensive tracking system in 1985. This system provides information on the number of permits, projects, waivers, types of BMPs, construction inspections and enforcement actions, maintenance inspections and enforcement actions, and detailed budget information for each county in the state. Unfortunately, program funding cuts by the Legislature in 1992 greatly reduced the data entered into the system by about a factor of ten. Data input was further reduced by 66% in 1993 with no data entered for 1994 and 1995.

Overall Statistics

Seventeen programs (53%) provided quantitative information on the number and type of stormwater management practices constructed in 1992 and 1993. Two additional programs provided qualitative information.

A program with an effective tracking system will have an easier time assuring that practices are inspected periodically and that the responsible maintenance entity is doing its job.

10b. Does the Program Require Maintenance of Completed Stormwater Management Systems?

Thirty programs (93%) require maintenance of completed stormwater management systems as a program component. The only two jurisdictions that do not require maintenance are the Denver UFCD and Washington State which both rely on local governments to oversee maintenance.

10c. Responsible Maintenance Entities

The complexity of stormwater management systems, especially treatment BMPs, and their inclusion as part of the local infrastructure implies that ideally they should all be owned and maintained by government. However, this is seldom true. Many local or regional governments do not want this responsibility because of the cost. They also believe that systems serving private businesses should be maintained by the owner. Additionally, many systems serving residential developments also serve as open space or recreational areas, with large areas of grass or landscaping that require intensive maintenance - a responsibility local governments do not want, especially because of aesthetic considerations. The questionnaire listed the most common legal operation and maintenance entities - public agency, private entity, or property owners association - along with "other".

Cities

Public agencies are an allowable maintenance entity in eight programs (88%), usually systems serving public roads or other public land uses. All nine programs require private property owners to be the responsible entity for maintenance, especially for commercial or industrial land uses. Stormwater systems serving residential developments are accepted for maintenance by the local government in five programs (56%), although some do not perform maintenance of vegetation. The other four programs (44%) require a Property Owners Association to be responsible for maintenance of residential systems.

Counties

A public agency is responsible for maintaining certain stormwater systems, especially those serving public roads and lands, in all ten programs (100%). All programs also require private owners to be responsible for maintenance for systems serving

The complexity of stormwater management systems, especially treatment BMPs, and their inclusion as part of the local infrastructure implies that ideally they should all be owned and maintained by government.

However, this is seldom true.

commercial or industrial land uses. Nine programs (90%) allow property owner associations to be responsible for maintenance in residential developments, but with restrictions in two programs. King County only allows maintenance by Property Owners Associations in limited circumstances, while Prince Georges County allows them to perform maintenance for aesthetic purposes only. The Unified Sewerage Agency of Washington County or the county's municipalities accept residential systems for maintenance after they are constructed.

Regional Authorities

Each regional program allows maintenance to be the responsibility of any of the three options listed on the questionnaire (100% in each category). The three Florida water management districts also allow local water control districts, a special taxing district, to be the responsible maintenance entity.

States

Five programs (62%) allow the responsible maintenance entity to be any of the three categories. South Carolina's program requires local governments to maintain residential stormwater management systems while commercial and industrial systems are maintained by the property owner. Maintenance responsibility in two programs (25%) is determined by the local agency implementing the program.

Overall Statistics

Except for the two state programs that leave designation of the maintenance entity to local governments, all 30 other programs (94%) allow a private owner to be responsible for maintenance. A public agency can be the responsible maintenance entity in 29 programs (91%), usually for systems serving public roads or other public land uses. Only seven programs (22%) require public maintenance of residential systems, while 23 (72%) allow a property owner association to be the responsible maintenance entity.

10d. Are Maintenance Inspections Done by a Public Agency?

Assuring that a stormwater management system is maintained properly and continues to operate as designed depends largely on a regular inspection by a qualified individual. Whether the inspector is from a public agency is examined in this question.

30 programs require maintenance of completed stormwater management systems as a program component.

Cities

Eight programs (89%) require a maintenance inspection by a public agency and specify a desired minimum inspection frequency. Four programs (44%) recommend annual maintenance inspections, while three (33%) recommend an inspection once every two years. Alexandria's programs inspects systems semiannually. The District of Columbia program recommends three inspections annually for the first five years, but only has enough inspectors to perform one every six months to a year.

Counties

Nine programs (90%) require a maintenance inspection by a public agency. The recommended inspection frequency varies greatly as listed below:

- once per year (3 programs)
- once in the first year, then every three years (1)
- by complaint or incidental drive-by (2)
- no specific interval (1)
- once every 5 years for detention facilities only (1)
- once/year for class 1 and 2 dams; once every two years for all others (1)
- every three years, every year for county facilities (1)
- annually for county facilities (1)

Regional Authorities

Four regional programs (80%) allow a public agency to be responsible for maintenance inspections. While four programs can use their staff to conduct inspections, only the SRWMD regularly conducts them - once every three years. The other regional programs will conduct inspections in response to complaints. All three Florida water management districts require owners to submit private inspection reports, with the frequency depending on the type of BMP.

States

Only the Delaware and South Carolina programs (25%) require maintenance inspections by a public agency, with inspections done annually. All six other programs depend on local governments to establish a schedule for and to conduct

Assuring that a stormwater management system is maintained properly and continues to operate as designed depends largely on a regular inspection by a qualified individual.

maintenance inspections. Maryland's program suggests an inspection be conducted once every three years, while Virginia's program recommends semiannual inspections. Florida's program encourages local governments to establish an operating permit system that requires annual inspections, especially of infiltration and filtration systems.

Overall Statistics

Maintenance inspections must be done by a public agency in 23 programs (72%). Eighteen programs (56%) specify a minimum inspection frequency, with two additional state programs having local governments establish minimum inspection intervals. The recommended frequency of inspecting stormwater systems by public agency staff is summarized below:

- semiannual (1 program)
- annually (9 programs)
- once every two years (5 programs)
- once every three years (4 programs)
- by complaint or incidental drive-by (5 programs)

10e. Is There a Dedicated Funding Source Available for Maintenance Activities?

With 29 programs allowing public agencies as the responsible maintenance entity for stormwater management systems, it is important to see if funding is available to conduct the needed maintenance activities.

Cities

Of the eight programs which have some responsibility for maintenance, seven have a dedicated funding source - a stormwater utility fee - available for maintaining stormwater management systems.

Counties

Of the ten programs which have some responsibility for maintenance, seven have a dedicated funding source available for maintaining stormwater management systems. Two programs depend on ad valorem or general taxes, a risky funding source, while five have implemented a stormwater utility or special taxing district.

The programs clearly recognize that public agency inspections are necessary to ensure the continued functioning of stormwater management systems, with 72% requiring such inspections.

Regional Authorities

Only the Denver UFCDD, a special taxing district, is responsible for maintaining certain stormwater systems, with the other regional programs depending largely on local governments or private owners. While the Denver UFCDD has a dedicated funding source to pay for maintenance, the other regional programs encourage local governments to establish a stormwater utility to provide funds for stormwater system maintenance.

States

None of the state programs are responsible for maintaining stormwater management systems, with responsibility typically resting with private owners, local governments, or the state highway department. No dedicated funding sources for maintenance of stormwater management systems have been established at the state level.

Overall Statistics

Public maintenance of stormwater management systems is performed in 24 programs (75%), but only 15 (63%) have a dedicated funding source to pay for maintenance activities. Of these 15 programs, all but one is a city or county, and two of these programs pay for maintenance from general or property taxes, traditionally an unreliable funding source.

10f. Are Legal Steps Available in the Event that Maintenance is not Accomplished?

When maintenance of stormwater management systems is the responsibility of the private owner or a property owners association, there must be a legal mechanism available to ensure that maintenance is performed when needed. The most common enforcement tool (14 programs) is a public agency notifying the owner about the maintenance needed and giving a deadline by which the activities must be completed. If maintenance is not performed by the deadline, it is performed by the public agency (or by contract) with the owner billed for the cost. Often a tax lien is placed on the property until the owner pays the bill. Other common enforcement tools include code enforcement violations with fines (10 programs), and legal enforcement (6 programs). Two programs, Washington County and Washington State, do not have legal steps available if maintenance is not performed. Three state programs and one regional program leaves the enforcement main-

Public maintenance of stormwater systems is performed by 24 programs, but only 15 have a dedicated funding source to pay for maintenance activities.

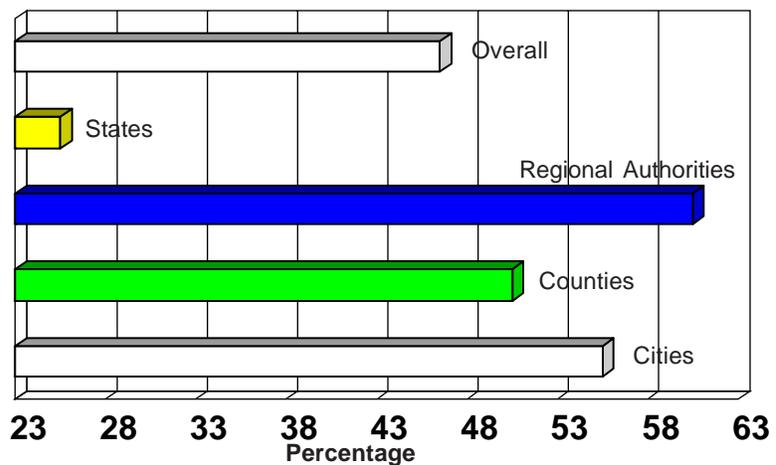
When maintenance of stormwater management systems is the responsibility of the private owner or a property owners association, there must be a legal mechanism available to ensure that maintenance is performed when needed.

tenance to local governments.

10g. Have legal steps ever been taken to facilitate needed maintenance?

Having legal enforcement tools to assure that maintenance is performed doesn't matter if they aren't used. As seen below, using these legal tools is not a high priority, which helps to explain why so many stormwater management systems are not maintained and operated as designed. In Florida, surveys have shown that up to 70% of the systems constructed since 1982 are not being maintained and operated properly.

Have Legal Steps Been Taken to Facilitate Needed Maintenance?



11. Program Coordination with Related Programs

Erosion and sediment control and stormwater management programs must coexist with an ever increasing variety of other programs. These include wetlands protection, wellhead protection, building permits, land use planning, floodplain management, wastewater treatment, and water supply. All of these other programs can profoundly impact successful implementation of urban runoff control programs. Therefore, it is very important that urban runoff control programs be closely coordinated with other environmental and land use management programs. This will help to minimize conflicts between programs, maximize the benefits of all programs, and can help to assure effective implementation of the urban runoff control program.

11a. Is There Significant Coordination Between the Erosion and Sediment Control and the Stormwater Management Program?

There is close coordination in 30 programs (94%), with 22 programs having an integrated erosion, sediment, and stormwater control program. This close coordination greatly enhances program effectiveness. It needs to be remembered that these two programs are integrally related. After all, minimizing erosion, preventing off-site sedimentation, and managing runoff on a construction site is all interconnected.

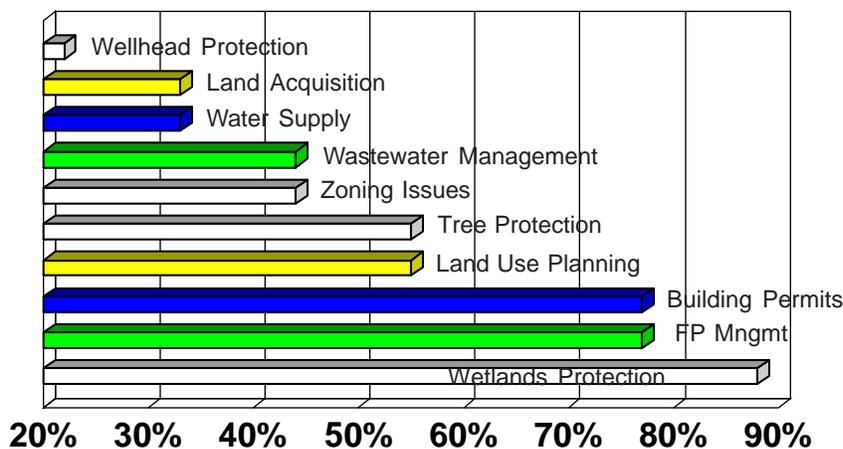
11b. With what other programs is there significant coordination?

The questionnaire provided a list of possible programs for which coordination might be necessary including:

- land use planning
- wetlands protection
- floodplain management
- wastewater management
- wellhead protection
- zoning
- building permit
- water supply
- land acquisition
- tree protection

Cities

Other Programs Where There is Significant Coordination



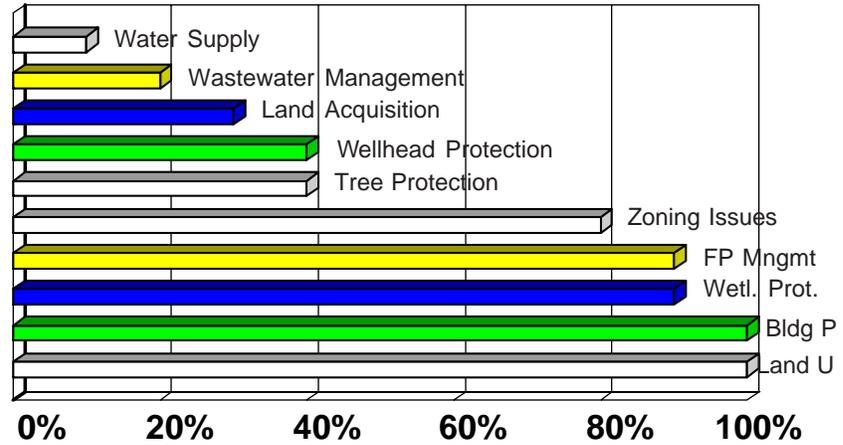
There is close coordination in 30 programs between the erosion and sediment control and stormwater management components.

22 programs have these two components integrated.

Since storm-water systems, especially regional systems, can provide multiple benefits including open space and recreation, coordination with land acquisition, wellhead protection, floodplain management, and wetland protection programs can often create "win-win" opportunities.

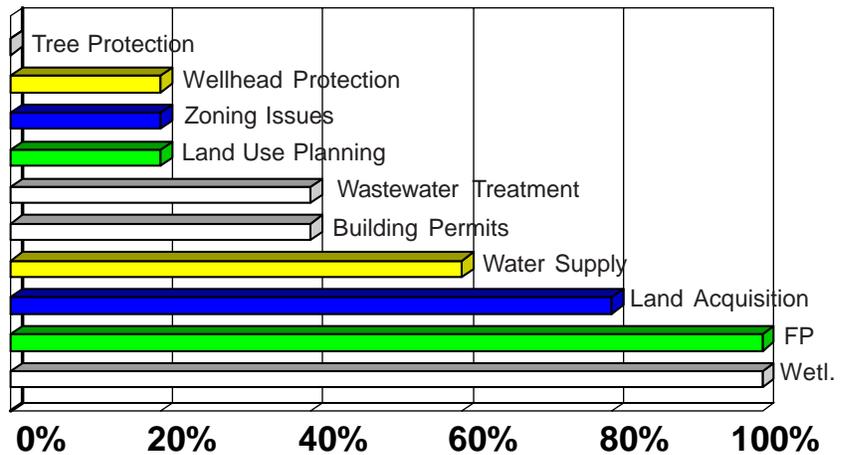
Counties

Other Programs Where There is Significant Coordination



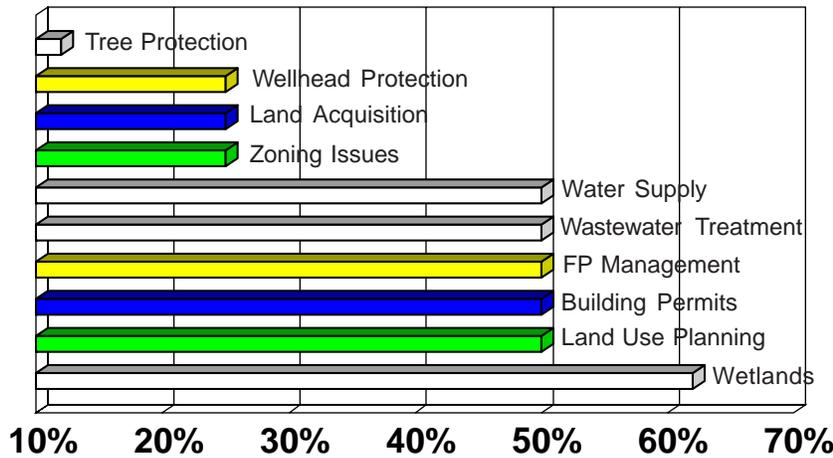
Regional Authorities

Other Programs Where There is Significant Coordination



States

Other Programs Where There is Significant Coordination

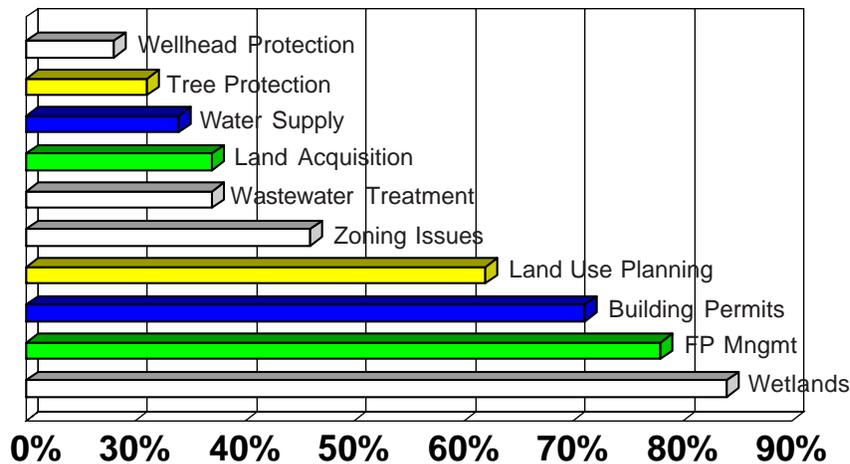


Overall Statistics

The overall statistics clearly demonstrate the relationship of urban runoff control programs to other land use, infrastructure, and environmental programs. Stormwater management systems frequently are located in floodplains and may adversely impact wetlands. Since land use changes create the need for erosion and sediment control and for stormwater management systems, close coordination with land use planning, zoning, and building permit programs is essential. Siting ur-

The overall statistics clearly demonstrate the intimate relationship of urban runoff control programs to other land use, infrastructure, and environmental programs.

Other Programs Where There is Significant Coordination



Since storm-water systems, especially regional approaches to management, can provide multiple benefits, coordination with other programs can often create "win-win" opportunities

ban runoff controls needs to be coordinated with the construction of wastewater treatment systems, especially on-site systems, and water supply systems, especially private wells, to minimize any potential adverse impacts. Installation of utility lines or pipes conveying wastewater or potable water is a major cause of land disturbance and close coordination is required for effective erosion and sediment control. In wellhead protection zones, special design criteria for stormwater systems may be desired to minimize potential adverse impacts on aquifers. Since stormwater systems, especially regional systems, can provide multiple benefits including open space and recreation, coordination with land acquisition, wellhead protection, floodplain management, and wetland protection programs can often create "win-win" opportunities.

11c. Are There Conflicts with Other Programs Which Prevent or Hinder Effective Program Implementation?

Conflicts and differences in policy between environmental and land use programs, and even between different environmental programs, is inevitable. While the goals and functions of some of these programs may be compatible, they also may conflict. *It is important to identify conflicts which prevent or hinder effective program implementation.* Such conflicts must be resolved if goals of the programs are to be achieved.

Additionally, programs must be operated with a minimum of conflict to maximize their efficiency and productivity, especially since resources are so scarce.

Conflicts with other programs which prevent or hinder effective program implementation exist in 22 urban runoff control programs (71%). This is an extremely high rate of conflict, but not unexpected.

The reasons for these conflicts are highly variable and depend to some degree on local politics and institutional frameworks. However, the areas of conflict can be grouped into five major categories:

1. Development vs. environmental protection. This category is an area of conflict in eight programs (36%) - three cities, three counties, one regional, and one state program. Development programs, which promote land alteration and impervious surfaces, and urban runoff control programs, which require expenditures to mitigate the impacts of these land

use changes, often are viewed as having conflicting goals. Growth management and urban runoff control programs should be mutually compatible. Unfortunately, in most locales, there is no growth management. Urban sprawl does not allow for efficient infrastructure use and makes effective resource protection almost impossible, especially on land with development constraints such as steep slopes, wetlands, karst conditions, high water table, etc.

2. Stormwater vs. wetlands protection. This category is an area of conflict in eight programs (36%) - one city, two counties, one regional, and four state programs. Wetlands are an important part of a watershed's natural stormwater management system. They also are considered "waters" under the Federal Clean Water Act. Ideally, wetlands should be incorporated as part of an overall stormwater management system, either for an individual site or for a watershed. However, current federal wetland policies often prohibit or inhibit this natural function from being used as part of the solution. Consequently, urban wetlands often become desiccated as imperviousness in a watershed increases, or they become "trashed" or adversely effected by indirect stormwater discharges due to their location within the landscape. Alternatively, they often are filled or converted to open ponds. This creates a "lose-lose" situation rather than a "win-win" opportunity.
3. Conflicts with road department. This category is an area of conflict in six programs (27%) - two cities and four counties. Urban runoff control programs can conflict with road departments with respect to transportation corridor planning which may now need to consider protection of wetlands, floodplains, and stormwater quality concerns. Stormwater BMPs usually are land intensive, requiring road departments to obtain more right-of-way and spend more dollars. Often, road departments prefer concrete lined ditches or pipes to convey runoff rather than using grassy swales.
4. Conflicts with other environmental programs. This category is an area of conflict in five programs (23%) - two county and three state programs. With the proliferation of environmental protection programs at all levels of government, it should come as no surprise that conflicts arise between the urban runoff control program and other environmental programs. This can be caused by duplication of requirements, especially when different implementing agencies are in-

Conflicts with other programs, which prevent or hinder effective program implementation, exist in 22 urban runoff control programs (71%).

This is an extremely high rate of conflict, but not unexpected.

volved. It can also be caused by new, stricter standards in a program which hinders the runoff program. For example, solid or hazardous waste program requirements can hinder the ability to maintain stormwater systems, placing new burdens on how to test stormwater sediments or restricting where they may be disposed.

- 5. Conflicts with federal programs. This category is an area of conflict in four programs (18%) - one regional and three state.

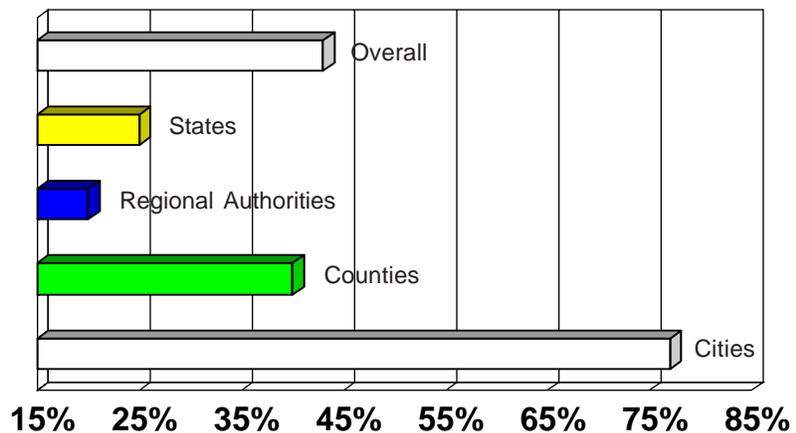
There are conflicts over flood protection versus resource protection. There are duplicative efforts among different agencies with different requirements. For example, many states have had an erosion and sediment control program, and some have had stormwater management programs, long before the NPDES storm water regulations were implemented. The new NPDES permit requirements conflict with these existing state requirements, a problem that can be solved by better coordination and communication.

11d. Is There Effective Communication with Federal Agencies on Related State and Federal Programs?

Communication is essential for effective program implementation.

Communication is essential for effective program implementation. The amendments to the 1987 Federal Clean Water Act and the 1990 CZARA amendments create new mandates for states to implement NPDES storm water permitting programs and non-point source management programs. This question examines the effectiveness of communication between federal agencies and local, regional, and state agencies. It must be stressed that com-

Jurisdictions having Effective Communication with Federal Agencies on Related State and Federal Programs



munication is a two way street. The responses to this question indicate that all agencies need to improve their communication and coordination efforts.

Surprisingly communication is most effective between federal agencies and city programs, not state programs. One would expect the most effective communication would occur between the states and federal agencies, but that is not the case. Instead, there is a general trend with declining communication effectiveness between federal agencies and cities, counties, regional authorities, and states. One possible explanation may be the large number of local urban control programs surveyed that are obtaining NPDES storm water permits.

12. Program Evaluation and Evolution

As with any environmental or public program, periodic evaluations are necessary to determine program benefits, identify areas where program implementation can be improved, and help the program evolve. Periodic evaluations are especially important to urban runoff control programs because of their reliance on relatively new BMPs. In fact, a central tenet of a performance standard, BMP-based program is the need to periodically evaluate BMP effectiveness and design criteria.

12a. Are There Measures of Program Success?

Program success can be measured in a variety of ways, either qualitatively or quantitatively. The ultimate measure of success is a lessening of environmental degradation or even an improvement in quality. However, monitoring to assess the impacts of urban runoff or the benefits of urban runoff programs is very difficult. These programs are discussed in Question 12d. Obviously, quantitative data provides more information, but given their budgetary and staffing restraints, many programs must rely on more qualitative measures. Five programs (16%) have no measures of success, while the other programs' measures are summarized below:

Cities

Six cities (66%) defined measures for program success. The measures are highly variable and are listed individually:

- monitoring of stormwater runoff and surface and ground water quality
- water quality monitoring, public education

It must be stressed that communication is a two way street.

The responses to this question indicate that all agencies need to improve their communication and coordination efforts.

Monitoring to assess the impacts of urban runoff or the benefits of urban runoff programs is very difficult.

Obviously, quantitative data provides more information, but budgetary limitations means programs rely on more quantitative measures.

- water quality monitoring
- ability of staff to come together and agree on roles
- comprehensive BMP tracking system; recognition by others

Counties

Seven counties (70%) have measures to evaluate program success. The measures are variable and are listed individually:

- completed capital improvement projects; public involvement, adopted basin plans; etc.
- Use of design manual by many municipalities on their projects
- workload evaluations; enforcement actions
- citizens complaints and drainage problems
- review of As-Built plans; inspections; flow monitoring
- county pilot studies
- maintenance activities evaluated, regular monitoring; public education tracked

Regional Authorities

All five regional authorities (100%) have some measures of program success. The measures are variable and are listed individually:

- watershed studies
- lack of water quality and flooding problems; wetland survival
- stormwater management research selectively monitors and evaluates practices
- major systems provide multi-objective urban facilities favored by local jurisdictions

States

All eight states (100%) have some measures of program success. The measures are variable and are listed individually:

- number of individuals receiving training
- bioassessments and sediment monitoring
- awareness, reputation from longevity
- Soil Conservation District evaluation of compliance; 90% of municipalities have

- stormwater management ordinances
- meeting monthly deadlines for inspections
- Puget Sound Water Quality Management Plan is redrafted every two years

Overall Statistics

25 jurisdictions (78%) have some measures of program success. Of those 25, only seven (28%) provided information that could be considered as quantifiable in terms of chemical or resource-based monitoring.

12b. What Areas of Improvement are Needed in the Program?

There are a number of categories which may be generalized, but a listing of the individual responses is valuable. Some of the more generalized issues will be mentioned in the general statistics category:

Cities

- introduction of educational elements to program
- maintenance responsibility and enforcement
- water quality best management practice requirements are undergoing review at this time; Older basin studies need updating
- biological and ecological context is needed for monitoring the water environment
- community development staff should be hired; training for other staff must be more frequent; field staff must give erosion and sediment control more priority
- the ability to statistically show improvement of the water quality in surface water; measuring attitude changes towards water quality
- preventive maintenance inspections for stormwater management; public education; improve design of urban BMP's for better removal of nutrients

Counties

- maintenance
- long-term maintenance funding; funding for correction of existing problems
- improved maintenance of stormwater management; improved erosion and sediment control; improved

While 25 programs have measures of program success, only 7 provided information that could be considered as quantitative in terms of chemical or resource-based monitoring.

The most common area of needed program improvement is overcoming the lack of maintenance of completed stormwater management systems.

- designs for stormwater management; improved integration with related programs
- education of contractors in erosion and sediment control; tracking proper installation and maintenance of erosion control structures
- monitoring; BMP research, development and improvement; developing performance standards; biological criteria for recreational waters
- intergovernmental cooperation by watershed
- public education; expansion of technical standards for water quality; private maintenance review, inspection, and enforcement
- maintenance; citizen complaints
- need to find additional ways to measure program effectiveness, particularly those areas not readily monitored

Regional Authorities

- inspection; maintenance; enforcement; training; better acceptance and awareness of nonpoint BMP's
- Get the state out of the stormwater business and give the local government the responsibilities (with accountability)
- specific criteria and standards for erosion and sediment control plans; updating stormwater management criteria, operation, maintenance, and enforcement
- more attention is needed by local cities and counties; to better integrate stormwater quality and erosion and sediment control

States

- additional funding for inspection; creation of a stormwater utility for long-term maintenance of stormwater management structures; improved relations with federal agencies
- in all areas of program implementation - in particular: updated rules, increased staff especially for inspections, education of practitioners
- better inspection coverage and consistent implementation for erosion and sediment control; water quality criteria and consistency for stormwater management; education in general
- improved coordination with wetlands and coastal ar-

- eas review; make municipal stormwater management ordinances mandatory; watershed protection funding for soil conservation districts; funding in general; coordination and prioritizing of watersheds for stormwater quality
- need to develop a fine schedule for typical violations and set as a policy
- benefits of comprehensive management need to be stressed; funding mechanisms; comprehensive handbook needed
- more money; recognition by Congress that mandates are not easy or inexpensive to implement

Overall Statistics

The most common area of needed program improvement is overcoming the lack of maintenance of completed stormwater management systems, which was cited by 10 jurisdictions (31%). Educational activities were mentioned by eight jurisdictions (25%). Six jurisdictions (18%) discussed both the need for better criteria and for improved funding mechanisms. Four programs (12%) mentioned monitoring needs and improved enforcement. It should also be stated that even if only one jurisdiction mentions a particular topic area as being a program weakness, that weakness may be true on a widespread basis and no less important.

12c. Are Research Projects Underway and Do They Have Widespread Applicability?

This topic is a means to consider program evolution on a widespread basis. There is a need in both program components to learn more about all aspects of program development and implementation. This is especially true about BMP design and performance, and about their water quality and resource management benefits. The responses to this question are overwhelming, in that so many jurisdictions are engaged in research activities, so that a breakdown in terms of cities, counties, regional authorities, and states is unnecessary.

Research is a program component in 29 jurisdictions (90%). Of these, 26 programs (89%) state that their research has widespread applicability. One of the programs replying that their research does not have widespread applicability stated that it has regional applicability. This represents a significant pool of information that is being developed.

Other program needs include educational elements, better design criteria and funding mechanisms, monitoring needs, and improved compliance and enforcement.

29 programs (90%) have a research program component, with 26 stating that their research has widespread applicability.

The predominant areas of research are in the implementation of innovative stormwater management practices and monitoring the performance of these practices. This is a very large potential source of information that could be vital in efforts to characterize urban runoff and quantify the design and performance of urban practices. Imagine if there was coordination of these efforts in terms of data collection and analysis!

12d. Is Monitoring a Program Component?

This question asks if monitoring is being done and, if so, what types of monitoring. Monitoring efforts can include water chemistry, sediments, biological, and flow rates.

Cities

All nine programs (100%) engage in some form of monitoring as a program component. One city did not provide a breakdown of monitoring parameters. Eight programs (88%) monitor water chemistry with seven (77%) monitoring flow rates. Three cities (33%) monitor sediments and biology.

Counties

Nine programs (90%) conduct monitoring but one county did not detail the individual parameters. Seven programs (70%) monitor both water chemistry and flow rates. Six (60%) conduct biological monitoring while five programs (50%) do sediment monitoring.

Regional Authorities

Four regional programs (80%) conduct monitoring. Water chemistry analysis is performed by three programs (60%) while two (40%) measure flow rates and monitor sediments. Only one regional program (20%) does biological monitoring.

States

Five programs (62%) conduct monitoring with all five sampling water chemistry. Three programs (37%) conduct biological monitoring while two (25%) do sediment and flow rate monitoring.

27 programs engage in monitoring as a program component.

23 programs (71%) monitor water chemistry, 18 (56%) monitor flow rates, 13 (40%) conduct biological assessments, and 12 programs (37%) sample sediments.

Overall Statistics

27 programs (84%) engage in monitoring as a program component. Water chemistry is monitored by 23 programs (71%), 18 (56%) monitor flow rates, 13 (40%) conduct biological assessments, and 12 programs (37%) sample sediments.

12e. Does the Program Address Retrofitting to Reduce Impacts from Developed Areas?

In addition to addressing whether retrofitting is a program component, the question is further broken down as to whether the retrofitting addresses flooding, water quality, stream channel erosion, or aquatic resources.

Cities

All nine programs (100%) implement retrofitting to reduce impacts from developed areas. All nine (100%) address water quality in retrofitting while six programs (66%) address flooding. Five programs (55%) consider stream channel erosion, and four (44%) consider aquatic resources.

Counties

Six counties (60%) include retrofitting to reduce impacts from developed areas as part of their stormwater management program. All six programs (60%) address water quality in their retrofits while five (50%) consider flooding impacts. Four programs (40%) address stream channel erosion and protection or restoration of aquatic habitats when retrofitting.

Regional Authorities

Only two regional programs (40%) are retrofitting to reduce impacts from developed areas. These two (40%) consider flooding, water quality, stream channel erosion, and aquatic resources in their retrofit activities.

States

Six programs (75%) address retrofitting to reduce impacts from developed areas. All six (75%) perform retrofitting to improve water quality, while five programs (62%) also consider both flooding and stream channel erosion. Three programs (37%) address retrofit to protect or restore aquatic habi-

23 programs (71%) do retrofitting to reduce impacts from developed areas, and all 23 address water quality in their retrofits.

tats.

Overall Statistics

23 programs (71%) do retrofitting to reduce impacts from developed areas, with all 23 addressing water quality improvement. 18 programs (56%) are retrofitting to reduce flooding. 16 programs (50%) consider stream channel erosion while 13 jurisdictions (40%) implement retrofits to restore or protect aquatic habitats.

12f. Are Watershed-Specific Approaches Being Used?

This question also considers whether watershed approaches include consideration of regional stormwater management structures, water body targeting, and nonstructural BMP's.

Cities

Eight programs (88%) use watershed-specific approaches. Seven programs (77%) engage in water body targeting and nonstructural BMP's. Five (55%) include the implementation of regional stormwater management systems in their watershed-specific approaches.

Counties

Watershed-specific approaches are a program element in eight programs (80%). All eight include regional stormwater management systems and nonstructural BMP's in their watershed-specific approaches. Six programs (60%) conduct water body targeting.

Regional Authorities

All five regional programs (100%) engage in watershed approaches as a program element. Only four regional authorities provided a breakdown of the various individual approaches. Four regional programs (80%) conduct water body targeting. Three programs (60%) engage in nonstructural BMP's while two (40%) consider regional stormwater management systems.

States

Seven programs (87%) use watershed approaches as a program element. Six states (75%) engage in all three approaches

87% of the programs include watershed approaches as a program element.

This statistic demonstrates the usefulness of using watershed approaches in urban runoff management and protection.

detailed in the question.

Overall Statistics

28 programs (87%) engage in watershed approaches as a program element. This statistic demonstrates the necessity of using watershed approaches in urban runoff management and protection. Nonstructural BMPs are used by 24 programs (75%) use nonstructural BMP's in their watershed approach. 23 jurisdictions (71%) use a waterbody targeting approach and 21 jurisdictions (65%) use regional stormwater management practices in their watershed approaches.

13. General Items

The questionnaire, up to this point, is specific regarding program elements and items. At this point, it is important to consider more "intangible" items that also determine a program's effectiveness and lessons that can be learned from experience. The answers to this item are more qualitative and are based on the experience of the individuals responding to the questionnaire. The discussion will begin with the relative length of time that the programs have been in effect. Further discussion will be on pitfalls that agencies and individuals need to avoid and weaknesses that impede program effectiveness. The final item in this chapter will be any additional thoughts that the individuals who responded wished to make.

13a. Program History of Respondents

In terms of program age, regional authorities have been involved with erosion and sediment control and, primarily, stormwater management for an average of 18 years. Next in longevity are state programs, having an average age of 13.1 years. County programs have existed for an average of 12.8 years and city programs have an average age of 11.5 years. The important point of this discussion is to recognize that the programs represented in this discussion have a lot of experience in erosion and sediment control and stormwater management. When considered as a whole, the programs reviewed have a total of 415 years of experience, or an average of 12.9 years.

We need to learn from these programs. Recognize that overall program functioning and effectiveness depends on program elements just as much as good science and technical information. There are some common threads in all programs that were learned only through years of experience, regardless of where a

The agencies represented in this discussion have a lot of experience in erosion and sediment control and stormwater management.

When considered as a whole, they have an average length of experience of almost 13 years.

program is located, its local political structure, or its physiographic factors. These common elements are necessary wherever program implementation is being considered.

13b. Pitfalls to be avoided

The responses to this item will be presented as they were provided. There will not be an attempt to offer statistics for the responses, and they should be carefully read by anyone involved in erosion and sediment control and stormwater management. Please remember that the items discussed are pitfalls and not recommendations unless phrased that way.

"Need to have community support. Need to have early successes and to communicate these successes."

"Not doing anything is a pitfall; so is studying things to death and not trying new technology."

Cities

- BMP construction must be supervised by design professionals; general construction contractors need supervision
- early on, many of the development regulations had lots of "loopholes" and exemptions - these have mostly been corrected
- need to have community support; need to have early successes and to communicate those successes; need to be responsive to ratepayers; this means providing good customer service with feedback. Bellevue has a customer action request system.
- objectives need to be clearly defined for any program related to stormwater management; flood control, water quality, and their relationship to overall environmental quality must be an integrated program. If not, staff will spend excessive time on institutional barriers
- not doing anything is a pitfall; studying things to death; not trying new technology
- developing regulations which may prove impractical to enforce; not developing a good partnership with the regulated community; good partnership between regulators and regulated is critical; developing constant interaction with top management is crucial
- public hearings on projects before you proceed

Counties

- all violation notices must be written; if securities are required, do not permit the use of surety bonds; use

- of corrugated metal pipe in pond embankments; building permit issuance must be controlled by sediment control inspection staff
- maintenance and retrofitting is under-funded; issues of equity are very sensitive
- keep upper management informed on all major developments as they occur - this will reduce the stress of updating management and getting approval at critical points in the development of a program; educate in-house personnel
- don't get too many agencies involved in utility development; educate and involve the public before deciding the program elements and keep them onboard
- need for dedicated funding source; need for adequate staff; avoid program fragmentation; need for performance standards
- each program has a unique political environment to consider; we are currently hamstrung by low rates, yet we would have no program at all, most likely, if there were higher rates; seek highest rates possible as a starting point
- overreliance on theoretical and technical knowledge during design without appropriate consideration for construction, maintenance, long term aesthetics, and community acceptance
- separation of grading, erosion and sediment control and stormwater management programs should be avoided; plan review and maintenance programs should not be politically separate
- estimate resources to start the program and then fund the program 2 -3 times that amount; be prepared for the public's expectations when you start - they are high

Regional Authorities

- take the time to educate the decision-makers and their technical advisors; be patient, don't expect immediate results; the best opportunity for progress and funding is immediately after a flood or other catastrophic event; you need to move quickly
- avoid exemptions for special interests; keep systems simple with low maintenance; don't allow property owners associations to operate systems with moving parts; delegate to responsible local government

"Avoid separation of grading, erosion and sediment control, and stormwater management programs."

"Take time to educate the decision makers and their technical advisers."

"Be patient, don't expect immediate results."

- when possible; avoid regulatory duplication
- develop comprehensive technical criteria first; conduct staff then public education and training; operate the program awhile; update the program after a couple of years; implement goal oriented research and evaluation effort; try to avoid frequent criteria changes
- don't start the program until it is well funded; be patient - start slow and phase buildup of the program
- impatience of municipal units through state and federal regulatory permit programs that create adversary attitudes and everyone closes up for fear of imposition of outside requirements and enforcement

"Education should be stressed; dedicated funding source should be identified."

"Avoid turf fights with related programs that overlap."

States

- avoid turf fights with related programs that overlap; lack of understanding and support from management; reliance on funding assistance from EPA
- legislative support - money, staffing, authority, enforcement; delegation - not without strong oversight and ability to rescind
- education should be stressed; include a diversity of ideas for program development; dedicated funding source should be identified
- avoid municipal enforcement of erosion and sediment control; expertise is essential; the voluntary nature of municipal programs slows implementation; site based (as opposed to watershed based) regulations
- inflexible inspectors; must have sure and certain enforcement; specify minimum statewide standards to base local plans on and to be in effect until local plans are developed; prioritize watersheds and concentrate on developing or threatened watersheds
- be very clear about application of first flush and what it pertains to; specify when efficiency calculations are required
- enforcement provisions must be flexible and have "teeth"; work early on with other government agencies to ensure that the law and regulations will be compatible with other stormwater management programs; include a detailed handbook, checklists, etc.
- have a law on the books! It is very hard to convince people to change their ways unless you have some

enforcement authority; also, unfunded mandates really do not cut it

13c. Weaknesses Which Impede Program Implementation

This item is related to the pitfalls section but tends to detail more program specific items versus external concerns.

Cities

- inexperienced city staff and development engineers with stormwater BMP's; lack of public education program; fragmentation of clean water responsibility
- since Bellevue was the second stormwater utility, the early problems were that the utility was considered a rain tax; any new program must develop public participation programs for support
- lack of understanding by the general public and policy makers surrounds environmental quality aspects of stormwater management; inability to define a single problem with a primary source and solution makes it difficult to get political support for necessary resources; chronic problems do not generate the fear and subsequent calls for action
- coordination with community development office; despite repeated efforts to train reviewers and inspectors, full compliance hasn't been achieved; plans are approved without adequate review; changes are made out in the field which affect the effective operation of stormwater facilities; do not crack down on erosion and sediment control violations
- inspections are the weakest link in our program; the grant funded nature of the stormwater management program makes it difficult to recruit and retain staff; cumbersome hiring practices

Counties

- lack of long-term funding
- loss of revenue to incorporations/annexations; environmental regulations/permitting lead to delays and cost overruns for CIP's; too much emphasis on planning
- program is not integrated with the NPDES storm water program; our role is providing assistance -

"Lack of understanding by the general public and policy makers surrounds environmental quality aspects of stormwater management; inability to define a single problem with a primary source and solution makes it difficult to get political support for necessary resources; chronic problems do not generate the fear and subsequent calls for action".

"Lack of adequate funding; lack of performance standards and research to improve performance; lack of inter-agency coordination".

"Lack of commitment at all levels of government; lack of growth management and program integration and enforcement; delegation needs oversight".

during tight fiscal times programs get cut; integration of water quality with flood is needed; change is difficult

- lack of public support; lack of problem recognition; strong development lobby; no new taxes movement; lack of strong research basis for BMP's
- lack of adequate funding; lack of performance standards and research to improve performance; lack of interagency coordination
- low rates; lack of clear strategies for each watershed supported by public consensus (being developed now)
- county enabling legislation give planning board review authority over development which may effect roads or drainage facilities, channels, stream corridors
- internal county government process
- developer pressure on policy decision makers to keep away from doing much

Regional Authorities

- funding limits - especially for watershed planning; lack of political support; lack of awareness and support for water quality concerns, especially NPS
- there is the usual political and special interest bickering over economic impact to development; an inherent hindrance to enforcement by due process
- agricultural exemption and WEAK land use and zoning link
- we respond to the greatest local needs as our and local funds permit; most flooding problems have been addressed

States

- inadequate funding levels; failure of decision makers to recognize the impact of urban pollutants; lack of interest in the program by the regional EPA office
- lack of commitment at all levels of government; lack of growth management and program integration/enforcement; need for education; lack of oversight with delegation
- staff and resources at the state and local level; education; consistency
- program needs to be mandatory at the municipal

- level
- funding; funding at state level; shortage of county matching funds; too many municipal programs who feel that the state is intruding on authority
- when delegated to local governments, the program does not appear to be as strong as when the day to day operation is handled by the state
- stormwater management program is not mandatory; limited local staff to inspect and enforce local ordinances; many localities do not charge appropriate administrative fees to cover efforts in programs, thus reducing their effectiveness; many local programs do not require adequate surety for land-disturbing projects
- lack of authority

13d. Any Additional Thoughts of the Individual Respondent

Cities

- the small size of our city bureaucracy has allowed innovation that might not have been possible in a larger jurisdiction
- community education is a very important part of these programs - to get public support for city programs; it helps when the public understands about NPS and general drainage
- we need to keep offering training courses for inspectors; research on effective BMP's for erosion and sediment control needs to continue
- there is the need to develop performance standards for erosion control and stormwater management

Counties

- agriculture needs regulation; the pleasure boat industry is polluting the waterways with their exhaust, sewerage, and fuel spills; stormwater regulations have to have water quality goals
- without a dedicated source of long-term funding, that is a stormwater utility, the type of program created here cannot survive
- there is a great need for coordinated/integrated management of water resources and programs;
- the major focus of any stormwater management program should be education; any education program

"The major focus of any stormwater management program must be education; must address internal staff education; need to keep training inspectors".

"Much can be accomplished if local, regional, and state agencies can work as partners; they must all participate in identifying what are the most important problems as viewed by the communities, instead of priorities being set by state, regional, or federal agencies by themselves."

would be remiss if it didn't address internal education; regional approach is effective

- the major debates here are related to property rights versus preservation for the future; the public's ability to bear increased costs; shared involvement by all water quality contributors
- if impact is immediate, address through construction of on-site or regional facility to prevent impact, if not immediate, contribute an equivalent amount to county-controlled regional program
- state/federal agencies need to be more proactive in identifying, designing, and implementing new practices; state/federal funding is necessary to assure success of these programs

Regional Authorities

- our best successes have come through working public/private forums at the regional level, this helps diffuse opposition and demons; projects are helpful, education is critical
- the most efficient program would be one which utilized common criteria among local, regional, and state which involved each level of government to its capability without duplication
- the information and data provided herein are cursory, are partially based on the opinion of the person completing the form and could be subject to change after closer scrutiny
- develop an institutional culture to service applicants
- much can be accomplished if the local, regional, and state agencies can work as partners; this means that all of them participate in identifying what are the most important problems as viewed by the communities, instead of them being defined by the state, federal, or regional agencies by themselves; partnerships are needed to establish long-term goals and provide sensible resource allocation for their implementation over realistic time frames. Our current regulatory environment does not permit this; hiding behind "higher" government shield to define what "lower" governments need to do does not work and will never work; we cannot afford the unfunded mandates we now have, much less new ones

States

- erosion and sediment control and stormwater management must be combined for maximum program effectiveness; watershed planning efforts should be combined with efforts to establish stormwater utilities
- without strict land use planning, aggressive state/local land acquisition programs, and integrated watershed management our erosion and sediment control and stormwater management programs cannot do the job
- program history and evolution has helped; wetlands and stormwater conflicts have to be resolved; conflicts with other programs must be resolved (6217, 319,402, etc.)
- our stormwater management program is currently being comprehensively revised to address stormwater on a watershed basis, expand water quality measures and practices
- better compliance through education and cooperative attitude for erosion and sediment control; need better coordination with EPA; state law only empowers to work with locals; no minimum standards
- new certification requirements and new local program review process should help to improve the erosion and sediment control program; significant improvements have been made since 1990

"Without strict land use planning, aggressive land acquisition programs, and integrated watershed management, our erosion, sediment, and stormwater control programs can not do the job."

Chapter 4

Common Elements of Successful Urban Runoff Management Programs

All urban runoff control programs share common elements such as a legal framework, administration, performance standards, design criteria, public education, BMP research, program evaluation

Developing and implementing urban runoff control programs presents many unique challenges. These are quite different from those encountered in the establishment of water quality management programs for traditional point sources of pollution. The challenges are associated with the diffuse, intermittent nature of runoff, and the management practices and strategies employed to mitigate the adverse impacts of urban runoff. The experiences of agencies that have developed and implemented urban runoff programs can help other entities establishing programs to overcome some of these challenges. This chapter summarizes and discusses the common elements of the urban runoff programs reviewed in Chapters 2, 3, and Appendix B. It also provides recommendations for establishing urban runoff control programs.

Recognize that essential program elements may differ depending on whether implementation is at the state, regional, or local level. However, all urban runoff control programs do share common elements. These include legal framework, administration, performance standards, design criteria, public education, BMP research, program evaluation and monitoring data, etc. No single entity can do everything. A "watershed management team" effort is needed involving all appropriate levels of government. Programs must be cooperative and involve federal, state, regional (if appropriate), and local governments that share responsibility for program implementation. Cooperation, coordination, and partnerships are cornerstones of successful programs. However, remember that erosion and sediment control and stormwater management programs primarily are regulatory programs. They must have an effective enforcement mechanism to ensure proper site implementation and maintenance.

The questionnaire results reveal that cities, counties, and regional authorities have a greater ability to provide funding and staff support for program implementation than do the states. Clearly, much of the day to day implementation must be done primarily at the

local level with significant support, expertise, and technical assistance at the regional or state level.

Individual jurisdictions may have very specific reasons for implementing an urban control program. The recommendations this chapter are provided as a basic approach to program implementation. They may not be completely appropriate if a specific issue forms the basis for an individual program. In these situations, the agency still should consider the various components discussed and recommended in this document, then evaluate their utility for the specific program.

Existing programs may not have the flexibility to implement some recommendations due to constraints imposed by their institutional frameworks. It is also important to recognize that although we strive for perfection in criteria and program elements, the reality of program implementation is another story. There is an important distinction between what we need to have for implementation of an effective urban runoff control program and what we usually get. Recognize that funding and staff support for urban runoff control programs must compete with other needed programs. Therefore, it is often necessary to prioritize program elements and allow the program to evolve over time.

GENERAL INSTITUTIONAL FRAMEWORK ISSUES

1. Possible Roles of Various Levels of Government

The complex challenges posed by urban runoff management are too great for any single level of government to solve. However, it is essential to minimize the number of jurisdictional levels. This allows for maximum implementation flexibility and reduces the potential for conflicts. At the same time, there must be oversight to ensure that the program is implemented consistently thereby assuring equitability throughout the nation, state or region. A team approach involving federal, state, regional (if appropriate), and local governments is needed. As mentioned so often in this document, programs must be cooperative, involving the appropriate levels of government, which must share responsibility for program implementation. The roles of each partner must be clearly defined to minimize duplication and conflicts. Effective coordination among implementing entities is crucial to maximize program effectiveness. Cooperation and partnerships among all levels of government are essential for successful program implementation.

The number of potential jurisdictional levels needs to be consid-

Recognize that funding and staff support for urban runoff control programs must compete with other needed programs. It is often necessary to prioritize program elements and allow the program to evolve over time.

The ideal approach to program implementation is for federal requirements to be the broad mandates which necessitate state, regional, and local participation.

ered when developing a program. To the degree possible, mandated levels beyond those essential for program implementation should be "invisible". For example, the minimum NPDES storm water requirements can be contained within the state or local program's requirements, which might be more restrictive or inclusive. Issuance of the state or local permit would be a requirement before the NPDES storm water permit Notice of Intent (NOI) for coverage could be filed. The NPDES permit also would reference compliance with applicable state or local requirements.

An ideal approach to program implementation is for federal requirements to be the broad mandates which necessitate state, regional, and local participation. The state program would establish minimum performance standards, provide design guidance, conduct research and educational activities, and oversee program implementation. Regional authorities would further the state activities, conduct watershed-wide planning and coordination, and be involved with day to day implementation. Alternatively, local governments can be involved with day to day implementation, but only after their programs successfully completed priorities such as stormwater master planning and effective maintenance and operation of facilities. Having local governments conduct research and education further enhances program implementation and evolution.

Federal role

Federal agencies have an important role in the implementation of urban runoff control programs. Chapter 1 briefly summarizes federal programs implemented by the Environmental Protection Agency, NOAA, Department of Agriculture, and other federal agencies which can have an indirect or direct influence on urban runoff programs.

The Federal Clean Water Act and the Coastal Zone Management Act Reauthorization Amendments of 1990 provide impetus for establishing urban runoff control programs at the state, regional, and local level. Given our knowledge about the deleterious effects of erosion, sedimentation, and stormwater on receiving waters, it is important that federal laws establish minimum national requirements for controlling these pollution sources. These need to be broad mandates which require all states to establish urban runoff control programs thereby assuring national consistency. This prevents states and local governments which do not want to address these problems from gaining an economic and competitive advantage over those governments which accept their re-

sponsibility to be good stewards. However, the national requirements must recognize the site specific nature of urban runoff control and allow states flexibility to establish appropriate institutional frameworks and BMP design criteria.

Funding also is an important contribution that the federal government needs to make. In particular, funding is needed to demonstrate BMPs, develop and distribute educational materials, and to conduct research on BMPs - to develop new technologies, refine existing ones, and to determine the effectiveness of design criteria. Initial "seed money" also is needed to assist states develop, implement, and institutionalize their programs. Funding for the programs and staff can be switched over time to state and local sources, but only after the programs are established, and gain support and acceptance from residents, the regulated public, and elected officials.

Technology transfer is another important role for federal agencies, especially EPA. While implementing urban runoff programs presents many unique challenges, often there is no need "to reinvent the wheel", either institutionally or technically. As seen in Chapters 2, 3, and Appendix B, most of the urban runoff control programs are conducting research that has widespread applicability. A national clearinghouse is needed to quickly and easily transfer information about the results of recent and on-going research projects around the country. Electronic bulletin boards are an excellent way to do this, as are periodic national conferences.

Federal accountability and consistency is a final role for federal agencies. Federally funded projects and activities on federal lands need to serve as models, especially with respect to BMP implementation and maintenance. Additionally, many federal programs, especially older ones, conflict with the goals of more recent environmental programs. Communication, coordination, and cooperation between EPA and other federal agencies, and between state and federal agencies, is needed to minimize conflicts and assure that federal programs and activities serve as models.

State role

State programs need to serve as the broad umbrella for effective urban runoff control. Implementation should involve state, regional (if appropriate), and local governments. The state's legal framework should allow delegation of program implementation to lower levels of government. However, experience shows that the effec-

Experience shows that the effectiveness of delegated programs depends on strong oversight and presence by the state to assure that actual program implementation is aggressively pursued at the local level and to ensure statewide consistency.

tiveness of delegated programs depends on strong oversight and presence by the state to assure that actual program implementation is aggressively pursued at the local level and to ensure state-wide consistency. Important state roles include:

- Coordinating with federal agencies, regional or local programs;
- Enacting proper legal authority through the legislative and regulatory process;
- Establishing performance standards for erosion control and runoff treatment;
- Conducting and coordinating BMP and other vital research needed to establish sound design criteria;
- Providing technical assistance and technology transfer;
- Developing and implementing public education programs, including training and certification programs for practitioners designing, constructing, inspecting, or maintaining runoff practices;
- Developing and implemented sediment and biological monitoring programs to evaluate program effectiveness;
- Establishing the legal authority allowing local governments to implement dedicate funding mechanisms such as stormwater utilities;
- Overseeing delegation of program components to regional or local entities to assure consistency between programs at the regional or local level.

Regional Role

The need for and existence of regional authorities will depend on many factors including the size of a state, responses to past water resource management problems, and impetus for water resources management programs. Defining an appropriate role for regional authorities is difficult because their purpose and nature varies greatly. However, regional authorities often share many of the responsibilities of states. They also provide an effective link between a region's cities and counties, and also they can enhance communication between the state, counties, and cities.

One benefit of regional water authorities, as seen from Florida's water management districts and the Puget Sound Program, is the establishment of programs that are based on watershed boundaries instead of political ones. This allows a more comprehensive approach to protecting and restoring water bodies by assuring inclusion of all governmental entities within the watershed. Regional authorities, in cooperation with local governments and citizens, can take the lead in developing watershed management

Regional Authorities often share many responsibilities of states, but can often enhance communication between the state, counties, and cities.

plans. They can target and prioritize watersheds, allowing watershed plans and goals to be developed systematically. Stormwater pollutant load reduction goals developed as part of the watershed plan can become part of a TMDL, provided there is close cooperation with state agencies. Regional authorities also can play an important role in the development of watershed-wide runoff management plans, especially coordinating the stormwater master planning efforts of local governments within a watershed.

Regional authorities also allow for the modification of state BMP design criteria to address special concerns such as ground water protection, or to address differences in characteristics such as soil types, geology, topography, or water table conditions. All of these greatly influence the appropriateness and performance of specific BMPs. Regional agencies also can conduct or coordinate the research necessary to develop the regional specific design criteria.

Regional agencies are very appropriate for providing technical assistance to local governments. Two of the regional authorities, the Northeastern Illinois Planning Commission and the Puget Sound Authority, developed urban runoff control design manuals for use by local governments. Coordinating the development and implementation of public education programs, and training programs for stormwater system designers and builders, is another role often undertaken by regional authorities.

Traditionally, many regional water authorities have been created as flood control agencies. Examples of this include the Urban Drainage and Flood Control District of Denver and the South Florida Water Management District, both of which were established to address flooding that crossed jurisdictional boundaries. However, as the water pollution aspects of urban runoff became known, their programs evolved into more comprehensive water resource management programs that also address runoff quality.

Cities and Counties

Local governments must be one of the lead entities in any successful runoff program. Local governments typically make land use and development decisions which create urban runoff problems and the need for stormwater infrastructure. At the local level, the erosion, sediment and runoff control program can be integrated with other critical local programs such as land use planning, floodplain management, wetlands protection, tree protection, open space and recreation, transportation, and wastewater

Regional water authorities also can play an important role in the development of watershed-wide runoff management plans, especially coordinating the stormwater master planning efforts of local governments within a watershed.

Local programs should focus first on developing and implementing stormwater master plans which are consistent with future land use plans and regional watershed plans, inspections during and after construction, illicit connections, operation and maintenance, and getting dedicated funding sources.

management. This promotes use of nonstructural management practices which can help to prevent and minimize urban runoff problems.

The city and county role should focus first on:

- Developing and implementing local stormwater master plans which are consistent with local future land use plans and with regional or state watershed plans;
- Conducting inspections both during and after construction;
- Implementing dedicated funding sources, like stormwater utilities;
- Identifying and removing illicit connections;
- Conducting operation and maintenance activities.

Once these program components have been successfully implemented, local programs, like state programs, can evolve to include additional activities. Public education programs should be one of the earliest program additions. They are essential in selling the concept of a stormwater utility fee. Cities and counties where program implementation efforts have gone far beyond the minimum components above provide an example of what can be done if there is local recognition of the importance of proper erosion, sediment, and stormwater management and support for urban runoff program implementation.

Local governments can be essential in assuring inspections and compliance. They typically have inspectors onsite several times during the construction process. Although linking the urban runoff program inspections to other permit inspection requirements may seem to maximize benefits, there must be a dedicated staff for inspection and enforcement of erosion, sediment and urban runoff controls. Using building or grading inspectors to assure compliance with controls may be fine on small sites, but larger sites are more complicated in terms of types of practices and phasing of their implementation. These sites need inspection by individuals who are specially trained in the design, construction, and operation/maintenance of erosion and sediment controls and urban runoff BMPs, and whose primary function is urban runoff control inspection. Secondly, assuming that existing staff can assume responsibility for another program, in addition to their current responsibilities, just does not work. Experience has shown that these individuals always will have a primary responsibility, such as final inspections for occupancy of a house or structure. Consequently, less emphasis is placed on erosion, sediment, and urban runoff control.

Local governments also can play important roles in the erosion, sediment and stormwater permitting and enforcement process. Delegation of permitting to local governments should be done with caution and close oversight. Experience has shown that as the permitting process moves from the state to the local level, permitting decisions can be more easily influenced by nontechnical factors. At the local level, the issuance of building or grading permits can be linked to the issuance of erosion, sediment, and stormwater permits, helping to assure that control practices are installed before land clearing begins. Additionally, other local approvals (i.e., occupancy certificate) can be leveraged in the event that enforcement action is necessary.

2. Should the erosion and sediment control and urban runoff management programs be integrated?

Integration of erosion and sediment control and stormwater management components greatly enhances the environmental and cost-effectiveness of the program. Urban runoff management programs should be viewed as a broad umbrella encompassing the prevention and management of runoff both during and after construction or land disturbance. The importance of program integration is well recognized, with the majority of programs reviewed having integrated erosion/sediment control and urban runoff management. Staff in two of the ten jurisdictions with separate programs opined that they should have integrated programs.

Program integration helps consolidate and coordinate permitting and design requirements, and plan review. Site requirements and design criteria for erosion/sediment controls and urban runoff controls also can be better coordinated and more consistent with an integrated program. For example, site control requirements such as the design volume of a sediment basin should be consistent with the design volume for the urban runoff management basin. This allows the sediment basin, when the site is finally stabilized, to be converted to provide permanent urban runoff treatment and management. Program integration can help to achieve highly desired multiple benefits, avoid duplicative review processes, and can reduce overall program administration and construction costs.

Program integration also greatly enhances inspection and proper operation of control practices, an area of program weakness in nearly every program reviewed. Construction inspection can be done by one inspector instead of two, an important consideration

Integrating erosion/sediment control with stormwater management can help to achieve highly desired multiple benefits, avoid duplicative review processes, and reduce overall administrative and construction costs.

Integration of erosion and sediment control and urban runoff management programs is strongly recommended.

Urban runoff management needs to be viewed as a continuum.

since trained erosion, sediment, and runoff control inspectors are not abundant. Integrated inspections help to assure that sediment control basins are not converted to urban runoff facilities prior to final site stabilization. Linking the two programs also provides implementing agencies additional enforcement tools, helping to improve site compliance.

In summary, integration of erosion and sediment control and urban runoff management programs is strongly recommended. Urban runoff management needs to be viewed as a continuum. Programs must address the adverse impacts of urban development from initiation of site disturbance, through the development process (erosion and sediment control, temporary urban runoff control), to completion of construction and final site stabilization, and finally to maintenance and operation of BMPs after completion of site development (urban runoff control).

3. Program Goals

To maximize their cost-effectiveness and to gain broad public support, urban runoff programs should be multifaceted, establishing goals to address the important runoff related problems within the jurisdiction. Program goals should be based on problems which are clearly recognized as being important and interrelated by the general public and elected officials at the implementation level.

Examples of related goals which can be addressed as a component of an overall urban runoff management program include:

- water quality
- flood control
- ground water protection
- channel erosion
- habitat protection
- fisheries protection
- resource protection
- wetlands protection

It is not necessary for all of these to be goals of an urban runoff program, but they are closely related and generally best managed through an integrated program. An urban runoff control program can be a component of a broader, more comprehensive resource protection program.

The absolute worst reason to implement a program is only because it is required by others. It is very difficult to gain local sup-

port for a program where the jurisdiction does not have ownership of the program. However, it must be recognized that many urban runoff control programs would not exist if not for federal or state requirements. The federal or state requirement must be turned into a local priority, by addressing problems of local importance, if funding and staff support is to be provided. Of the 32 programs reviewed, 37% indicate that a partial reason for program implementation is because it is required by others. However, many of these programs also developed in response to local needs as opposed to only responding to requirements imposed by some other entity.

The bottom line is there must be local ownership of the program if it is going to be effective. Individuals charged with establishing an urban runoff program must educate local officials and the general public about the benefits that the program will provide for their community.

STORMWATER MANAGEMENT

1. Basic goals and performance standards

The basic intent of these programs should be stated in terms of protection: protection of public health and well-being; protection of aquatic or natural resources; protection of property. Public support is more likely if the general public clearly understands that urban runoff control personally benefits them, either through protection of their lives, homes, property, aquatic resources, or quality of life. The goals of an effective urban runoff control program should include flood protection and water quality protection as a minimum, with other goals such as aquifer recharge, habitat or fisheries protection included when appropriate. A program which addresses several urban runoff related problems will have more supporters, especially when local benefits can be observed. One problem that often arises in large watershed programs (i.e., Chesapeake Bay Program) is a lack of political commitment by those jurisdictions that don't perceive a personal benefit from their expenditures. Land owners and local governments in the upper parts of the watershed need to understand why it is important for them to be part of the solution.

Ideally, a program's basic performance standard should be to assure, for all new construction or redevelopment, that the post-development runoff peak discharge rate, volume, and pollutant loading do not exceed pre-development levels. Implementation of this approach might require onsite runoff treatment for all

Public support is more likely if the general public clearly understands that urban runoff control personally benefits them, either through protection of their lives, homes, property, aquatic resources or quality of life.

The basic performance standard should be to assure that post-development peak discharge rate, volume, and pollutant loading doesn't exceed pre-development levels.

projects, with runoff quantity control requirements depending on factors such as project size, impervious area, or location within a watershed.

Maintaining pre-development or historical peak discharge rates has been the primary performance standard of most stormwater quantity control programs. Factors that must be analyzed in setting this standard include the design storm (return frequency and duration), downstream conveyance capacities, and stormwater master plan considerations. In recent years, programs have used more than one design storm, one for flood protection (25-yr, 24-hr) and the other to minimize channel erosion (2-yr, 24-hr). A new concept is the "critical duration storm" which is defined as the storm creating the greatest change in pre-development and post-development conditions. This design storm is used by the Suwannee River Water Management District (Florida).

Traditionally, few urban runoff programs have included goals or performance standards for runoff volume. However, the importance of volume in runoff management is becoming more recognized. Volume control can greatly increase flood control, especially in closed basins; help recharge aquifers and maintain stream baseflow; minimize stream channel erosion and habitat loss; and protect water quality by reducing loadings and by reducing excessive freshwater flows, especially into estuaries where salinity regimes can be adversely altered by urbanization.

Unfortunately, most of the currently used urban stormwater treatment practices can't achieve the goal of reducing post-development pollutant loadings to pre-development levels. A more realistic runoff quality goal is to reduce post-development total suspended solids loadings by 80%, as measured on an average annual basis. This goal is the basis for the urban runoff treatment programs in Florida and Delaware.

2. Design Criteria for Runoff BMPs

The program's goals and performance standards will greatly influence which practices are used to achieve compliance. If volume control is a program goal, then practices which infiltrate or reuse runoff will be relied upon. If peak discharge rate control is the goal, then detention facilities, which are more capable than other practices in temporarily holding large quantities of runoff, will be favored. Of course, the "BMP Train" approach in which several practices, appropriate for the site, are used in combination typically is the best approach, regardless of the goal.

Considerations in establishing peak discharge design criteria typically include the design storm, runoff calculation methods, weir or control structure sizing, conveyance capacities, and downstream erosive velocities.

Establishing design criteria to achieve a specified level of runoff pollutant load reduction is much more complicated. Factors that must be analyzed, and for which local data are needed, include precipitation characteristics, including storm volume frequencies and inter-event times; pollutants of concern; runoff concentrations and loadings; existence of "first flush" effects; treatment efficiency of various practices; drawdown time; land use; drainage area; type of conveyance; and whether treatment practices will be "off-line" or "on-line". Since the design of runoff treatment practices is still in its infancy, design criteria must be periodically revisited and revised as more data about the design and effectiveness of practices becomes available.

Practices to control runoff volume are limited to either infiltration practices or reuse practices, thus limiting somewhat where volume control can be achieved. Considerations in establishing design criteria for these practices include those discussed above plus irrigation rates, area to be irrigated, and site characteristics such as soil type, depth to ground water, etc. Experience in many states has shown that infiltration practices generally can not be considered where there are:

- Silt or clay soils
- areas where water tables or bedrock are close to the surface
- steep slopes

An important concern with respect to both volume control and urban runoff treatment is to assure that there are no adverse impacts to ground water quality. Infiltration practices should be vegetated to help bind runoff pollutants in the soil, and to maintain soil permeability. Particular care is needed where soluble pollutants are prevalent, especially in highly transmissive coarse sands where their migration to ground water could occur unimpeded. Again, the BMP Treatment Train approach is crucial, especially the inclusion of nonstructural source controls which can reduce pollutants with a high migration potential.

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3. Exemptions, waivers, and variances

Ideally, all land use activities should be subject to the stormwater program's requirements. However, nearly all programs include exemptions or waivers because of limitations on program resources, and as a result of compromises or political decisions made during the development of the program. Typically, the exemptions and waivers tend to be broader than many program staff feel should be allowed. If included in a program, they should be for activities which will not seriously undermine program effectiveness.

Exemptions

The most common exemptions are for agriculture, forestry, and the construction of single family homes which are not part of a larger plan of development. The construction of single family homes, that are not part of a subdivision, usually poses little problem because of their limited individual runoff impacts. The first two exemptions may be appropriate for urban runoff management programs. However, these activities should be included in broader based programs, especially statewide runoff management programs. In Florida, the state stormwater rule exempts agricultural activities provided the land owner has a Conservation Plan and has implemented the BMPs contained in the Plan. Likewise, forestry activities are exempt provided the operations are conducted in accordance with the requirements set forth in the state's Silviculture BMP Manual.

Another common reasonable exemption is a disturbed area or impervious surface area threshold, especially for runoff quantity management. Impervious surface thresholds vary widely. They range from 5,000 square feet, which is common for exemptions to runoff quality management, to up to two acres, which is used in some runoff quantity management programs. It is recommended that thresholds for runoff quantity management be based upon local conditions and impacts (i.e., master plan considerations, location within a watershed, downstream conveyances, etc.) Runoff quality thresholds should not exceed 5,000 square feet since this size typically allows small improvements such as turn lane or parking additions. This is a small area of disturbance and makes a statement that all development must consider the urban runoff quality impacts as an essential component of site development.

Waivers

Waivers are less generic than exemptions, typically requiring

Runoff quality thresholds should not exceed 5,000 square feet.

This is a small area of disturbance and makes a statement that all development must consider the urban runoff quality impacts as an essential component of site development.

case-by-case determinations. Examples of waivers include a runoff pollution loading threshold (for a specific parameter or for several) or, for runoff quantity only, a minimum increase in peak discharge before quantity controls are necessary. For example, the Maryland Critical Areas Program establishes a maximum pre- to post-development increase in phosphorus loading. A common waiver for stormwater quantity control is for projects that do not increase the pre-development peak discharge rate for the two-year storm by more than 10%.

Stormwater quantity waivers can be separated from runoff quality waivers in that quantity controls may depend on the location of a project within a watershed. On the other hand, stormwater quality waivers are very project specific. They should be considered on a much more limited basis, especially because of the cumulative loadings of small projects.

Variations

There also must be some form of variance procedure for those situations where strict implementation of program requirements presents an unnecessary hardship or is not feasible. Flexibility must be provided to deal with those specific situations yet not weaken the program. A variance procedure could allow for an innovative practice on a site where strict adherence to existing criteria would be costly and of negligible benefit. The basis for variances must be clearly documented in a case file, providing a record to help maintain equitability. This is especially important when variances are denied, or if an applicant believes that they are being held to a higher standard.

4. Design assistance and guidance

In most areas of the country, urban runoff quality control programs are very new. Practitioners have little experience in developing and implementing programs, designing or constructing BMPs, or inspecting or maintaining runoff systems to reduce pollutants. It is essential that design assistance and guidance be given to those implementing the program, and to those being regulated by the program. Training on the design, construction, operation, and maintenance of runoff quality control practices is an essential part of the much larger educational component of a successful urban runoff management program.

Regular educational programs on the design, construction, and maintenance of runoff controls are essential. This helps assure

Training on the design, construction, operation, and maintenance of runoff quality control practices is an essential part of the much larger educational component of a successful urban runoff management program.

A design document, which includes appropriate plan requirements and material specifications helps assure a consistent policy across political boundaries reducing possible inequities. It also helps designers and contractors properly design and build BMPs.

that individuals remain current with the rapid changes in information on the design and performance of practices. It also provides opportunities for training the large influx of new personnel each year in the design and construction industry, and in the rapidly growing field of urban runoff management. Education programs help individuals have a good understanding of their roles and responsibilities. This is crucial to effective program implementation.

Common design aids include comprehensive BMP design handbooks such as the *Florida Development Manual: A Guide to Sound Land and Water Management* and the Washington Department of Ecology's *Stormwater Management Manual for the Puget Sound Basin*. Many of the programs reviewed for this handbook have developed excellent design handbooks. Another approach is the use of individual documents for each BMP such as Maryland's "Infiltration Standards and Specifications" and "Constructed Wetlands". While distributed as separate documents, they represent a comprehensive approach to design guidance when considered together.

The format of these design aids is not as important as their availability. Development of BMP manuals is very challenging technically and often very expensive. This is one reason why state or regional agencies usually take the lead in their preparation. Preparing BMP manuals requires close cooperation among state, regional, and local agencies along with the engineering and development communities. Universities often are involved, especially in testing BMP designs to assure they achieve the desired level of treatment. This approach helps assure that the final document is comprehensive and accurate, with widespread applicability. Having a design document, which includes appropriate plan content requirements and material specifications, that is accepted across political boundaries, assists designers in becoming proficient in accepted design, and also assists in proper implementation by contractors. Having a consistent policy also reduces possible inequities by assuring that land developers in one jurisdiction do not have additional economic burdens that do not exist in an adjacent or nearby jurisdiction.

5. Management and source controls

It is becoming more recognized that structural treatment controls can only partially mitigate urban runoff pollutant loads. These practices can not reduce post-development pollutant loadings to pre-development levels. Structural controls can be very effective at

removal of suspended solids and the pollutants bound to them, but they are much less effective in reducing soluble pollutants. Consequently, source controls, which reduce the generation of pollutants at a site, must be used in conjunction with structural practices to fully achieve the desired goals of an effective urban runoff management program. Which source controls should be emphasized depends on the specific pollutants of concern in a given jurisdiction.

Source controls do not have to be expensive or complicated. In general, they are simple, common sense practices such as covering areas to limit exposure of materials to rainfall or runoff; recycling oils, lubricants, fuels, and antifreeze; reducing the use or amount of fertilizers or pesticides; or, routing roof runoff to pervious areas. When implemented, these practices can provide significant water quality benefits, although it is very difficult to quantify the benefits. Additionally, using source controls often can save money.

Source control guidance documents are extremely beneficial since most people are still unfamiliar with "pointless personal pollution". They still do not understand how their everyday activities affect water quality. However, preparation of guidance documents takes time and money, requiring these efforts to be prioritized. Prioritizing can be based on a widespread problem such as household hazardous waste disposal, or based on a limited specific activity which may have large environmental consequences, such as proper disposal of waste products associated with motor vehicle maintenance.

Once the source controls to be emphasized are selected, a timetable must be established to prepare guidance documents on a priority basis. Guidance must not only explain the benefits of using the source control, but also must include when, where, and how they can be used. If recycling of waste oil or hazardous wastes is a source control, then fairly accessible locations must be provided and publicized so that individuals can easily dispose of their wastes. A major consideration with respect to source control guidance is the method of delivering the information. Effective delivery mechanisms include stories in the local paper or television; newsletters or utility bill stuffings sent to the general public; articles in trade journals or trade association newsletters; and presentations at meetings of civic or trade organizations. However, experience has shown that you can not rely on a passive approach, such as making pamphlets available at various locations. There has to be a more aggressive approach which stresses in-

Source controls are an integral component of successful urban runoff programs which can not be considered short term in nature. Guidance materials are essential since most people do not understand how their everyday activities affect water quality.

teraction and repeated education.

In summary, source controls are an integral component of successful urban runoff programs. They can not be considered short term in nature.

EROSION AND SEDIMENT CONTROL

1. Basic goals and performance standards

The most common goal of jurisdictions implementing an erosion and sediment control program is protection - of public safety, water quality, or other aquatic related resources such as habitat or fisheries. A more realistic goal, as mentioned by a number of jurisdictions, is minimization, "to the extent practical", of off-site impacts. That's because even with the best designs, the process of site development with its associated earth disturbance, can still create adverse downstream impacts because of the limited effectiveness of current erosion and sediment practices, especially when severe storm events exceed the design storm for these practices. The intent of erosion and sediment control programs should be to minimize the potential for off-site impacts by reducing the areal extent and time duration of impacts.

In defining how a program can minimize impacts, a dual strategy is recommended. The program should seek first to prevent erosion and then seek to reduce the associated sedimentation. Prevention practices include sequencing construction to reduce areas of disturbance, conducting land disturbance during the dry season, establishing limits on areas of disturbance during the wet season, and timely stabilization (temporary or permanent) of disturbed areas. Reduction of impacts would follow using traditional erosion and sediment control practices such as stabilized construction entrances, silt fences, diversion dikes, sediment traps and basins. Reduction practices are most effective at removing coarser sediments, while preventive practices are more effective at removing silt or clay particles by preventing their initial movement.

In summary, a basic goal of erosion and sediment control programs should be to minimize off-site impacts by following a philosophy of first preventing erosion and then maximizing control of sedimentation onsite.

Once the program's goal is determined, it is necessary to establish an achievable performance standard which will form the ba-

A basic goal of erosion and sediment control programs should be to minimize off-site impacts by following a philosophy of first preventing erosion and then maximizing control of sedimentation onsite.

sis for the development of design criteria for the various erosion and sediment control practices to be used. Performance standards can be either technology based or water quality based. Technology based standards are the most common. They typically are related to a reduction in the level of suspended solids (e.g. 80%) leaving a site, or may be expressed in terms of retaining sediment onsite. The former standard is appropriate because there is a good understanding of the processes involved in the reduction of suspended solids. The latter performance standard addresses potential adverse impacts beyond water quality such as public safety concerns associated with tracking sediments onto public streets or sediment clogging of runoff conveyances which can increase flooding. Water quality based standards often are a "backstop" since most environmental laws prohibit violations of water quality standards. A common water quality based standard is that discharges may not increase turbidity, measured in NTU, above background conditions by more than a specified amount. A common problem with this approach is the issue of compounding sources of sediment, possibly from other sites under construction, which may hinder enforcement of a specific site.

2. Design Criteria

Once a performance standard has been established, then design criteria need to be developed for the individual erosion and sediment controls. By providing both performance standards and design criteria, site planners and engineers can select those practices which will work best on a given site because of its specific soils, topography, slopes, geology, and hydrology characteristics. Design criteria need to be specified for both prevention and reduction practices.

Specific design criteria should be included for at least two prevention practices. First, a maximum area of disturbance at any one time should be specified, with a variance provision for specific activities which cannot meet that limitation such as highway interchange construction. Second, a maximum time frame for either temporary or permanent site stabilization upon cessation of grading needs to be set. Delaware's program limits site disturbance at any one time to a maximum of 20 acres and requires site stabilization within 14 days when an area is not being actively worked. The specific design criteria for prevention practices will depend largely on local rainfall patterns and associated runoff characteristics. If there is a defined seasonality to the rainfall, the criteria may be primarily directed towards activities conducted during the wetter seasons. This approach is used by the Puget Sound

Many of the structural practices, except for storage volumes of sediment traps or basins, tend to have universal design criteria.

Vegetative practices must include local considerations such as the types of plant materials and how they are best established and maintained.

Water Quality Management Program which establishes seasonal limits on disturbed area.

Design criteria for reduction practices often are based on sizing criteria, either in terms of contributing drainage area or storage volume or both. Most programs establish a minimum size for sediment traps and basins, such as 1,800 cubic feet per acre of drainage area. This volume figure was developed years ago by the Natural Resources Conservation Service (then the Soil Conservation Service) to achieve a 70% reduction in suspended solids on a Piedmont hydrologic soil group C soil. The volume was then placed in design criteria as a minimum standard for site design.

BMP design criteria typically are based on a design storm. It is essential that long term rainfall records be analyzed to determine the appropriate design storm.

It must be recognized that the sizing of these practices is based on a design storm having a specified return interval, such as the two- year, 24-hour storm. Therefore, it is essential that long term rainfall records be analyzed to determine the appropriate design storm. The selected design storm should be one which occurs on a frequent basis, and for which the probability of exceedance is relatively low. Control practices will not achieve the desired level of performance for those storms which exceed the "design storm". The final selection of the design storm must balance performance and costs. Establishing a very stringent standard may be desirable from a resource protection standpoint, but may create costs that the regulated public considers excessive. Essentially, selection of the design storm depends on the level of risk associated with the probability that storms will occur which exceed the design storm. Most standards established around the country recognize that the implementation of site controls may still allow adverse downstream impacts when larger storms occur.

3. Exemptions and waivers

If the erosion and sediment control program is integrated with the stormwater management program, the exemptions and waivers should be consistent, but not necessarily identical. There are activities which, due to their limited size, should not be required to provide permanent stormwater management, but which should be required to implement erosion and sediment control. An example, is single family home construction that is not part of a larger development.

The most common and simplest approach for establishing exemptions and waivers is based on the amount of disturbed area. This approach is easily implemented since determining the amount of disturbed area is simple. The size of the disturbed area for an

exempt activity will depend to some extent on local conditions such as rainfall patterns, soil types, and topography. It is recommended that the threshold size of disturbance be relatively small, such as 5,000 square feet. This emphasizes that erosion and sediment control are integral components of site development. It also helps to minimize potential cumulative impacts if many construction projects are on-going within a watershed.

There also has to be some flexibility for unforeseen types of activities for which preconstruction review and approval would be an undue hardship and not be in the best public interest. These activities typically are of an emergency nature, such as those required after an extreme storm event which creates situations needing an immediate response. Such activities must still implement erosion and sediment controls, but implementation should be based on requirements defined onsite. Alternatively, a special process can be established which calls for submission and review of plans within an appropriate time frame.

4. Design Assistance and Guidance

To maximize program effectiveness and the proper use, design, construction, and maintenance of erosion and sediment controls, it is essential to have a design guidance document available for designers, developers, and contractors. It is not difficult to develop such a document, as most areas of the country already have one in use. To a large extent, the manuals are very similar to one another. For each practice, the design manual should specify the purpose, applicability in different site situations, sizing, materials, construction standards, maintenance needs, and operational information. The manual must include both structural and vegetative practices. Many of the structural practices, except for storage volumes of sediment traps or basins, tend to have universal design criteria. Vegetative practices must include local considerations such as the types of plant materials and how they are best established and maintained

PROGRAM IMPLEMENTATION ISSUES

State programs are limited in their ability to obtain resources, being dependent upon uncertain annual legislative general appropriations. Therefore, an approach used in several state programs is the concept of "delegation of authority", with the permitting program delegated to a lower level of government. This is similar to the historic delegation of authority that EPA has used in the NPDES program. However, EPA only delegates this program to states

The threshold size of disturbance should be relatively small.

This emphasizes that erosion and sediment control are integral components of site development and helps to minimize potential cumulative impacts if many construction projects are on-going within a watershed.

Delegation, as a program component, depends on oversight and a strong presence by the state. This assures a minimum level of program implementation and assures state-wide consistency.

and prohibits further delegation to lower levels of government. State programs which use delegation generally allow the lower level of government an option of accepting delegation of the program, with implementation done by the state if the regional or local government chooses not to do so. The effectiveness of this approach depends on oversight and a strong presence by the state. This assures that actual program implementation is aggressively pursued at the local level. It also assures statewide consistency.

Delegation can create several problems including a lack of statewide consistency and potential conflicts between the state and the delegated agency. These issues can be minimized by:

1. Specifying a maximum time frame for which delegation is granted and having the state conduct a periodic review of performance by the implementing agency. The delegation review should have a defined process which clearly specifies which program elements will be reviewed, and establishes the minimum standards for evaluation of program performance.
2. Specifying a permitting appeals process. It is important that the state not undermine the authority of the delegated agency. It is common to have an individual attempt to get conflicting guidance from the state agency when the delegated agency makes a decision with which the individual does not agree. The state statutes or regulations should specify an appeals process applicable for a delegated program, as well as for the state program.

Maryland's state erosion and sediment control law, passed in 1970, directs local governments to implement a local erosion and sediment control program. Initially, the program was somewhat effective. By the early 1980's its effectiveness declined, especially in terms of field implementation of required practices. In 1984, the State of Maryland enacted a number of legislative packages to improve ongoing efforts to protect Chesapeake Bay. One initiative was related to delegation of enforcement authority for erosion and sediment control. It requires the State to set a minimum standard of implementation for delegated enforcement of erosion and sediment control programs. If local governments can not achieve the specified rate of site inspection and compliance, the State assumes responsibility. Consequently, in those jurisdictions where inspection and enforcement is a local priority, they improved their erosion and sediment control site inspection program

to meet State requirements. Jurisdictions with no interest in the program could stop their inspection and enforcement efforts and let the State assume responsibility. The State budgeted additional site inspection staff to assume local inspection responsibility where needed. Field implementation of the erosion and sediment control program improved dramatically. In this example, delegation of authority worked, primarily because the State accepted the responsibility and committed additional budgetary resources to provide inspection staff where they were needed. Without this commitment of additional resources, delegation will not work and overall program effectiveness will suffer.

In 1990, Delaware's program expanded the delegation concept to include all aspects of implementing its integrated erosion, sediment, and stormwater control program. These two program components are linked, so delegation of authority for erosion and sediment control also includes stormwater management. Delegated program elements include:

- plan review of new projects
- inspection during construction
- maintenance inspections of completed stormwater management structures
- education and training

This approach has worked well because the critical delegation issues were addressed in program design. Delegation is for a finite time period - a maximum of three years. To continue as a delegated program, a local government must apply and be granted approval after state review. The three year delegation period allows the state program to conduct a formal review of program element implementation. Implementation of recommended program improvements are more likely to be implemented with regular recertifications. Between formal evaluations, state program staff must interact informally with local or regional staff to ensure that any areas of concern, which could affect redelegation, are addressed informally, not in public forums. This approach will reduce the potential for adversarial state-local relationships. Communication, cooperation, and coordination are keys to successful use of delegated programs.

1. Project permitting procedures

The foundation for program implementation is the process for review and approval of proposed activities. This review should be comprehensive, considering all potential adverse impacts. Unfor-

To minimize delegation problems, there must be a finite time period, followed by a review of program implementation performance, and a redelegation if warranted. An appeals process also is essential.

The earlier in the design process that stormwater management requirements are considered, the more likely that the final design will meet program requirements and be approved expeditiously.

Unfortunately, staff resources in many jurisdictions are inadequate to review all projects for erosion and sediment control and stormwater management. Consequently, day to day implementation usually involves a hierarchy of permitting and review processes.

The review process should include a conceptual approval or pre-construction conference phase. This helps reduce potential problems such as the siting of stormwater facilities or assuring that sufficient space is set aside for these facilities in the design plan. The earlier in the design process that stormwater management requirements are considered, the more likely that the final design will meet program requirements and be approved expeditiously. This early coordination also can help to assure integration of the stormwater management system into a project's open space and landscaping, thereby providing aesthetic benefits and even recreational opportunities.

The permitting and review hierarchy typically consists of some mixture of individual permits, general permits, and/or noticed exemptions. There should be a relationship between the complexity of the review process and the potential for adverse impacts. Projects with lower potential for adverse effects, typically smaller projects or those located far from water bodies, should have simpler requirements and reviews. As projects grow larger or have more potential to create problems, the review process should get more complex. Required submittals will vary but may include application forms, general and technical information, design plans and supporting calculations, and possibly professional engineering certification.

Individual permits usually are reserved for larger projects, those with a high potential for adverse impacts, those with wetlands onsite, or those located near water bodies. Individual permits also are used when new or experimental technologies or practices are proposed. The review process is more detailed and comprehensive, involving submission and checking of computations (sometimes using models), specifications, site plans, and even bid documents. A comprehensive review ensures that the area and location needed for required site controls is available, that the proposed controls are the most appropriate for the situation, and that the contractor bidding on the job is aware of the obligations and costs associated with project construction and permit compliance.

Another consideration in this approach is how to meet the obligations of inspection and enforcement. Review of the urban runoff

programs reveals that inspection staff resources will not be adequate to inspect all active projects. Establishing a prioritizing method for these tasks is essential. Inspection should be performed on all projects permitted individually. For projects with general permits, inspections should target sites with a higher potential for off-site impacts. Projects with noticed exemptions should be effectively handled in most situations through interaction between the project engineer and the developer or between an inspector and the developer. All projects should have regular onsite inspections by the site contractor, engineer, or developer, with inspection records kept at the site.

In summary, individual project permitting is recommended, to the extent that resources allow effective implementation. General permits and noticed exemptions can be used for activities with a lower potential for creating problems.

2. Use of plan review checklists

Checklists provide the erosion, sediment, and stormwater control plan designer and plan reviewer with a concise guide to minimum design and submission requirements. The checklist should be given out to consultants and all applicants. Submittal of a completed checklist should be required by the plan review agency to ensure that the designer has gone through each item and included it as part of the submittal. If an item is not included, there should be a narrative description of why it isn't.

Plan review checklists also promote consistency between reviews. They provide the plan reviewer, especially if fairly new in the position, with guidance on what information the agency considers essential in plan submittals. The development of the checklist should be based on a review of ordinances, regulations, and design handbooks. It can even detail the scale of plans, components of a design narrative, the format for narrative descriptions or computations, or any other items which may seem trivial, but which may save a significant amount of time in the review process. Time is money when plan review is being done. Reducing the review time for individual projects allows for more reviews in a given time frame and reduces backlog.

3. Linkage with other approvals

It is recommended that approval of erosion/sediment control and stormwater management computations and plans be linked to other common approval processes. This can help assure that land clear-

Submittal of a completed checklist should be required by the plan review agency to ensure that the designer has gone through each item and included it as part of the submittal.

Stormwater design and approval should be coordinated with wetland and floodplain protection programs, especially since these natural systems are an integral part of a watershed's natural runoff management system.

ing or construction is not initiated without the necessary urban runoff control approvals. Based on the questionnaire, building and grading permits are the most common approvals linked to erosion, sediment, and stormwater control. At a minimum, these related permit approval processes should be linked, with erosion, sediment, and stormwater management approval needed before issuance of building or grading permits. Generally, this can be implemented fairly simply. For example, the building permit office can have a box for erosion, sediment, and stormwater control on their master form which must be checked off prior to the issuance of the building permit. This approach is similar to that used in many jurisdictions to coordinate building permits with other associated concerns such as fire protection, sanitary facilities, structural, electrical, or plumbing.

Besides building or grading permits, there are a several other areas to which stormwater management approvals can be linked. This can help facilitate meeting requirements of other related programs. Having stormwater management considered during the zoning approval process helps assure compatibility with a master stormwater management plan. Linking stormwater management to site review, and to tree protection, landscaping, and open space requirements, provides better opportunities to coordinate these considerations into an integrated site design. This also helps to minimize any potential conflicts that may arise in siting buildings, roads, stormwater facilities, and other parts of a project, all of which require space and land. Stormwater design and approval should be coordinated with wetland and floodplain protection programs, especially since these natural systems are an integral part of a watershed's natural runoff management system. Wastewater management is another area that should be linked to stormwater management, especially where onsite wastewater systems will be used.

4. Inspection procedures

Inspection must be conducted both during and after construction is completed. Both inspections are essential components of an urban runoff control program. It is recommended that a public agency be responsible for both inspections. Site developers, contractors, or property owners also should be responsible for making inspections, especially after each rain. Inspection records, on a form provided by the lead program agency, should be kept at the site for review by agency inspectors. Unfortunately, the review of the programs indicates that inspection staff resources usually are too few to assure compliance. Creativity is essential.

Inspection During Construction

During construction, inspections need to be made of both erosion and sediment controls and stormwater management facilities. Erosion and sediment controls must be inspected periodically throughout the construction process, especially after storms. Stormwater management systems need to be inspected at critical times during construction of the individual practices.

Inspection frequency needs to be flexible, corresponding to shifts in the intensity of activity going on at the site. When active construction is occurring, erosion and sediment control inspections should be conducted on a specified, appropriate frequency. When work on the site stops temporarily, inspections should be done periodically to assure that erosion and sediment controls are being maintained and still working, and to ensure that work has not resumed. Ideally, inspections should be done at a specified regular time interval and after significant storm events. This allows any changes in site conditions to be observed, and ensure that erosion and sediment controls are still functioning as designed and approved. It is recommended that inspections be conducted by a public agency person at least once every two weeks. This is the most common frequency of inspection used by the reviewed programs.

Inspection staff resources typically are insufficient to visit all active construction sites. An implementation strategy decision must be made whether to visit fewer sites and completely follow the inspection procedures, or to conduct less comprehensive inspections at more sites. It is recommended that the inspection procedures be followed completely at sites which are inspected. Inspections need to be prioritized based on potential impacts, helping to assure compliance on tougher sites. Following the prescribed procedures also is important should legal enforcement actions become necessary.

Inspectors should always attempt to contact an individual onsite who is responsible for the site grading activities. The contractor should be aware that the inspector is visiting the site even if the contractor does not accompany the inspector. This improves the dialogue that is so important between the inspector and contractor. Highly visible inspections reinforces the commitment and importance a jurisdiction places on effective implementation of site controls. By knowing that the site will be inspected periodically, contractors are more likely to be aware of and meet site control

The contractor should be aware that the inspector is visiting the site, even if the contractor does not accompany the inspector.

responsibilities.

After completing the inspection, the inspector should leave an inspection report with the contractor, sending a copy to the developer and possibly the property owner. The report should serve as a site report card, clearly documenting proper installation and maintenance of site controls as well as any deficiencies in site control implementation. If there is a violation, the inspection report initiates a "paper trail" which is integral to successful enforcement actions.

It is unlikely that public agencies will ever have enough inspectors. Creating state "certified" private inspectors can reduce the frequency of public inspections and increase compliance and program effectiveness.

It is unlikely that public agencies will ever have enough inspectors, simply do to the large number of active construction projects at any time and resource limitations of urban runoff programs. A creative innovative to solve this problem is a partnership between the urban runoff program agency and the development community. This concept is being used in Delaware where the contractor or developer supplies their own inspectors. This person must attend and pass a State sponsored training course for inspectors. They are then responsible for inspecting the site at least once a week, completing an inspection form, and providing a copy of the form to the contractor, developer, and appropriate inspection agency. Having a "certified" private inspector on the site weekly can reduce the inspection frequency by the appropriate agency. The concept will be discussed in more detail later in this chapter.

To improve the effectiveness of inspections, it is important to establish standard, well-documented inspection procedures. These procedures should specify in detail the actions an inspector conducts at a site, set out options and list steps to be taken when site compliance is inadequate, and establish an appeals process, should the inspector and developer disagree on matters. The procedures need to be developed in conjunction with available legal authorities and penalty provisions.

Inspection of the stormwater management system during construction typically is not done on a regular schedule, but at certain stages of practice construction. For each type of BMP, there are certain stages of construction where inspection is essential to assure proper construction and performance. For example, practices with an impoundment should be inspected during placement of core trenches, riser and barrel assemblies, and anti-seep devices. BMP manuals should include recommendations on when inspections should be conducted during the construction of each type of practice. By having a presence onsite at critical times during the construction of stormwater management practices, com-

mon problems such as not connecting concrete barrels to corrugated pipe risers or omitting watertight bands around barrel sections can be prevented. Many contractors are unfamiliar with proper construction of stormwater management practices. The contractors' lack of awareness or priority for construction of stormwater management practices can cause problems which impairs long-term function and performance. Inspections at critical times help assure that important details, like watertight bands, are not missed.

Post-construction Inspection

Periodic maintenance inspections are essential to assure continued functioning of stormwater management practices, especially treatment practices. While they need to be conducted on a regular basis, the optimal frequency depends on the type of practice. Infiltration and filtration practices may need to be inspected semi-annually or even more frequently. Wet detention systems may only need inspections annually, or after extreme storm events. Maintenance inspections of stormwater management systems are discussed in greater detail later in this chapter.

5. Inspection agency relationship to review agency

Whether inspections are conducted by the plan review agency or by another agency may not matter with respect to effective program implementation. What is essential, if two agencies are involved, is effective communication and a close relationship between them. Otherwise, program effectiveness can be greatly diminished. Too often, rivalries or friction develops among agencies involved in urban runoff program implementation. These are known to cause problems and weaken program effectiveness. Avoid them if you can. Communicate.

It is recommended that inspections be conducted by the plan review agency. This eliminates any potential rivalry between agencies, and facilitates communication, coordination, and cooperation between the plan reviewers and the inspectors. The working relationship between plan reviewers and inspectors can be further strengthened by locating their offices nearby. Close proximity greatly enhances staff level communication. Collaboration between the inspector and plan reviewer can facilitate needed changes to the approved plan and practices, better solve problems on specific sites, and increases knowledge and recognition of which land development activities require more careful review and approval. On projects where an innovative approach to site

Stormwater practices need inspection during and after construction. Having a presence on-site at critical construction times helps avoid problems.

Maintenance inspections are essential to assure continued functioning of stormwater management practices, especially treatment practices.

The three most common funding mechanisms are general appropriations, permit fees, and dedicated revenues, such as a stormwater utility fee.

control is being considered, the inspector can be more easily involved in planning and selecting the controls, then provide a feedback loop to plan reviewers as construction occurs and performance is evaluated, at least qualitatively. An example of this process is the involvement of the inspector before approval of an innovative sand filter system where the concrete structure is prefabricated and delivered onsite in sections. Having the inspector closely involved in the approval process allows for discussion of potential field issues such as sealing the units together. Once the precast filter system is installed and monitored for performance, guidance eventually can be provided to the design community making future applications of the filter easier.

PROGRAM FUNDING

It is recommended that funding for erosion and sediment control and stormwater management programs be integrated, like the programs themselves. The three most common funding mechanisms are general appropriations, permit fees, and dedicated revenues, such as a stormwater utility fee. Each of these approaches has its own advantages and limitations. They will be discussed individually. Most programs rely upon some combination of all three approaches to provide optimal funding levels.

General appropriations

General appropriations are the traditional way of funding most government programs and services. The strongest advantage of general funding is their stability during times when land development activities are reduced. General appropriations are a demonstration of political support and public commitment for the urban runoff control program. A major disadvantage of general appropriations is the severe competition for limited funds. At either the state or local level, there are many programs important to assuring the public's health, safety, and welfare. Elected officials must make difficult decisions about spending priorities, especially with increasing resistance to higher sales, property, or income taxes, the major source of general appropriation funds. Once police, fire, emergency medical, and other critical programs have been funded, often there is little left for public works or urban runoff management programs. The budgets of these programs are among the first to be reduced when jurisdiction finances become restricted. Unfortunately, it seldom rains or floods at budget time, which makes it difficult to break the "hydro-illogical cycle". However, general funds are an excellent funding source to get programs started. Over time, the program's funding needs to be

HYDRO-ILLOGICAL CYCLE



allowed to evolve to include other funding sources in the future, especially dedicated ones.

Permit fees

This method is the most common funding mechanism used by the reviewed urban runoff management programs. In fact, permit fees totally fund 12% of these programs. Permit fees are relatively easy to get approved. They don't represent a tax on the general public, and they place the cost on those who create the need for the services. While paid by the developer, the costs are transferred to eventual property owners. One issue that must be addressed is determining what proportion of the program's costs should be paid by permit fees. Many believe that the entire costs of the program should be borne by those creating the need for the service. This is seldom accomplished. In recent years, as program budgets have been cut, many programs have increased the proportion of program costs recovered by permit fees. This is creating increased controversy as the regulated community begins to object to the costs of higher permit fees.

Permit fees can pose a financial problem for developers. They are assessed during the permit review and approval process, before construction funding is available from financial institutions. A better way of implementing fees is to assess a plan review fee prior to project approval, and an inspection fee during construction when the developer has additional funding available. Payment of inspection fees can be assured by making it a condition for the approval of occupancy permits. This approach does not reduce permit fees but partially defers payment until construction is underway. This demonstrates an awareness of, and sensitivity to, developers' cash flow.

A major disadvantage of funding programs through permit fees is their direct dependence on the level of growth occurring at any one time. During the reduction of land development in the mid-Atlantic region in the early 1990's, many programs could not be adequately funded by permit fees. In these situations, trained staff had to be released, diminishing program effectiveness. Permit and inspection fees are important parts of the funding formula, but they cannot be relied upon totally to fund urban runoff management programs.

A variation of the permit fee approach, commonly used by small jurisdictions, is the use of a private consultant to conduct plan reviews, construction inspections, and stormwater system main-

A major disadvantage of funding programs through permit fees is their direct dependence on the level of growth occurring at any one time.

A potential problem with permit fees is their imposition on other government agencies. A program funded by permit fees must collect those fees from all applicants, including government agencies.

tenance inspections. In this scenario, the consultant bills the developer for time spent on project review. Every time an inspection is performed, the developer is billed for services rendered. Maintenance inspections of runoff practices are billed to the jurisdiction or to the responsible maintenance entity as they are conducted. This approach has worked well where it has been used, and represents a small cost to the jurisdiction itself for program implementation.

The cost of permit fees can be based on several criteria, depending on which provide the most equity, and are most easily understood by the regulated public and elected officials. Fees can be assessed on the basis of area, either of disturbance or impervious area. They can be based on the type of development, with a flat fee for residential development and a higher fee level for commercial development. Fee structures also have been implemented which includes different tiers, where a certain amount of development is assessed a set fee, with a higher rate for additional area or units.

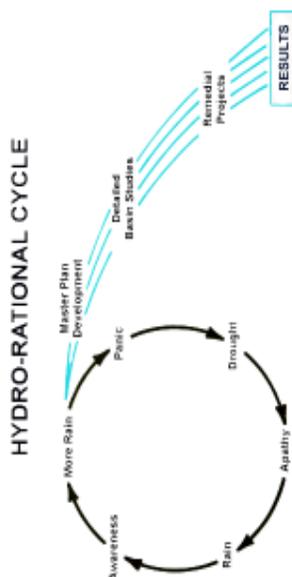
Another potential problem with permit fees is their imposition on other government agencies or for projects performed by the permitting agency. If the program is funded primarily from fees, then they must be collected for all projects, without consideration of the applicant.

Diversion of permit fees from the urban runoff control program is another potential problem. Fees may go into an overall agency budget and not be returned to the urban runoff control program in the same proportion as collected. In these situations, fees can not provide adequate funding support for effective program implementation.

Dedicated Funding Sources

This approach is often seen as the optimal approach for program implementation because it provides a stable, dedicated source of revenue for the program. This helps to break the 'hydro-illogical cycle' and allows the "hydro-rational cycle" to move forward.

A major benefit of dedicated funding sources, such as a stormwater utility fee, is that, once established, they are not subject to the annual budget considerations of general appropriations. Since stormwater utility fees must be related to the cost of providing benefits, funds are less likely to be diverted to non-stormwater program activities. A major advantage of stormwater utility fees,



in comparison to permit fees, is they can provide funding for maintenance inspections after construction is completed. Maintenance inspections of stormwater systems will be necessary for the life of the development. Funding has to be available for the inspections and maintenance. One further advantage of dedicated funding sources is the ability to sell bonds, allowing expensive capital improvement projects identified in the stormwater master plan to be implemented on a faster schedule than if only year to year funding is available. For more information on stormwater utilities contact should be made with the Cities of Bellevue, Olympia, Orlando, and Seattle; King and Snohomish Counties, and the Unified Sewerage Agency of Washington County.

A significant educational process is required before a stormwater utility can be implemented. The fee commonly is perceived as a "rain tax." The equitability and benefits of the user fee must be clearly explained to the public. Citizens must understand the importance and fairness of a stormwater fee that is based on the amount of impervious surface. This is not true when paying for stormwater services with property taxes, which bear no relationship to the runoff service demands created by a parcel. Most importantly, the general public must understand exactly what activities and projects will be funded, and how they will personally benefit or be affected by implementation of the fee.

When implementing a stormwater utility fee, it is recommended that the fee start out low (i.e., \$1-3 per month per house). It should be phased in over a five year period, during which general appropriation funding for the program is slowly reduced while being replaced by utility fee funding. A stormwater master plan also is strongly recommended so that capital improvement projects and their costs can be determined. Adoption of the plan needs to include a long term funding strategy to assure that adequate resources are available to implement it on schedule. By following these recommendations, objections to starting or increasing stormwater utility fees can be minimized. One surprise in the questionnaire responses is that jurisdictions with stormwater utilities often have problems raising rates to pay for program implementation.

Another concern with the stormwater utility approach, based on the questionnaire responses, is that the funds are used primarily for stormwater management, especially capital projects and operation and maintenance. Utility funding generally is not available for erosion and sediment control program implementation. The temporary nature of construction activities tends to limit the importance and funding many stormwater utilities dedicate to ero-

A major benefit of dedicated funding sources, such as a stormwater utility, is that, once established, they are not subject to the annual budget considerations of general appropriations.

sion and sediment control efforts.

Another form of dedicated stormwater funding in use in several jurisdictions is a special taxing district. Often this is a special assessment on an individual's property tax which funds various stormwater management improvements or programs. This approach recognizes that additional development increases the need for runoff management services. It funds them through increased tax revenues within a watershed, city, or county. Requests for additional information on this approach should be directed to Prince George's County, the Southwest Florida Water Management District, the Suwannee River Water Management District, the Flood Control District of Maricopa County, and the Urban Drainage and Flood Control District of Denver.

By defining areas of importance, and the necessary resources which must be available when they are needed, a jurisdiction can better recognize the short and long term commitments that accompany approval of the program.

PROGRAM STAFFING

It must be clearly understood by those developing and implementing urban runoff programs that they will always face funding challenges which will prevent them from fulfilling their total responsibilities. As discussed in Chapter 3, over half of the programs responding stated they did not have adequate staffing for their programs. Of the programs reviewed, even those with a variety of funding mechanisms, staffing generally is not adequate (66% for erosion and sediment control; 54% for stormwater management). Public expectations always will be higher than the program's ability to meet those expectations. To overcome these challenges, several strategies are recommended:

Prioritize program elements and activities

Successful urban runoff control programs contain several integral elements. Program funding and staffing limitations make prioritizing and scheduling essential. Prioritizing assigns a degree of importance to the various program elements. It helps establish a long term implementation strategy outlining where the program needs to be in a given time frame. This will determine when resources will be needed to develop and implement each program element. By defining areas of importance, and the necessary resources which must be available when they are needed, a jurisdiction can better recognize the short and long term commitments that accompany approval of the program.

Initial implementation efforts must include a significant emphasis on education and training. Especially on the program's minimum criteria and how compliance with the criteria may be achieved.

This training has to be provided to not only the development and design community, but especially to agency staff that will review and approve projects. Training of implementing staff is particularly important when program implementation is necessitated by an entity other than the program's lead agency. Timely plan review depends on having well trained staff, especially if staff resources are insufficient.

Accurately estimate staffing needs

Developers often have a tight schedule with budgets closely tied to the time at which construction begins. To minimize delays and additional costs to the regulated community, it is very important that projected program work load and staffing needs be accurately estimated .

In determining how many plan reviewers are necessary, factors that need to be analyzed include the projected number of projects; complexity of projects; whether project review is for erosion, sediment, and stormwater control only, or if it includes other related programs; individual versus general permit review; and the amount and complexity of required submissions. Experience has shown that an average plan reviewer can complete approximately two to three projects per day, depending on the complexity of the individual projects. Design plans rarely are approved during their initial submission, with most projects needing at least two reviews before approval. These additional reviews also take a significant amount of time and must be factored into staffing needs. In establishing permit fees, some agencies provide a minimum number of reviews for the base permit fee. Additional reviews are assessed an additional fee.

Innovation often provides solutions to common urban runoff program implementation shortcomings. In Maryland, to expedite plan review and approval of their projects, other state agencies funded several plan review positions within the Maryland Department of the Environment. This helps to assure that these public projects are not unnecessarily delayed causing increased costs to the taxpayers.

Inspection is also integral to successful program implementation. Experience has shown that inspection staff, especially in erosion and sediment control, historically have been insufficient for successful program implementation. It takes approximately 18 months to train an erosion and sediment control inspector until the individual has the knowledge and confidence to assume responsibil-

Staffing needs must consider that design plans rarely are approved during their initial submission, with most projects needing at least two reviews before being approved.

Many other programs, especially at the local level, have similar plan review and inspection requirements.

Theoretically, staffing and funding resources of these programs can complement and assist in implementing erosion and sediment control and stormwater management programs.

ity for site inspection and compliance. Another factor that must be considered in estimating the number of inspectors needed is their office time. Approximately 20% - 25% of their time will be spent writing inspection reports, managing case files, communicating with supervisors over enforcement needs at specific sites, and lining up times to meet with developers or contractors on their sites. Other factors that must be evaluated in determining the how many inspectors are needed include the geographic area they must cover (travel times to visit various sites), the number and size of active sites, and the frequency of inspections. The optimal number of inspectors typically will be beyond the program's available funding. This reality factor must be recognized. A program can only do as much as its resources will allow.

Finally, in determining program staffing needs, consideration must be given to the role and needs of support staff. In addition to plan reviewers and inspectors, successful programs require management and clerical staff. Other staff needs may include biologists, chemists, and maintenance crews, depending on the breadth of the program. Failure to consider these staff resources and their associated needs for computers, vehicles, and other equipment can have a profound impact on effective program implementation.

Build relationships with other related programs

Many other programs, especially at the local level, have similar plan review and inspection requirements. Specific examples of these programs are discussed elsewhere in this chapter. Theoretically, staffing and funding resources of these programs can complement and assist in implementing erosion and sediment control and stormwater management programs. The degree of relationship between the programs can vary greatly. As a minimum, the relationship should assure recognition by the individual programs of each other's requirements. This will help reduce the possibility that conflicting guidance will be given to the regulated community, a situation which can decrease confidence in program staff and lead to a loss of political support. A good example of the importance of good communication between programs in reducing potential conflicts is between a wetlands protection program and the erosion, sediment, and stormwater control program. Approval by the urban runoff program of the placement of a stormwater management practice in an existing wetland without the concurrence of the wetlands program can adversely affect both programs, and the resources they are supposed to protect. Just being aware of the requirements of related programs is a significant

benefit to all of the programs. Even better, the requirements of closely related programs should be developed cooperatively by both programs so that they are as compatible as possible.

Effectively communicate obligations to all players

One of the most frustrating aspects of program implementation comes when those submitting or reviewing plans, or implementing the plans on site, are not knowledgeable of their specific responsibilities and obligations. Even with effective communication, this problem will always exist to some extent. There always will be some individuals who "slip through the cracks", or plan designers, developers, or contractors who are new to the jurisdiction and are not familiar with the program's requirements.

Effective communication among all parties involved in program implementation is essential and in everyone's best interest. Effective communication can help assure that projects are implemented smoothly and on schedule providing benefits, both economic and political, that are especially important to local developers, contractors, consultants, and to the program. "Repeat customers" can especially benefit by establishing a good relationship with program staff.

Effective communication is particularly important among individuals at state, regional, and local agencies if there is shared responsibility for program implementation. There has to be a cooperative attitude by all levels of jurisdiction. Implementing staff need to develop a spirit of teamwork and establish relationships which are positive and complementary. The absolute worst situation occurs when communication between implementing agencies breaks down. In this case, staff at the "front lines" may feel threatened or abandoned by the lead agency which oversees program implementation.

Be creative - seek alternative methods of program implementation and staffing

Creativity and innovation are cornerstones of urban runoff management programs, especially in overcoming resource limitations which can threaten the program's effectiveness. One concept that has already been discussed is delegation of program authority. Especially for a statewide urban runoff program, resources will not be available for the state agency to conduct all aspects of program implementation. Delegation of authority is a proven approach which can be an effective vehicle for program implemen-

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Oversight, training, and communication are continuing obligations of the lead agency, which must have staff dedicated to these crucial functions.

tation. However, as previously emphasized, the delegation process must provide for oversight by the lead agency to assure that the delegated agencies are administering the program's responsibilities consistently and correctly. Oversight, training, and communication are continuing obligations of the lead agency, which must have staff dedicated to these crucial functions.

Generally, it must be recognized that there will never be enough public agency inspectors to provide for timely inspection of erosion and sediment controls at construction sites. Additionally, fluctuations in work load, annually or seasonally, means that adequate staffing for peak times would result in too many inspectors at other times (we can all dream!). The "certified inspector program" is an innovative approach that can rectify these common program weaknesses and greatly increase compliance with the program's requirements.

Delaware's Certified Inspector Program requires individuals to attend and pass (through written examination) a State conducted course specifically designed for inspectors. Individuals successfully completing the course receive a certification, which is recorded in a computer data base, and recognized with a wallet size certification card. All delegated agencies are provided with a complete list of certified inspectors.

The regulations for Delaware's urban runoff management program requires the developer to supply a "Designated Inspector" on all projects over 50 acres in size. The inspector must conduct weekly site inspections, document the results of the inspection on forms developed for that purpose, and provide a copy of the inspection report to the implementing agency, the contractor, and the developer. The concept has been modified and expanded by local jurisdictions to meet their specific needs. One county requires all commercial activities to have a Designated Inspector. The Florida DEP is developing a similar program which will include inspections of both erosion and sediment controls during construction, and inspections of completed stormwater systems to assure that they are maintained and operated properly. The City of Bellevue also is considering this concept for annual maintenance inspections of completed stormwater management structures.

The program does not require the Designated Inspector to be an enforcement officer and actually mandate correction of problems. Instead, the inspector's job is to provide the developer, contractor, and permitting agency with a report on the status of erosion, sediment, and stormwater management practices. The appropri-

ate public inspection agency, upon reading the report, decides whether it needs to send one of its inspectors to the site to ensure that problem's have been corrected. A major objective of this program is to reduce the frequency of public agency inspections by having the private inspector act as a program overlay. If the Designated Inspector does not accurately represent site conditions in the inspection report, the individual's certification can be revoked. If this occurs, the developer must hire another Certified Inspector or else the site is in violation of a permit condition, and enforcement action can be taken. The Designated Inspector approach does not eliminate the need for public inspection, but it can reduce the number of inspectors needed.

It is important to recognize areas where program implementation is weakest and develop innovative strategies to overcome these weaknesses. If the optimal implementation approach can not be used, creative alternatives must be developed or the success of the program will be diminished. Be creative and use whatever tools may be available to achieve the desired objectives.

PROGRAM EDUCATIONAL ACTIVITIES

If there is one theme that has been expressed repeatedly in the responses to the questionnaire, and in this document, it is the need to have a strong educational component in urban runoff control programs. This fact was clearly demonstrated with 93% of the programs surveyed including education as a program component. However, there is great variation in these educational programs - their content, form, frequency, distribution, target audience, and legal requirements.

1. Are educational programs mandated by law or regulation

Generally, educational programs should be voluntary. However, there are certain program elements which can benefit from, or even depend on, legally mandated educational programs. These include components such as Delaware's Designated Inspector program, Maryland and Delaware's Contractor Certification Program, South Carolina's program for local erosion, sediment, and stormwater control plan reviewers, and Virginia's training and certification programs for inspectors, plan reviewers, and program administrators.

Required education for plan designers often gets controversial, with disagreements arising among the different professional organizations involved in design. If the inclusion of a specific audi-

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Educational programs aimed at individuals directly involved in program implementation are essential. Relating the program's goals to outdoor, water related activities, which often are enjoyed by attendees, can lead to a more personal commitment.

ence in a mandatory educational program becomes so controversial that implementation is jeopardized, then remove the controversial requirement. The educational program is still necessary and must be pursued, even if attendance is not required. Fortunately, many design professionals will attend voluntary educational programs to enhance their skills and knowledge. By developing education programs that allow attendees to receive Continuing Education Credits, a requirement of many professions, attendance can be increased.

The states of Maryland and Delaware have a Contractor Certification Program which requires every site contractor to have at least one individual, who is responsible for site grading control, attend a state sponsored or presented course in erosion and sediment control and stormwater management. These programs have been attended by thousands of individuals and have proven very popular with attendees. Individuals attending these programs generally enjoy outdoor, water-related activities such as swimming, fishing, boating, or hunting. Relating these activities to the program's goals leads to a more personal commitment by attendees. This greatly enhances program effectiveness.

2. Intended audience and frequency for educational programs

Intended Audience

Educational programs aimed at individuals directly involved in program implementation are essential. As a minimum, programs need to be provided for plan reviewers, inspectors, contractors, consultants, and developers. Education also is vital for the general public. They must understand how their everyday activities, whether at home, work or play, contribute to "Pointless Personal Pollution", and how they can be part of the solution. The public must also be educated about the importance of the urban runoff control program, and about how they can further program effectiveness, whether by reporting possible noncompliance at sites, or by using source controls at their homes or work. Having good community awareness and understanding of the program will lead to greater support and a more effective program.

Unlike educational programs for the regulated community, which are fairly easy to define, public education programs must be much more broadly defined. The intended audience is highly diverse - in their knowledge about Pointless Personal Pollution, their interest in the environment and in the goals of the urban runoff program, and in the use of their personal time. Decisions must be

made about the topics to be covered, and the way in which information and educational programs will be delivered. Traditionally, pamphlets, booklets, newsletters, and even utility bill inserts have been relied upon heavily to inform the general public. However, these passive methods may or may not achieve desired results. More interactive approaches such as making slide presentations at various community meetings can be more effective but they typically reach a very small audience. New computer and compact disc technologies offer exciting opportunities to create interactive, entertaining, multimedia educational materials

Experience indicates that more creative, highly visual, hands-on, educational programs are better received and achieve a higher level of learning. Stream walks, where the public walks along a water body and removes accumulated litter, provides an opportunity to see the adverse impacts of uncontrolled urban runoff. They create an appreciation for the importance of litter control and solid waste programs. Storm drain stenciling efforts are simple to perform, an excellent project for youth groups, and draw a clear connection between how our activities on the land impacts aquatic resources. Citizen monitoring programs, which are growing in popularity around the country, foster an "ownership" of local water bodies. Stormwater management demonstration or retrofit projects, especially those which are highly visible, are another opportunity for education and for building public support for the program. Concern over having erosion and sediment control and stormwater management issues presented in courts during enforcement cases led to Maryland providing educational seminars for judges. This has helped the judges better understand the importance of successful program implementation and not feel that sediment in streams is "just dirt".

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Frequency of Educational Programs

Mandated educational programs must be given on a regular basis. This allows individuals who must have the training an opportunity to attend sessions, become qualified or certified, and carry out their function under the program. Educational activities for the general public generally cannot be given on a regular schedule, but rather when opportunities become available.

How frequently mandatory educational programs are given will depend on factors such as the size of the jurisdiction, staff resources, the location of the courses, the projected number of attendees, and the length and complexity of the program and its associated training materials. To some degree, the frequency will

also depend on the amount of preparation that is necessary to conduct the program.

For example, Delaware's certified inspector training program involves 32 hours of class which are given one day a week for four weeks. Generally, about 90 individuals attend the course at any one time which creates a significant work load for the instructors in preparing slide show lectures and handouts. Based on response to the course, staff feels that a frequency of once per year is adequate. However, Delaware is a small state. Larger, more populated jurisdictions would need to present the course more frequently, and in more locations. It is important that public inspectors also attend the course to assure that they understand the program's requirements.

Educational programs aimed at the construction industry present a special challenge because of the constant change of individuals employed.

Educational programs aimed at the construction industry present a special challenge because of the constant change of individuals employed. This implies a need for courses to be given on a more frequent basis. Delaware's experience has shown this to be true. Their contractor's certification course cannot be given often enough, with capacity attendance at every session. To meet demand, the course needs to be presented between four and six times a year. The course should be presented cooperatively by the permitting agency and by the inspection agency. This allows contractors to be introduced to the inspectors in a non-adversarial environment, helping them to start their relationship in a positive manner. A contractor's training program should last no more than 3 - 3.5 hours. It needs to stress general information about urban runoff management problems, solutions, and programs together with information about the contractor's specific responsibilities and obligations.

Education of plan reviewers also is critical to program success. Once plan reviewers have a good understanding of erosion, sediment, and stormwater management, and their program responsibilities, they can help educate the developers, designers, and consultants with whom they interact. Educating both plan designers and reviewers is extremely important since proper site control and BMP performance is so dependent on proper site planning and design. Problems will occur, poor quality plans will be approved, and structures built incorrectly, but education can minimize such mistakes helping to maintain public support for the program.

While design guidance manuals are invaluable, designers and consultants can benefit greatly from periodic workshops on de-

sign aspects of the program. These can explain the rationale behind practice selection and design criteria, provide supplementary, up-to-date information on designing practices, and include case studies which illustrate good and bad examples of design and use of BMPs. Having a good relationship with the design community reduces potential problems in all aspects of program implementation.

Public education programs need to be flexible and opportunistic. Accordingly, it is very important to make organizations, civic groups, and educational forums aware that program staff are available to put on educational programs. Presentations can be made at meetings of various civic organizations (Rotary, Lions, garden clubs, environmental groups, contractor meetings), schools, and before elected officials, helping to increase awareness of the program. Newsletters, brochures, pamphlets, and booklets can be effective if targeted to a specific group, area or problem. Probably the most effective means of public education is the construction of BMPs in highly visible locations such as city hall, schools, or in parks. The more people who see implementation of practices, the more they recognize the benefits of the program.

In summary, public education should be pursued at every opportunity and location where there is a receptive audience. If there are limited resources, public education should be one of the program's top priorities. Without public education, support for the program will not be broad based.

PROGRAM COMPLIANCE AND ENFORCEMENT

This component of program implementation is one of the most controversial and difficult to address. A consensus approach to program implementation, which relies on everyone assuming responsibility for their part of program implementation is the ideal approach. Unfortunately, there always will be some individuals who try to circumvent or avoid their responsibilities. There must be legal mechanisms to deal with these situations, however distasteful that option may be. This is especially true for erosion and sediment control during construction since noncompliance can quickly result in off-site damages.

Enforcing compliance with program requirements assures that there is a level playing field, where all the players have the same responsibilities. There is a perception in the construction industry that not implementing erosion and sediment controls saves money. Some developers or contractors may feel that this gives them an

Unfortunately, there always will be some persons who try to circumvent or avoid their responsibilities. Compliance and enforcement mechanisms must be available to deal with these situations and to assure there is a level playing field.

Programs with only one method of compliance and enforcement often can not properly address the many different situations that arise during the land disturbance and development process.

economic advantage over competitors. Fortunately, news of enforcement actions travel quickly through the regulated community, serving as an incentive for responsible site development and helping to reduce the potential for problems on other sites. Conversely, failure to take enforcement action can lead to widespread problems on other sites.

Enforcement is made more difficult because no one wants to be considered a "bad guy". Inspectors and program administrators need to recognize that, at times, they will have to act as "policeman". To facilitate these actions, the program's framework should specify the procedures, options, and remedies to be followed by staff when conducting compliance and enforcement activities.

In addition to having the will to take enforcement action, the program must have a sound legal and administrative foundation. The most successful programs are those which use a variety of tools to assure compliance. Different tools are needed in different situations. Programs with only one method of compliance and enforcement often can not properly address the many different situations that arise during the land disturbance and development process. Flexibility is needed, as are tools that can be used quickly.

1. Civil penalty provisions

Civil penalty provisions, as demonstrated by the questionnaire results, are clearly considered a necessary program component. These usually are monetary penalties, generally between \$200 and \$1,000, which are imposed when sites are not in compliance. The amount of the penalty typically varies depending on the severity and extent of the problem. Factors considered may include whether off-site damage occurs, how long the problem occurs, whether the project is permitted, and whether it is a repeat violation for either the site or the developer. First time violations frequently are assessed the minimum amount unless the problem is especially bad. Most programs use a penalty fine schedule which increases the monetary penalty for each day the violation exists. Assessments can grow rapidly when each day is considered as a separate offense.

Civil penalties often are implemented using a form of ticket where the violator is fined on site and has the option of appealing the ticket in court. This type of administrative ticket is highly recommended. It can be administered quickly, something which is especially important in assuring proper implementation of erosion and sediment controls during construction. Of course, it is impor-

tant for the court to understand the importance of site compliance and to uphold the program's requirements.

2. Criminal penalty provisions

Unlike civil penalties, the need for criminal penalties is not considered universal. Criminal penalties usually include a fine and incarceration. Many elected officials and law enforcement programs do not feel erosion, sediment, and runoff control violations are severe enough to warrant criminal penalties. While criminal penalties have been assessed for violation of industrial discharge permits, there has been some hesitation by courts to convict an individual of runoff or sediment pollution. These problems just aren't thought to be severe enough to warrant penalties associated with more heinous crimes such as robbery or murder. Additionally, if convicted of a criminal offense, a developer or contractor could lose their professional license or face problems obtaining bank loans.

Experience has shown that criminal penalties seldom are used for enforcing urban runoff program requirements. Nonetheless, programs should include them as a "last ditch" option after all other tools have been used and found lacking. One option is to develop specific penalties that are appropriate for the violations rather than simply relying on the penalties already included in state or local laws which typically is done. However, the program should not rely on criminal penalties, but rather on the variety of other tools which have proven effective.

3. Other available enforcement options

Urban runoff control programs use a variety of other tools to enforce compliance with their requirements. Each of these tools must have a sound legal foundation, either in the program's specific law or regulations, or in the jurisdiction's general laws or rules. These should specify when and how the enforcement mechanism can be used, including all procedures. An appeals process needs to be specified.

Halting construction

The ability to halt construction has to be considered one of the most important and powerful enforcement tools. No other enforcement mechanism will get the immediate attention of the developer or contractor, since stopping work delays construction and increases costs. When construction is halted, the only site work

The program should not rely on criminal penalties but rather on the variety of other tools which have proven effective. These include stop work orders, withholding occupancy permits or other permits, and performance bonds.

allowed to continue is installation and maintenance of erosion, sediment, and runoff controls. Stop work orders particularly are effective at those few sites where requests to improve onsite controls are ignored repeatedly. They are less effective on inactive sites where halting construction is of little concern.

Withholding occupancy permits

Completion of site stabilization and all stormwater practices in accordance with approved plans can be made a condition of issuing the certificate of occupancy. This approach is very effective if the buildings are ready to be occupied, but is of little use in earlier phases of project development. Delays in occupancy can affect the timely transfer of property to the new owner or lessee, delaying monetary returns to the project developer.

Withholding other permits

Applicability of this enforcement option is limited to those developers with a number of on-going projects in the jurisdiction. When used, withholding other permits has been a very effective incentive in getting cooperation and action taken to correct problems. Implementation is fairly simple, with the inspection office requesting the appropriate permitting agency to not process permit applications or issue permits until the enforcement process has been concluded.

Performance bonds

A common enforcement tool to assure that the approved urban runoff control practices are installed properly is requiring a performance bond. They are especially useful when project construction is stopped before the stormwater practices are built. By requiring a performance bond, the permitting agency can hire someone to construct the stormwater practices. All other enforcement tools should be used before requesting payment of the performance bond from the bonding company since this can seriously hinder the ability of the developer to get a bond in the future. In addition, the process of getting the bond money is time consuming, making this is option not practical in situations requiring quick resolution.

Administrative Remedies

The legal framework for many state, regional, and local regulatory programs establishes various administrative steps that the

Urban runoff control programs use a variety of other tools. Each of these tools must have a sound legal foundation.

agency can take to enforce compliance. The process typically includes issuing a "Notice of Violation", which lists the actions to be taken by a certain date to bring the site into compliance. If the actions in the NOV are not taken, additional administrative actions can include permit revocation or suspension, a Consent Order, or Court Order. However, these administrative remedies normally take a lot of time. They are not effective enforcement tools for urban runoff control programs, especially during the construction phase.

4. As-Built Certifications for stormwater systems

Requiring the submittal of As-Built Certifications and Record Drawings is highly recommended. These help assure installation of practices in accordance with the approved plans and that the structures are structurally sound. Requiring submission of this information should assure better onsite supervision by the project engineer, especially during critical times of construction, such as during barrel assembly and placement, compaction, and installation of core trenches, anti-seepage devices (collars or diaphragm), filters, discharge structures, and even during the planting of aquatic plants in littoral zones.

Submission of the certification also reduces the responsibility of the site inspector with respect to approving adequacy of construction, especially of structural components of the stormwater system. Stormwater systems, especially discharge structures and treatment practices, can be complicated to construct and may represent new challenges to contractors with little experience in their construction. Having a design professional conduct inspections during construction helps assure that the contractor is installing the practices and structures so they will function properly and safely.

As-built certification and record drawings should be received by the permitting agency before release of any performance bonds. This will assure that funding is available if there is a problem. These submissions also can serve as a baseline for determining when periodic maintenance inspections and operations should be undertaken. For example, many programs require removal of accumulated sediments when the storage volume is reduced by a certain amount or percentage. The record drawings serve as a reference of the system's original depth and storage volume.

An important aspect of the final inspection is to compare the as-built certification and record drawings to the approved design plans to ensure they are consistent.

5. Final inspections of stormwater management systems

Inspecting stormwater practices during construction is important, but having a final site inspection after construction is complete is essential. Typically, once construction of a project is completed, responsibility for maintenance of stormwater systems is transferred from the site developer to the eventual property owner(s) or lessee. Having a final inspection of the runoff system before the developer transfers ownership helps ensure that the system is constructed properly, and that the new owner is aware of maintenance responsibilities. This inspection can serve as the official release of the site developer from any further obligations for the stormwater system.

The final inspection should be requested by the developer. It is recommended that the inspection be conducted by an inspector from the appropriate agency, and be performed in conjunction with submission of the as-built certification and record drawings. The inspection should be done before issuance of a certificate of occupancy, release of any performance bond, or final sign-off on the stormwater system. An important aspect of the final inspection is to compare the as-built certification and record drawings to the approved design plans and specifications to assure they are consistent.

MAINTENANCE OF STORMWATER SYSTEMS

Successful implementation of urban runoff control practices requires attention to three major program components - good project design, proper construction, and long term maintenance. Nationwide, the largest weakness of urban runoff control programs is assuring long-term performance of the practices.

Assuring proper long-term functioning of stormwater practices requires use of several different tools. Very few programs have the necessary legal framework and staff resources to perform this vital task. Too often, there has to be a history of failure, often with loss of property or lives, to get adequate resources for maintenance of stormwater systems. The elements listed below may not be immediately attainable for new programs, but they are essential. That's why program evolution is so important. Recognizing the need for these program elements hopefully will ease their acceptance at some point in the future. The maintenance and operation of stormwater systems is an issue that is very important to program success. It must be addressed. A long-term implementation strategy which includes operation and maintenance must

Successful implementation of stormwater management practices requires attention to good design, proper construction, and long term maintenance. Nationally, the largest weakness of urban runoff control programs is assuring long term performance of BMPs.

be prepared early in the program's development. By phasing in elements, public awareness and acceptance can be increased.

1. Requiring maintenance of stormwater systems

Either through law, regulation, ordinance, or other legal authority, maintenance of stormwater management systems must be required. This simple basic statement must be recognized and included in the initial development of the program, especially when stormwater treatment is required. *The more effective these practices are at removing pollutants, the more frequently they must be maintained.* The maintenance responsibility must be recognized, planned for, and funded. It does little good to require construction of practices if there is no legal requirement to assure their proper maintenance and operation.

The program's legal framework must specifically address the maintenance of stormwater practices. Items that need to be included are requiring a legal maintenance entity, determining who can be one, establishing minimum legal and financial requirements for them, and providing a series of enforcement tools should the maintenance entity fail to do its job.

2. Responsible maintenance entities

Determining which entities should be allowed to be legally responsible for the maintenance of stormwater systems is an extremely important and difficult decision. Historically, performing maintenance was the responsibility of local government or the property owner. This approach can work well when there is one entity responsible for maintenance. Experience shows that government, private or public utilities, and many commercial or industrial property owners can often be relied upon to fulfill their maintenance responsibilities.

Conversely, this approach has not worked well when a property owners association is the responsible entity. This often is true for residential projects such as subdivisions. Several surveys have shown that residential stormwater practices generally are not maintained. These systems often become a problem for the local government, which is expected to perform the required maintenance. To increase maintenance of stormwater systems by property owner associations, Hillsborough County (FL) implemented an "Adopt a Pond" program. Associations that join the program receive education and training from county staff on their stormwater system - type of BMP, how it functions, maintenance activities and fre-

While government, utilities, and many commercial or industrial property owners will maintain their stormwater systems, those maintained by property owner associations are seldom maintained properly.

It is recommended that runoff systems serving residential properties be dedicated to and accepted for maintenance by the government (hopefully with a stormwater utility!).

quency, etc. Special focus is given to "aquascaping" the system by planting beneficial aquatic and wetland plants which also have attractive flowers. BMP does not stand for "Big Muddy Pond."

It is recommended that stormwater systems serving residential properties be dedicated to and accepted for maintenance by the government (hopefully one with a stormwater utility!). The stormwater practices and structures should be built to the jurisdiction's standards and specifications, be warranted by the developer for at least two years, and be accepted only after a final site inspection by inspectors from the jurisdiction. An alternative approach is to have the local government responsible for maintenance of residential stormwater practices and structures, with the property owners association responsible only for vegetative and aesthetic maintenance. Unfortunately, since funding is often unavailable, responsibility for maintenance is generally left to the residential property owners with the recognition that the maintenance will not get done.

An innovative alternative is for the program to require a property owners association to establish a maintenance organization, responsible for annually assessing and collecting fees from each property owner. These maintenance fees generally are used for private road maintenance and maintenance of public open space, but stormwater system maintenance certainly can be added. This approach is used by several local programs but requires oversight to assure that the fees actually are collected and used properly. Education of property owners about how the fees are used and the benefits provided helps increase their willingness and likelihood to pay. This approach does not eliminate the need for the jurisdiction to conduct periodic inspections to see if runoff systems are being maintained and operating properly.

3. Public agency inspection of stormwater systems

To assure long term performance, stormwater practices must be maintained on a regular schedule. However, the frequency of maintenance varies greatly with the type of runoff practice, its contributing drainage area, and land use. Inspections are required to determine when to undertake maintenance operations. Ultimately, the responsibility for conducting inspections will fall on the public agency responsible for program implementation. Most programs are aware of this responsibility with 81% of the surveyed programs requiring public agency inspection.

The increasing complexity of urban runoff controls is one reason

that public agency inspection is necessary. Few property owner association representatives or maintenance staff for commercial or industrial operations will have the knowledge to inspect or maintain runoff structures or practices. Public inspectors are trained to know the components of stormwater management practices, understand how they work, and know how they should appear. Inspectors need to be trained to evaluate the function of mechanical devices, such as used for pond dewatering; check for seepage at the downstream embankment face; measure sediment accumulations or discharge rates of filters or underdrains; and conduct other common maintenance tasks.

It is recommended that runoff practices be inspected by a public inspector on an annual basis at a minimum. However, remember that some treatment practices, such as filters, will need more frequent inspections. Public inspections serve as a final backstop to help assure that regular maintenance inspections and needed maintenance are actually being performed by the responsible entity. They also serve as a check when the runoff control program requires submission of an inspection report from the maintenance entity.

Based on the review of urban runoff programs, obtaining staff to perform maintenance inspections is very difficult and a low priority. Staff needs for maintenance inspections are not a significant expenditure during the program's first few years, but the obligation grows year after year. Ultimately, if this vital task is to be completed, the program will need staff dedicated to performing maintenance inspections.

Creativity again can help to overcome program resource limitations. Generally, local or regional programs have staff dedicated to maintenance of primary drainage structures. These individuals can be cross trained in the proper maintenance of runoff treatment practices. Another creative approach is used in Tallahassee's program which requires operating permits for all stormwater management systems. These permits require an annual inspection of the system, with a certification on the condition of the system submitted to the city's stormwater utility program. To provide trained inspectors for this task, the Florida Department of Environmental Protection is developing a training and certification course for individuals who wish to inspect erosion, sediment, and stormwater controls. This program is patterned after Delaware's Certified Inspector program.

Few property owner association representatives or maintenance staff for commercial or industrial operations have the knowledge to inspect or maintain runoff structures or practices. It is recommended that systems be inspected by a public agency at least annually.

Not planning for maintenance costs in the initial program setup will create major financial problems in the future. Dedicated funding sources, such as stormwater utility fees, can help prevent this problem.

4. Funding maintenance - the need for dedicated revenues

Funding maintenance of runoff systems generally is not a problem for commercial or industrial sites. They usually have a maintenance budget and staff which can include this responsibility. However, finding funds to maintain systems can be a significant problem for public agencies and for residential property owners. To overcome this problem, a dedicated source of revenue for maintenance of stormwater systems is strongly recommended.

Stormwater utility fees are the most common dedicated funding source used by urban runoff programs. These "user fees" usually are based on a parcel's amount of impervious surface providing a direct relationship between the amount of runoff created and the demands created for stormwater management. They are a very equitable way of raising funds for runoff management, especially when a public entity is responsible for the maintenance and operation of practices and structures.

Dedicated funding to maintain residential stormwater systems can be provided by:

1. Stormwater utility fees
2. Requiring property owner associations to establish a maintenance organization which annually assesses and collects funds from the members.
3. Deed restrictions which obligates a property owner to pay a pro-rata share of the costs of maintaining the stormwater system serving the property.

Highway agencies have a special concern with respect to maintaining urban runoff controls. Highway construction projects must meet the same regulatory requirements as any other development, but highway construction poses special problems. Highways are linear in nature and cross many different drainage divides. To meet stormwater management program requirements, treatment must be provided for runoff within each of the impacted receiving waters. This necessitates the construction of many stormwater management structures which must be maintained, not only to meet permit conditions but to assure public safety, since lack of maintenance could lead to road flooding. Highway departments must be aware of these needs and be sure that their annual budgets include the funds needed to inspect and maintain their facilities.

In summary, there are several available options to provide fund-

ing for maintenance of urban runoff controls. It is important that one of these tools be selected and used. Do not assume that funding will become available when a problem arises. Not planning for maintenance costs in the initial program setup will cause significant financial problems in the future.

5. Legal steps to assure maintenance is done

The program must have a legal framework that includes compliance and enforcement processes to assure that maintenance is done, especially on systems maintained by private entities. These steps will depend, to some degree, on the program's maintenance framework.

Commonly, the program's civil penalties will address the problem of maintenance of systems not being performed. Another commonly used tool is allowing the program agency to either perform needed maintenance or have it done by a contractor. The cost is billed to the property owner. If payment is not received in a specified period of time, a lien is placed on the property for the amount of the bill.

An urban runoff program must have the legal tools to assure maintenance of stormwater systems. More importantly, there must be a commitment to use the tools when they are needed.

COORDINATION WITH RELATED PROGRAMS

1. Coordination between the erosion and sediment control program and the stormwater management program

As discussed previously, there must be close coordination of the erosion and sediment control program and the stormwater management program. It is strongly recommended that erosion and sediment control and stormwater management programs be administered as integrated programs under the same urban runoff management program umbrella. Having the functions located in the same agency and even in the same office clearly improves program effectiveness and fosters better communication and dialogue between inspectors and plan reviewers.

2. Coordinating urban runoff programs with other related programs

The intimate relationship of erosion, sediment, and stormwater control to other aspects of land development and natural resources

Do not assume that funding will become available when a problem arises. Not planning for maintenance costs in the initial program setup will cause significant financial problems in the future.

It is strongly recommended that erosion and sediment control and stormwater management programs be administered as integrated programs under the same urban runoff control program umbrella.

management suggest many possibilities for program coordination. This is supported by the questionnaire responses, with the urban runoff programs citing coordination with the following programs:

- land use planning
- zoning
- building permits
- wetlands protection
- floodplain management
- wastewater management
- water supply
- tree protection
- land acquisition
- wellhead protection

It is recommended that urban runoff programs be coordinated with all of the above related programs, if appropriate in the jurisdiction. All of these programs have important linkages to urban runoff programs. However, it is likely that coordination will need to be phased in, based on local priorities. For guidance, review the individual summaries in Appendix B to see which development programs were coordinated with the different urban runoff programs.

Initial coordination is recommended with land use planning, zoning, wetland protection, and building permit programs. Integration of stormwater management, tree protection, open space, recreation, and landscaping requirements often represents a "win-win" situation. At the local government level, the land development regulations often will include sections on each of these topics. If the various requirements of these different topics can be coordinated and integrated, multiple objectives can be achieved in the same area providing a developer with an opportunity to save money. More importantly, this allows much greater use of nonstructural controls which can help minimize runoff and the generation and delivery of pollutants.

Once coordination between programs is established, a designated contact person in each program should be identified between whom regular periodic communication must occur. Educational workshops also are recommended as a way to increase staff awareness of the requirements of each program.

3. Avoid conflicts with other programs

As stated in Chapter 3, there are a significant number of conflicts

with other programs which hinder or prevent effective program implementation. These conflicts will never be totally avoided, but they can be reduced through effective communication and cooperation. Adversarial relationships between programs must not be allowed to develop or continue. Experience shows that such disagreements will be displayed in public arenas, harming both programs. Unfortunately, because of human nature, this is easier said than done.

Experience by program implementing staff can attest to the frustration and conflict when interfacing with other programs whose goals may be compatible, but whose implementation concepts are very different. Unfortunately, this has been an issue for urban runoff management programs, which are the "new kid on the block" and which address cumulative, insidious environmental problems. Stormwater management programs face potential conflicts with wetland programs, water quality certification, flood control, solid waste programs, and onsite wastewater programs, among others.

Coordination and communication among programs is critical to avoid or minimize conflicts. Often, minor changes can be made to one or both programs which will accommodate the concerns of the other program without adversely affecting either program. It is important to people that their concerns, however minor from the program perspective, be given serious consideration. Minor problems have a way of escalating if not treated seriously when they first occur, especially when there is a concern over "turf". Communication, coordination, and cooperation are essential.

A creative process that can work fairly well is establishing a work group consisting of staff from two programs. They should meet regularly to find common ground on issues affecting both programs. This process can expand the normal dialogue among the programs' staff, giving both sides an appreciation for issues that could create conflicts. This approach is recommended to reduce potential conflicts between programs, no matter the level of government.

PROGRAM EVALUATION

1. Measures of program success

Elected officials and taxpayers are asking more and more questions about the cost of implementation versus the benefits provided by many programs. It is essential that answers be provided

Conflicts between programs will never be totally avoided, but they can be reduced through effective communication, coordination, and cooperation.

Periodic evaluations are needed to measure program effectiveness and benefits. They can be used to help gain program support and to help it evolve into a more comprehensive program.

to managers and the general public regarding program costs and effectiveness. That's why it is important to measure the benefits and successfulness of any program, either qualitatively or quantitatively. This is especially true for urban runoff programs which are a new concept, and which use practices that are relatively untested. There must be periodic evaluations to measure program benefits and effectiveness. These help determine whether improvements are needed, allowing the program to evolve.

Potential program evaluation tools include:

Qualitative measures

- project permit review times
- frequency of inspections
- evaluation forms by targeted groups
- appearance of control practices on sites
- response time for complaints
- number of permits issued
- number of individuals trained
- recognition by others
- enforcement actions taken
- maintenance activities
- reduced number of complaints

Quantitative measures

- chemical monitoring of practices
- chemical monitoring of receiving waters
- biological monitoring of receiving waters (bioassessments with habitat assessment)
- stream flow monitoring
- sediment monitoring (deposition, chemistry)

2. Research projects and monitoring

One of the biggest weaknesses of urban runoff programs is the sparsity of data on BMP performance or on the ecological effects of intermittent discharges. Unfortunately, projects to evaluate BMP design and performance are very complex and expensive. Nonetheless, research and monitoring are highly recommended components of urban runoff control programs. Monitoring is included as an element of the research component because so much storm-water research involves storm event monitoring and water chemistry analyses. Additionally, an important research area is developing monitoring techniques that can accurately assess the eco-

logical effects of intermittent discharges and cumulative loadings.

BMP research is needed to improve our understanding of the relationship between design variables and treatment performance. Particularly important is research to develop and test innovative erosion and sediment controls or stormwater practices. Often, a developer will want to try an innovative technology but won't because of the costs of building and monitoring. Development and testing of innovative practices must be done cooperatively by the runoff program, universities, and the development community. The design must be based on sound scientific principles, not the "seat of the pants". Cooperative research of innovative practices can lead to much earlier acceptance of the design by the program, leading to more widespread use of the practice.

Monitoring urban runoff impacts, BMP effectiveness, the benefits of BMP implementation, or the impact of BMPs themselves on receiving waters presents special challenges. Traditional water column chemistry monitoring programs are not effective because of the intermittent nature of storms. They only provide a "snapshot" rather than assessing the cumulative impacts caused by the many urban runoff discharges within a watershed. Additionally, many stormwater pollutants are particulate or settle and become bound to sediments. Sediments and biological communities integrate pollutants and provide a long term record of ecological health.

Bioassessments are a popular and effective alternative to chemical monitoring. A major benefit of bioassessments is they provide a holistic measure of the health of the receiving system. Bioassessments provide a more accurate representation of water body health, assessing both the available habitats and the abundance and diversity of organisms living there. Additionally, bioassessments are relatively inexpensive compared to chemical analyses.

Another innovative and valuable monitoring tool is assessing sediments - their distribution, depth, and chemistry. Sedimentation rates can be fairly easily estimated by coring bottom sediments. Paleolimnology allows determination of concentrations of materials in sediments at various dates, allowing water body restoration targets to be established. The Florida Department of Environmental Protection sediment research group developed a tool to assess whether metal levels in estuarine sediments were naturally occurring or anthropogenically enriched. They also established guidelines to assess whether they were harmful ecologically.

One of the biggest weaknesses of urban runoff programs is the sparsity of data on BMP performance and on the ecological effects of intermittent discharges.

When developing urban runoff control programs there is no need to "reinvent the wheel." Similarities among programs around the country are not coincidental, but a result of effective communication and technology transfer.

Research need not be restricted to assessing the performance of BMPs or monitoring receiving systems. The newness of urban runoff programs implies there is much to learn about topics such as how to effectively garner public support, develop an effective permit, or establish permit or site tracking systems. Research is needed on all aspects of program development and implementation

Communication with staff in programs around the country (or even around the world) provides valuable information. This can help programs from "reinventing the wheel" during the process of program development or implementation. The information presented in this document demonstrates that there are many similarities among urban runoff programs around the country. The similarities are not coincidental, but a result of communication and technology transfer.

Many of the urban runoff programs reviewed are conducting research. They are just a small number of the many agencies that are attempting to address urban runoff. Research can be important even with limited budgets. It is vital that the learning process continue. Programs that continue to implement existing operating policies, procedures, and practices without reviewing or questioning how they can be improved, can not improve their effectiveness. Research is critical to program evolution.

In the past, research funding has been provided primarily through state or federal grants, but these funding sources are declining. To improve the chances of obtaining these limited funds, staff in federal or state agencies administering erosion and sediment control, stormwater management, wetland protection, or water quality management programs should be contacted to see if grant funds are available for urban runoff research. If grants are available, obtain program guidance materials along with application forms so that solid project proposals can be submitted by the application deadline.

Other potential research funding sources includes fines paid by those who violate environmental laws and rules, license plate fees, fees on tobacco or alcohol products, and special surcharges on runoff related materials such as concrete, asphalt, fertilizer, or pesticides. These can all be effective ways of generating additional revenue. When using fines to pay for research and monitoring, the perception must be avoided that additional fines will be levied when additional funding is needed. Staff in urban runoff programs should communicate with the agencies which adminis-

ter these funds to find out how to submit projects for funding consideration. The chances of funding research efforts improve greatly if all of the potential funding sources are identified and used.

Since monitoring programs are among the lowest priorities of urban runoff and environmental management programs, creativity is needed to increase the collection of information that can be used to evaluate environmental effects or conditions, or to assess the effectiveness of practices or programs. In recent years, two innovative approaches have become widely used:

Citizen monitoring

Volunteer citizen monitoring programs are gaining increased acceptance and expanding rapidly. These programs provide many benefits including education of volunteers, increasing personal responsibility for managing one's water body, reducing data collection costs, and obtaining data from more sites than would be possible using program staff. Citizen monitoring programs must be well coordinated. Volunteers must be trained in proper sample collection and preservation techniques. To increase confidence in the data of citizen monitoring programs, it is recommended that the program have a quality assurance plan. Additionally, volunteers need to receive the results of their monitoring, usually in the form of periodic reports on their water body. Accordingly, there is a need for basic staff support and funding to perform these tasks and to purchase sampling equipment and pay for laboratory analyses.

Monitoring by private entities

Monitoring by private entities has a lot of potential to provide needed data. The NPDES storm water permitting program has a significant monitoring component as a means of ensuring permit compliance. Good communication between the NPDES storm water program and an urban runoff program (where they are separate) provides an excellent opportunity to research practices and strategies.

Another possible opportunity to conduct research occurs when regulatory requirements create a hardship on a developer. In this situation, a variance to permit requirements may be justified if the site owner agrees to monitor the performance of any innovative practices. This would assess the performance of the innovative practice and provide information on its potential use elsewhere.

Since monitoring programs are among the lowest priorities of urban runoff and environmental management programs, creativity is needed to increase collection of information that can be used to evaluate environmental effects, or to assess the effectiveness of practices or programs.

PROGRAM EVOLUTION

It has been stated many times that it is important for urban runoff control programs to start small and gradually evolve to include additional activities and expand the program. It is recommended that initially the program address only the adverse runoff impacts associated with new development, and possibly redevelopment. This includes erosion and sediment control during construction, and stormwater management during and after construction. As the program matures, the staff gains experience in programmatic and technical issues, and as acceptance and support of the program by elected officials and the public increases, consideration can be given to expanding the program to address additional problems such as reducing runoff pollution from older drainage systems (retrofitting). This requires the program to evolve from a site-by-site approach to a more comprehensive watershed approach.

1. Retrofitting to reduce impacts from developed areas

Retrofitting presents many unique, complex challenges - institutional, technical, and financial. Institutionally, retrofitting is best accomplished through watershed approaches which emphasize regional stormwater facilities and nonstructural practices. Technically, most BMPs are land intensive and inappropriate for use in highly urbanized areas where land is scarce and extremely expensive. Innovative technologies are critically needed. Financially, the cost of retrofitting can't even be estimated because stormwater is the "orphan infrastructure." Few jurisdictions have good maps of their system or a master plan, especially one which addresses runoff quality and volume. Establishing a formal program of retrofitting necessitates a dedicated funding mechanism, such as a stormwater utility or special taxing district.

A major concern in retrofitting is coordination with other programs. In urban areas, many utility lines and pipes are buried in the right-of-way. These must be located and avoided during construction of stormwater improvements. Another common retrofitting problem is the desire to locate regional facilities in a wetland, which are considered "waters of the United States" and subject to protection just like other water bodies. The purpose of retrofitting is to reduce adverse impacts on the public's water resources, not to reduce the runoff benefits already provided by a natural system such as a wetland or water body. It is important that coordination and communication occur early in the planning of retrofit projects to avoid conflicts with other programs, jeopardizing both

Retrofitting presents many unique complex challenges - institutional, technical, and financial.

Institutionally, retrofitting is best accomplished through watershed approaches which emphasize regional facilities and nonstructural practices.

the project and relations with other agencies.

Retrofitting can be done through an almost limitless number of ways. These include the following broad categories:

Retrofitting existing stormwater quantity control structures

This approach is applicable only in those jurisdictions which have implemented a stormwater quantity management program to reduce flooding potential. In this case there will be numerous existing detention basins, perhaps both onsite and regional, that can be retrofitted to provide water quality treatment. This can be fairly easy and inexpensive to implement. However, these modifications must not reduce flood protection or the basin's required "live" storage volume so as to adversely impact downstream water levels or velocities.

Nearly any modification of an existing runoff control practice which will slow runoff velocities, increase detention time, or promote runoff flow through wetland vegetation will increase the removal of runoff pollutants. The simplest way to retrofit stormwater detention basins to improve water quality treatment is to modify the existing outlet structure to provide extended detention of a specific volume of runoff (treatment volume). These modifications frequently will not reduce flood control benefits because the goal in treating runoff usually is to capture part of the runoff (i.e., 0.5 to 1.0 inch) from frequent, small storms (i.e., annual or 2-yr storm), whereas flood control basins are designed to capture all of the runoff from rare, large events (i.e., 25 to 100-yr storm). If site conditions are appropriate, it is recommended that dry detention or failing infiltration systems be converted to a wet detention or constructed wetland system. The permanent pool elevation will probably have to be excavated below the existing facility bottom so storage volume is not reduced.

Even wet detention systems can be retrofitted to improve treatment by modifying the discharge structure. Wanielista and Yousef (1992) demonstrated the importance of setting the discharge structure elevation at or above the seasonal high water table elevation. Otherwise, the discharge structure constantly discharges ground water, serving as a dewatering device to lower water table elevations. At the Greenview Subdivision system, a \$250 modification to the discharge structure closed the original orifice and added a v-notched weir, raising the pond's control level above the seasonal high water table. This modification changed the system's performance from being a pollutant load exporter to re-

Even wet detention systems can be retrofitted to improve their treatment effectiveness.

A \$250 change to the outlet control at the Greenview Subdivision changed the system from a pollutant exporter to one with >60% removal.

moving over 60% of the average annual loading.

Using existing road crossings to impound stormwater

Roads, by their linear nature, cross watershed boundaries. Where they pass over drainage systems, they generally have an embankment that keeps the roadway elevated above an established flood elevation. The upstream inlet of the highway stormwater conveyance system can be modified to extend detention time, promoting runoff treatment. Since the roadway embankment was not designed as a dam, treatment should be by a dry, extended detention system. This will prevent a phreatic zone of saturation from developing through the embankment which could cause its slippage. Limited access highways offer several opportunities for retrofitting. Grassy medians, shoulders, swales, and cloverleaf interchanges all provide possible areas for runoff treatment. Often the area inside a cloverleaf can be excavated, contoured and "aquascaped" to create a beautiful detention or constructed wetland system. Of course, this retrofitting approach must be discussed, coordinated, and approved by the appropriate highway agency.

Demonstration projects

Retrofitting often is done as a demonstration project. It provides an opportunity not only to reduce stormwater pollutants, but to test innovative treatment practices, helping to increase the number of BMPs useful in highly urban areas. Demonstration projects tend to be limited to showing examples of innovative practices in a forum where they are visible, thereby testing practices which may have more widespread applicability. These projects often are conducted on public lands such as parks, schools, or government centers making them highly visible and great opportunities to educate the public and build program support.

Funding for most demonstration projects generally is provided from grants, special taxes, or fines. EPA's Section 319 nonpoint source management program funds many demonstration projects. Other potential EPA grant funds for urban runoff demonstration projects includes Section 104(b)(3), 314, and 320 programs. In some states, construction of urban runoff controls can be funded by the state's revolving loan fund.

Permit requirement

The issuance, modification, or renewal of water pollution control

It is important that coordination and communication occur early in the planning of retrofit projects to avoid conflicts with other programs, jeopardizing both the project and relations with other agencies or programs.

permits can provide an opportunity to reduce stormwater pollution. Stormwater treatment can be required as a permit condition, or as part of a watershed trading of point and nonpoint source pollutant loads. For example, renewal of a wastewater discharge permit may require installation of urban runoff controls within the facility's service area. Another example is the issuance of a Water Quality Certification for a storm drain project, where runoff treatment practices may be made a permit requirement.

One of the primary goals of the Section 319 NPS, the NPDES storm water permitting, and the combined sewer overflow programs is to reduce water quality problems caused by intermittent, wet weather discharges. These programs require the assessment of discharge loadings and targeting of priority watersheds. Ultimately, the goal is to retrofit the watershed using structural and nonstructural practices to reduce loadings from existing land uses.

Under the NPDES program, operators of permitted Municipal Separate Storm Sewer Systems must develop a program to eliminate illicit connections to the storm drain system. Eliminating these sources can greatly reduce runoff pollution discharged from the local runoff system to downstream receiving systems. It is strongly recommended that all jurisdictions implement a program to eliminate illicit discharges to the storm drainage system, even if not required to by the NPDES storm water program.

Retrofitting through education

Educating the general public can result in a significant, yet difficult to quantify, urban runoff quality control benefits. Given the extent of "Pointless Personal Pollution", we cannot rely on government rules, inspectors, and programs to address all the potential pollution sources within a watershed. Our every day activities add pollutants to streets, parking lots, lawns, and other surface throughout a watershed. Educating the public about how to reduce these pollutants and to be better stewards is an effective retrofitting tool. Possible public education topics include proper disposal of household chemicals and automotive wastes, how to properly use and dispose of lawn fertilizers and pest control chemicals, and rerouting water from roof drains onto pervious areas.

Public education also can increase the popularity and effectiveness of citizen watch programs, where the public helps regulatory agencies find pollution sources. By increasing awareness of pollution indicators, and providing simple notification procedures such as a toll free number, citizens can help fill the void that most

Given the extent of "Pointless Personal Pollution", public education must be part of any retrofitting program.

We cannot rely only on government rules, inspectors, and programs to reduce pollution sources throughout a watershed.

programs have with respect to inspectors.

Educating managers and staff at industrial operations has proven to be a very effective mechanism in reducing pollution. Pollution prevention has been embraced by many industries, not only to meet permit conditions or reduce pollution, but also to save money by recycling, reducing or reusing materials. Especially in existing urbanized areas, pollution prevention is one of the most practical and cost effective approaches to reducing urban runoff pollution.

2. Watershed specific approaches

There is general recognition that program effectiveness can be improved through comprehensive watershed approaches, where all elements can be considered together to maximize benefits and minimize costs. Watershed-wide approaches long have been used in runoff quantity control, where downstream flooding concerns, and prevention strategies, can only be addressed effectively when the entire contributing drainage area is considered. The same is true for urban runoff quality management, especially when trying to reduce pollutant loadings from developed areas.

Whether called "watershed management" or "ecosystem management", there is a growing recognition of the interrelationships of all aspects of land and water resources. In fact, land and water management are inseparable. For example, erosion and sediment control and stormwater management are needed because of changes in land use which alter vegetative, hydrologic and pollutant characteristics. Watershed approaches not only allow better integration of program elements but also allow for more accurate measurement of program costs, impacts, and benefits.

Almost all of the urban runoff control programs reviewed (87%) include some form of watershed approach as a program component. Problems being addressed by watershed approaches include flooding, water quality, stream channel erosion, and aquatic resource protection.

As specific information relating to watershed approaches was beyond the scope of this project, no information was requested regarding institutional aspects of watershed approaches. It is recognized that there has to be a number of components to watershed approaches which need to be considered, and guidance needs to be provided regarding those components. However, this document was developed to provide guidance in base program initiation and implementation.

There is general recognition that program effectiveness can be improved through comprehensive watershed approaches, where all elements can be considered together to maximize benefits and minimize costs.

There are many levels of watershed program implementation. The approach can be as simple as targeting a watershed for additional educational activities to reduce nutrient loadings. It also can be very comprehensive, using sophisticated hydrology and water quality computer models linked to geographic information systems. The costs and resource needs vary greatly. It is important to recognize that these latter approaches can be very expensive and resource intensive.

The level of watershed effort depends on the degree and magnitude of the problem. It also depends on the source of the problem and the flexibility of the program infrastructure to incorporate the results of the watershed analysis. This last issue is particularly important and must be considered "up front" when discussions about using watershed approaches begin.

It is popular to expect people and programs to "do more with less". A common misunderstanding is that watershed approaches can be performed with existing resources, stretching staff to absorb another function. This will not work. When planning a watershed approach, dedicated resources must be an integral part of the discussions. Simply coordinating a watershed project often is a full time job. Failure to anticipate resource needs or to schedule resources when they are needed can cause other program functions to suffer.

CONCLUSIONS

Implementation of a comprehensive urban runoff control program which includes the management of erosion, sediment, and stormwater is not a painless or quick process. Since this is a relatively new field, there are many unique challenges, not the least of which is the lack of experienced staff. It must be recognized that staff responsible for developing a program or elements of a program may not have years of experience in the many details which are critical to program success. Staff and program growing pains must be expected. Training individuals to perform plan reviews or conduct good inspections takes time. Problems will occur, mistakes will be made. Learn from these mistakes. Of course, it is important to minimize mistakes if the program is to be supported by management and the general public. That's why program evolution is so important. Also why it is unrealistic to expect programs to be implemented in a short time period.

Where program shortcomings or mistakes are identified, take time

Implementation of comprehensive urban runoff control programs which include erosion, sediment, and stormwater management is not a painless or quick process.

Problems will occur, mistakes will be made.

Learn from them.

The big Cs of watershed management:

Comprehensive

Continuity

Cooperation

Common sense

Communication

Coordination

Creativity

Cash

Commitment

to thoroughly evaluate why they occurred and to review possible alternative solutions. If a problem is related to the program's legal authority, then upper management and elected officials must be educated about how these problems are reducing program effectiveness, to gain their support revisions to laws or rules. If plan review, permitting, or enforcement processes are flawed administratively, carefully evaluate all alternatives before recommending changes. Be sure to involve the regulated community in evaluating alternative solutions.

If a program is mandated, placing obligations on other levels of jurisdictions, recognize that there will be a growth curve as inexperienced staff learn what items are important and how much flexibility is warranted on a specific project. These individuals must have someone to turn to when they have questions. Staff at the lead program agency must be available and prepared to provide extensive technical assistance and training to staff of implementing jurisdictions.

Finally, remember the "Big Cs of Watershed Management" as they provide a sound foundation upon which to build effective urban runoff control programs:

1. **COMPREHENSIVE** management of land use, water resources, and infrastructure throughout a watershed.
2. **CONTINUITY** of stormwater programs over a long period of time will be required to solve these problems.
3. **COOPERATION** between state, regional, and local governments, between cities and counties, between the public and private sectors, and all of our citizens is essential to prevent and solve problems.
4. **COMMON SENSE** in our institutional framework, approaches, and the way that way live our everyday lives, helping to reduce sources of "Pointless Personal Pollution."
5. **COMMUNICATION** is essential. Between entities involved in the implementation of programs; between the implementing agencies and the regulated community; of elected officials to obtain their support for the programs; and of all citizens so they will understand how their everyday activities can affect water quality and how they can and must be part of the solution.
6. **COORDINATION** of stormwater retrofitting to reduce pollutant loading with other infrastructure improvements or redevelopment is needed for cost-effective implementation and to maximize benefits.
7. **CREATIVITY** in both BMP technology and in our approach to solving this complex problem is vital.

8. **CASH** in large amounts will be needed to build new stormwater infrastructure and implement programs.
9. **COMMITMENT** to solving these problems so our children will have clean water, a high quality of life, and a vibrant economy will depend on putting our money where our mouth is.

Appendix A
Sediment and Stormwater Management
Program Questionnaire

Distributed to
9 Cities
10 Counties
5 Regional Authorities
8 States

**Sediment Control and Stormwater Management
Program Implementation Questionnaire**

Elements

1. Jurisdiction _____

2. Date of response _____

- State
- Regional
- County
- Municipality
- Conservation District
- Other (explain below)

3. Who contacted

Name _____

Title _____

Agency _____

Address _____

Phone# _____

4. Sediment control and stormwater management

Fax# _____

- Separate programs
- Integrated together

If separate, please provide the following information individually for both programs (questions 5, 6, and 7)

5. Legal citation for program authority _____

6. Legal citation for regulatory authority _____

7. Impetus for program development and implementation (more than one answer may apply).

- Flooding
- Stream channel erosion
- Resource protection*
- Other

- Water quality
- Groundwater recharge
- Required by other legislation (federal/state)

* If so, specify resources targeted by program _____

Stormwater Management Program Criteria

8. What is the basic objective or goal of the Stormwater Management Program?

A. Basis of Design Criteria (check all that apply)

- Peak Discharge Control
- Water Quality Treatment
- Volume Control

B. If peak discharge release rates are controlled, please specify the design criteria (use additional sheets if needed).

- Design storm(s): _____
- Performance standard: _____
- Maximum release rate(s): _____
- Downstream evaluation required: _____
- Downstream channel stability considered: _____

C. If stormwater treatment criteria have been established, please describe them and how they are achieved.

- Performance standard: _____
- Treatment volume: _____
- BMP's allowed: _____
- _____
- _____
- Specific design criteria: _____
- _____
- _____

D. If volume control criteria have been established, please describe them and how they are to be achieved.

- Performance standard: _____
- Applicability: _____
- _____
- Why included: _____
- _____

E. Exemptions and waivers

- Single Family Homes
- Agriculture
- Forestry
- Others or acreage limits (describe)
- _____

F. Practice Selection - Are any practices favored in general or in specific situations? (from a regulatory perspective)

- Yes
- No

If so, which practices and when are they favored?

G. Is the designer given any criteria or guidelines to select the practices?

Yes
No

If so, describe in general.

H. Management and Source Control Practices - Are they encouraged?

Yes
No

If yes, for what land uses?

What specific practices are favored by the program?

Is guidance available to the applicant?

Yes
No

If yes, please describe in general and list publications or documents.

Sediment Control Program Criteria

9. What is the basic rationale or philosophy for Erosion and Sediment Control (E&S) Program?

A. Please summarize the program's design criteria and performance standards.

Performance standard: _____

BMP's allowed _____

Specific BMP design _____

criteria _____

Volume requirements for _____

basins and traps _____

B. Exemptions and waivers

Single Family Homes

Agriculture

Forestry

Others or Acreage limits

(describe) _____

Program Authority and Implementation Structure

10. Program Implementation Structure (check all that apply)

	E&S	Stormwater
Federal criteria - federal implementation	<input type="checkbox"/>	<input type="checkbox"/>
Federal criteria - state implementation	<input type="checkbox"/>	<input type="checkbox"/>
State criteria - state implementation	<input type="checkbox"/>	<input type="checkbox"/>
State criteria - regional implementation	<input type="checkbox"/>	<input type="checkbox"/>
State criteria - local implementation	<input type="checkbox"/>	<input type="checkbox"/>
Regional criteria - regional implementation	<input type="checkbox"/>	<input type="checkbox"/>
Regional criteria - local implementation	<input type="checkbox"/>	<input type="checkbox"/>
Local criteria - local implementation	<input type="checkbox"/>	<input type="checkbox"/>

11. Project Permitting Procedures and Applicability. Describe activities permitted.

	E&S	Stormwater
Noticed Exemption	<input type="checkbox"/>	<input type="checkbox"/>
General Permit	<input type="checkbox"/>	<input type="checkbox"/>
Individual Permit	<input type="checkbox"/>	<input type="checkbox"/>
Other	<input type="checkbox"/>	<input type="checkbox"/>

If a mixture of more than one is used, describe when each is used.

12. When individual permits are required, is a comprehensive review of the design accomplished?

13. Describe the review given to applications for the various types of permitting procedures.
(please send a copy of the application form for each type of permitting process)

14. Are detailed checklists used to ensure consistency of review?

	E&S	Stormwater
Yes	<input type="checkbox"/>	<input type="checkbox"/>
No	<input type="checkbox"/>	<input type="checkbox"/>

If yes, please obtain a copy as a reference

15. Is the sediment control and/or the stormwater management approval required prior to other approvals or is it only required prior to the initiation of construction?

	E&S	Stormwater
Building permit	<input type="checkbox"/>	<input type="checkbox"/>
Grading permit	<input type="checkbox"/>	<input type="checkbox"/>
Zoning approval	<input type="checkbox"/>	<input type="checkbox"/>
Other	<input type="checkbox"/>	<input type="checkbox"/>

If other, please detail

Inspection Procedures

16. Are inspections required during construction?

	E&S	Stormwater
Yes	<input type="checkbox"/>	<input type="checkbox"/>
No	<input type="checkbox"/>	<input type="checkbox"/>

If yes, is there a frequency requirement: How frequent? E&S _____
Stormwater _____

17. Are the inspections accomplished by a public agency?

	E&S	Stormwater
Yes	<input type="checkbox"/>	<input type="checkbox"/>
No	<input type="checkbox"/>	<input type="checkbox"/>

If no to either, who conducts the inspections? E&S _____

Stormwater _____

If yes, is the inspection agency the same as the plan review agency?

	E&S	Stormwater
Yes	<input type="checkbox"/>	<input type="checkbox"/>
No	<input type="checkbox"/>	<input type="checkbox"/>

If no, who conducts the inspection? E&S _____

Stormwater _____

18. In the opinion of the person being interviewed, is the inspection frequency and procedure for E&S adequate to ensure adequate implementation and maintenance of BMP's during construction?

Yes	<input type="checkbox"/>
No	<input type="checkbox"/>

If no, why?

Program Funding

19. Program Funding - Please check these sources used for your program.

Erosion and Sediment Control

<u>Source</u>	<input type="checkbox"/>	<u>Annual Amount</u>
General appropriation	<input type="checkbox"/>	_____
Permit fees	<input type="checkbox"/>	_____
Stormwater utility fee	<input type="checkbox"/>	_____
Special taxing district	<input type="checkbox"/>	_____
Other	<input type="checkbox"/>	_____

If other is checked, please describe those sources.

Stormwater Management

<u>Source</u>		<u>Annual Amount</u>
General appropriation	<input type="checkbox"/>	_____
Permit fees	<input type="checkbox"/>	_____
Stormwater utility fee	<input type="checkbox"/>	_____
Special taxing district	<input type="checkbox"/>	_____
Other	<input type="checkbox"/>	_____

If other is checked, please describe those sources.

20. If known, what percentage of the program is funded by the sources?

Erosion and Sediment Control

<u>Source</u>	<u>Percentage</u>
General appropriation	_____
Permit fees	_____
Stormwater utility fee	_____
Special taxing district	_____
Other	_____

Stormwater Management

<u>Source</u>	<u>Percentage</u>
General appropriation	_____
Permit fees	_____
Stormwater utility fee	_____
Special taxing district	_____
Other	_____

Program Staffing

21. Program Staffing - How many persons are assigned to the programs?

Erosion and Sediment Control

<u>Full Time</u>	<u>Part Time</u>
Administrative _____	_____
Engineer _____	_____
Scientist _____	_____
Inspector _____	_____
Clerical _____	_____
Support _____	_____
Other _____	_____

Is the current staffing level adequate to effectively implement the programs?

Yes No

Stormwater Management

Full Time

Part Time

Administrative _____
 Engineer _____
 Scientist _____
 Inspector _____
 Clerical _____
 Support _____
 Other _____

Is the current staffing level adequate to effectively implement the programs?

Yes
 No

If additional staff is needed to provide effective program implementation, which category of staff is needed and how many (estimated)?

Erosion and Sediment Control

Administrative _____
 Engineer _____
 Scientist _____
 Inspector _____
 Support _____
 Other _____

Stormwater Management

Administrative _____
 Engineer _____
 Scientist _____
 Inspector _____
 Support _____
 Other _____

Program Educational Aspects

22. Public Education - Are educational programs a component of the stormwater/E&S Programs?

Yes
 No

A. Are these programs mandated by law or regulation?

Yes
 No

B. What is the intended audience of these programs?

Contractors	<input type="checkbox"/>	Developers	<input type="checkbox"/>
Consultants	<input type="checkbox"/>	Inspectors	<input type="checkbox"/>
General public	<input type="checkbox"/>	Other (please detail)	<input type="checkbox"/>

C. Do educational efforts and materials include the following items?

Brochures	<input type="checkbox"/>	Monitoring	<input type="checkbox"/>
Shows	<input type="checkbox"/>	Exhibits	<input type="checkbox"/>
Stenciling	<input type="checkbox"/>	Amnesty Days	<input type="checkbox"/>
Demonstration Projects	<input type="checkbox"/>		

D. How many individuals (approximately) and how often are educational programs given?

	Total number of individuals	How often given (#/yr.)
Contractors	_____	_____
Developers	_____	_____
Consultants	_____	_____
Inspectors	_____	_____
General public	_____	_____
Other	_____	_____

Program Enforcement and Compliance

23. Program Compliance - Are there penalty provisions for non-compliance with sediment control or stormwater management requirements?

Yes

No

A. Do the penalty provisions include the following items?

Civil penalties	<input type="checkbox"/>
Criminal penalties	<input type="checkbox"/>

B. What other options are available to ensure compliance?

Halting construction (stop work order)	<input type="checkbox"/>
Withholding occupancy permits	<input type="checkbox"/>
Withholding other permit applications	<input type="checkbox"/>
Other (code enforcement - please detail)	<input type="checkbox"/>

C. Please describe the civil and criminal penalties, including fines, detailed in law.

Civil _____

Criminal _____

D. Are the penalty provisions adequate to achieve site compliance?

Erosion and Sediment Control

Yes
 No

Stormwater Management

Yes
 No

24. Are as-built certifications required to be submitted to the permitting agency for completed stormwater management practices?

Yes
 No

If yes, are certifications required for the following practices?

	yes	no
Infiltration practices	<input type="checkbox"/>	<input type="checkbox"/>
Filtration practices	<input type="checkbox"/>	<input type="checkbox"/>
Ponds	<input type="checkbox"/>	<input type="checkbox"/>
Normal pool	<input type="checkbox"/>	<input type="checkbox"/>
Dry	<input type="checkbox"/>	<input type="checkbox"/>
Extended Detention	<input type="checkbox"/>	<input type="checkbox"/>
Peak only	<input type="checkbox"/>	<input type="checkbox"/>
Biofiltration	<input type="checkbox"/>	<input type="checkbox"/>

A. Are final inspections required, prior to "signing off" on a completed stormwater management practice?

Yes
 No

if yes, who conducts the inspection? _____

B. Can you indicate the numbers of practices constructed over the past two years?

	1992	1993
Infiltration	_____	_____
Swales	_____	_____
Basins	_____	_____
Trenches	_____	_____
Porous paving	_____	_____
Filtration	_____	_____
Ponds		
Normal pool	_____	_____
Dry		
Extended detention	_____	_____
Peak only	_____	_____
Wetlands	_____	_____
Biofiltration	_____	_____

Maintenance of Stormwater Management Practices

25. System Maintenance - Does the program require maintenance of completed stormwater management structures as a program requirement?

Yes

No

A. Responsibility for maintenance - Please list and describe the entities that are allowed to be responsible for maintenance.

Public agency _____

Private entity _____

Property owners association _____

Other _____

What agency ensures maintenance is accomplished?

B. Are maintenance inspections accomplished by appropriate government agency?

Yes

No

How often are inspections required? _____

C. Please detail the specific maintenance responsibilities.

D. Is a dedicated funding source available for maintenance of stormwater management structures?

Yes
 No

If yes, please describe how the funding is provided.

E. Are legal steps available in the event that needed maintenance is not accomplished.

Yes
 No

If yes, what steps may be taken?

Have these steps ever been taken?

Yes
 No

Program Coordination with Related Programs

26. Program Coordination

A. Is there significant coordination between the erosion and sediment control program and the stormwater management program?

Yes
 No

B. Is there significant coordination with other related programs?

Yes
 No

If yes, do these programs include the following?

Land use planning	<input type="checkbox"/>	Wastewater management	<input type="checkbox"/>
Zoning	<input type="checkbox"/>	Water supply	<input type="checkbox"/>
Building permit	<input type="checkbox"/>	Tree protection	<input type="checkbox"/>
Wetlands protection	<input type="checkbox"/>	Land acquisition	<input type="checkbox"/>
Floodplain management	<input type="checkbox"/>	Wellhead protection	<input type="checkbox"/>

27. Are there conflicts with other programs which prevent or hinder effective program implementation?

Yes
No

if yes, please briefly describe those conflicts.

28. Is there effective communication from federal agencies on related state and federal programs (e.g.. NPDES, NPS, etc.)?

Yes
No

29. Are there any measures of program or implementation success?

Yes
No

If yes, please describe those measures.

30. What areas of program or implementation improvement are needed?

Program Evaluation and Evolution

31. Are any research projects underway to assess stormwater impacts or performance efficiencies of sediment control or stormwater management practices?

Yes
No

If yes, briefly describe those research efforts.

Do you feel that the research efforts have widespread applicability?

Yes
 No

32. Monitoring - Is monitoring a program component for any of the following parameters?

Water chemistry
 Sediments
 Biologic
 Flow rates

33. Retrofitting - Does the program address retrofitting to reduce impacts from developed areas?

Yes
 No

If the answer is yes, does the retrofitting address any of the following?

Flooding
 Water quality
 Stream channel erosion
 Aquatic resources

34. Are watershed specific approaches being used?

Yes
 No

If yes, does the watershed approach include any of the following?

Regional stormwater management structures
 Waterbody targeting
 Nonstructural BMP's

If no, are they being considered for program implementation?

Yes
 No

General Questions

1. How long has the program been in existence?

2. Are there any pitfalls, based on experience, which should be avoided by others?

3. Please provide a brief history and evolution of the program.

4. Are there weaknesses which impede implementation?

5. Is there potential for consideration elsewhere?

6. Are there any additional thoughts?

Appendix B
Sediment and Stormwater Management
Program Summaries

Cities
Counties
Regional Authorities
States

SEDIMENT CONTROL AND STORMWATER MANAGEMENT PROGRAM SUMMARY

JURISDICTION: **CITY OF ALEXANDRIA, VIRGINIA**

Transportation and Environmental Services Department
Box 178
Alexandria, Virginia 22313

The erosion/sediment control program and the stormwater management program are separate programs but they are administered by the same staff.

The primary impetus for the program are the requirements imposed by federal, and especially, by state law.

The program's legal authority is established in the Code of Virginia, specifically in three laws:

1. Erosion and Sediment Control Act; Title 10.1, Chapter 5, Article 4.
2. Stormwater Management Act; Title 10.1, Chapter 6, Article 1.
3. Chesapeake Bay Preservation Act; Title 10.1-2000-2015.

Stormwater Management Program

Program Goals/Objectives To protect the public interest in Chesapeake Bay, its tributaries, and other State waters.
To promote the general welfare of the people of the Commonwealth.

Exemptions and Waivers Projects disturbing 2,500 sf or less of land

Preferred practices None promoted within the regulations. Developers prefer systems that are not land intensive, such as the D.C. sand filter or the Delaware sand filter, since these allow more economic use of their property.

Practices installed

<u>Practice</u>	<u>1992</u>	<u>1993</u>
Infiltration basin		1
Infiltration trenches	1	1
Filters	4	2
Wet detention pond	2	1
Extended dry detention	2	

Design criteria are specified in the *City's Supplement to the Northern Virginia BMP Handbook*.

Performance Standards and Design Criteria

Water Quality	New development shall have no net increase in pollutant loading. Redevelopment shall decrease	Treat the first half inch of runoff from impervious surfaces using BMPs appropriate for the site's conditions. loadings by at least 10%.
Peak Discharge	No increase in rate	Post-development peak rate shall not exceed pre-development rate for the 2-yr. and 10-year, 2-hour storms
Volume	None	

Downstream evaluation is required to assure protection of downstream channel stability.

Available Publications *City's Supplement to the Northern Virginia BMP Handbook.*

Source Controls City is developing a Non-structural BMP Handbook for Auto-related businesses which will include practices designed to capture and recycle oils, lubricants, fuels, antifreezes, etc. Scheduled publication is 1995.

Erosion and Sediment Control Program

Program goal/objective To prevent off-site sediment transport by water or air.

Exemptions and waivers Activities disturbing 2,500 ft² or less of area

Preferred Practices Sediment basins and traps which are designed to capture 15 yd³/acre drainage area. Other practices allowed include silt fence, gravel construction entrance, slope protection, temporary and permanent vegetative stabilization.

Design Criteria Specified in *Virginia Erosion and Sediment Control Handbook.*

Program Authority and Implementation

Both the erosion/sediment control program and the stormwater management program are implemented using state and local criteria which are administered by the local government program.

Project permitting A separate permit is not issued. Approval is given by stamping "Approved" and by having the City Engineer sign the signature block on the detailed erosion/sediment control plan and stormwater management plan. Unless signed, the plan can not be used in the field.

Legal entities include	City for BMPs serving public lands Private owner Property owners association
Inspection frequency	Semi-annually
Oversight agency	Construction and Inspection Division, Alexandria Transportation and Environmental Services Department
Operation/Maintenance activities	Not specified, depends on type of system
Funding source	General tax revenues
Enforcement mechanism	After notification and waiting period, City can perform necessary O/M and bill property owner. Repeated failure to maintain can lead to withdrawal of all City permits to use the property.

Program Resources

The erosion/sediment control and stormwater management programs are funded by the City's general appropriations fund. The programs are not separate budget entities but are buried within the overall Department budget.

<u>Program Staffing</u>	<u>Position</u>	<u>Full Time</u>	<u>Part Time</u>	<u>Needed</u>
	Administrative		2	
	Engineer		1	
	Inspector		7	
	Scientist		1	
	Support		1	
	Clerical		2	

Educational Programs

Educational programs are not a component of the two programs. The City plans to implement educational programs when required to by the Phase 2 NPDES Municipal Stormwater Permitting Program.

Program Coordination

There is close coordination between the City's erosion/sediment control and stormwater management program.

The City programs also are integrated with local land use planning, zoning, wetlands protection, tree protection, floodplain management, wastewater management, water sup-

ply, and building approval programs.

Program Evaluation

Measures of success	None
Research projects	Sampling two Delaware sand filters for 30 storms to determine water quality treatment ability. In the future, will be monitoring filter serving City leaf composting facility and also a regional wet detention system
Monitoring	Water chemistry, flow rates

Program Evolution into Watershed Approach

The City's erosion and sediment control ordinance was passed by the City Council in February 1972, in response to passage of the Virginia Erosion and Sediment Control Act. The stormwater program began in January 1992 in response to requirements set forth in the 1988 Virginia Chesapeake Bay Preservation Act and the 1990 Virginia Stormwater Management Act.

Watershed approaches are being used on a limited basis for very small streams and an expansion of this approach is being considered.

**SEDIMENT CONTROL AND STORMWATER MANAGEMENT
PROGRAM SUMMARY**

JURISDICTION: CITY OF AUSTIN, TEXAS

Environmental and Conservation Services Department
206 East Ninth Street, Suite 17.102
Austin, Texas 78701

The erosion/sediment control program and the stormwater management program are integrated programs. To reduce and prevent urban stormwater problems the City of Austin has enacted three major watershed ordinances:

- The Comprehensive Watersheds Ordinance, 1986
- The Urban Watersheds Ordinance, 1991
- The Barton Springs Ordinance, 1992

The primary impetus for the program includes flooding, water quality, ground water re-charge, and protection of special resources such as the Edwards Aquifer, Colorado River and its associated riverine lakes.

The program’s legal authority is established in:

1. Texas Water Code, Chapter 26 (Water Quality Control)
2. Chapter 13-2, Austin City Code (Land Use)
3. Chapter 13-6, Austin City Code (Drainage)
4. Chapter 13-7, Austin City Code (Environmental Protection and Management)
5. Chapter 4-1, Austin City Code (Water Quality)

Stormwater Management Program

Program Goals/Objectives	<p>To protect citizens from potential flooding.</p> <p>To preserve the natural and traditional character of the City’s waterways.</p> <p>To protect the water quality of the Edwards Aquifer and the City’s drinking water supply.</p> <p>To protect the City’s recreational and aesthetic resources such as Town Lake and Barton Springs.</p>
Exemptions and Waivers	<p>Agriculture, State facilities</p> <p>Single family homes on platted lots are exempt from stormwater requirements but not erosion/sediment</p> <p>Single family subdivisions with a minimum lot size > 5 ac</p> <p>Preferred practices Sedimentation/filtration basins for stormwater quality and dry detention systems for flood</p>

control. Other practices allowed include wet detention, retention/irrigation, and filter strips.

Practices installed	<u>Practice</u>	<u>1992</u>	<u>1993</u>
	Filtration	40	60
	Wet detention	2	2
	Extended dry detention	2	2
	Peak detention control	50	70

Design criteria for sedimentation/filtration systems set in *Environmental Criteria Manual*. Other BMP designs are approved on a case-by-case basis.

Performance Standards and Design Criteria

Water Quality	No adverse water quality impacts	Use sedimentation/filtration to treat minimum of one-half inch plus 0.1" for each 10% increase in impervious area above 20%
	Within Barton Springs "zone"	No increase in pollutant loading for the 13 parameters listed in the Save Our Springs Ordinance
Peak Discharge	No increase in peak rate, no increase in streambank erosion	Post-development rate can not exceed pre-development for a 2, 10, 25, and 100-yr, 24-hr storm
Volume	None	

Downstream evaluation is required with evaluation of downstream channel stability. New performance and design criteria are being established.

Available Publications *Environmental Criteria Manual*
 Guidance for Compliance with the Technical Requirements of the SOS Ordinance

Source Controls The "Save Our Springs Ordinance" requires all land uses within the Barton Springs watershed to use source controls including limits on turf grass and landscaped areas, integrated pest management plans, restrictions on chemical storage, and homeowner education packets which include information on lawn care, pest treatment, recycling, house waste disposal, and general watershed information.

The City's Environmental Criteria Manual is being revised to include guidance on the above source controls. This information currently is available in "Guidance for Compliance with the Technical Requirements of the SOS Ordinance".

Erosion and Sediment Control Program

Program goal/objective	To prevent/minimize sedimentation in recreational lakes (Town Lake, Lake Austin, Lake Travis) and in urban creeks.
Exemptions and waivers	Agriculture State facilities Projects disturbing < 1000 ft ²
Preferred Practices	Sediment basins and traps which are designed for 1800 yd ³ /acre drainage area. Other practices allowed include construction sequencing, rock berms, filter dikes, diversion swales, temporary and permanent vegetative stabilization.
Design Criteria	Specified in <i>City's Environmental Criteria Manual</i>

Program Authority and Implementation

Both the erosion/sediment control program and the stormwater management program are implemented using local criteria administered by the local government program.

Project Permitting	Erosion/sediment control approvals include noticed exemptions and general permits for certain projects. For most projects, erosion and sediment control and stormwater management approval is part of the City's development approval process which leads to the issuance of a development permit.
Review process	The development approval process follows a sequence involving zoning, subdivision approval, development permit, and then building permit. All grading, erosion/sediment control, stormwater management plans along with supplemental technical information and supporting calculations is reviewed and approved by the city's staff. A detailed checklist is used for reviewing both the erosion/sediment control plan and the stormwater plan.

Erosion/sediment control and stormwater management approval is required before issuance of a development or building permit.

Inspections

Erosion/sediment controls	Required as needed to assure proper maintenance and operation and at the start of each construction phase; performed by city inspectors.
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<u>Program Funding</u>	<u>Source</u>	<u>Amount</u>		
Erosion/sediment control	General appropriation	\$ 250,000 (33%)		
	Permit fees	\$ 250,000 (33%)		
	Stormwater utility fee	\$ 250,000 (33%)		
Stormwater management	General appropriation	\$ 250,000 (3%)		
	Permit fees	\$ 250,000 (3%)		
	Stormwater utility fee	\$7,500,000 (94%)		
<u>Program Staffing</u>	<u>Position</u>	<u>Full Time</u>	<u>Position</u>	<u>Full Time</u>
ES/SW	Administrative	1/4	Inspector	7/8
	Engineer	2/16	Clerical	1/6
	Scientist	4/26	Support	1/6

Educational Programs

Educational programs are a voluntary component of the program. Brochures, presentations, exhibits, and storm sewer stenciling are used to reach the target audience of contractors, and the general public. Workshops are conducted for contractors every few years with ongoing programs provided for the general public.

Program Coordination

There is close coordination within the City’s integrated erosion/sediment control and stormwater management program.

The City programs also are integrated with local land use planning, zoning, wetlands protection, floodplain management, tree protection, wellhead protection, and building approval programs.

The City program has conflicting objectives regarding prevention or minimization of flooding and streambank erosion control and the goal of environmental preservation of its creeks and waterways.

There is effective communication from federal agencies on related programs.

Program Evaluation

Measures of success City has an extensive surface and ground water quality monitoring program and monitors the discharge from stormwater systems.

Research projects Evaluation of the treatment effectiveness of sand filtration basins, wet detention ponds, oil and grit separators, and inlet filters.

Monitoring Water chemistry, sediment, biological, and flow rates

Program Evolution into Watershed Approach

In response to relatively common flash flooding and the city's rapid growth, erosion/sediment control regulations, and floodplain and stormwater quantity regulations establishing peak discharge controls were implemented in the mid-1970s. In the early 1980s, stormwater quality requirements were implemented. In 1982, a drainage fee was established to provide a reliable funding source with the Drainage Utility being established in 1991. Watershed protection ordinances were implemented in 1986, 1991, and 1992.

Retrofitting is being pursued to help decrease flooding, water quality, stream channel erosion, and aquatic resource impacts.

Watershed approaches are being used including regional stormwater management systems, water body targeting, and emphasis on nonstructural BMPs.

**SEDIMENT CONTROL AND STORMWATER MANAGEMENT
PROGRAM SUMMARY**

JURISDICTION: **CITY OF BELLEVUE, WASHINGTON**
 Stormwater Utilities Department
 P.O. Box 90012
 Bellevue, Washington 98009-9012

The erosion/sediment control program and the stormwater management program were integrated programs from 1974 -1993. City reorganization in 1993 led to the erosion and sediment control program being assigned to a different department.

The primary impetus for the program is community interest in protecting its streams, riparian habitat, water quality, aquatic life, wetlands, and steep slopes. Other impetus for the program includes flooding, stream channel erosion, and ground water recharge.

The program’s legal authority is established in:

1. Ordinance 2003 (Established stormwater utility)
2. Chapter 24.06, City Code (Stormwater Utility Code)
3. Chapter 24.08, City Code (Stormwater Inspection/Maintenance Code)
4. Chapter 23.76, City Code (Clearing and Grading Code)

Stormwater Management Program

Program Goals/Objectives	<p>Minimize water quality degradation and sedimentation of water bodies and loss of wildlife habitat.</p> <p>Minimize impacts of increased runoff, erosion, and sedimentation caused by improper land development</p> <p>Maintain and protect ground water resources</p> <p>Decrease potential landslide, flood, and erosion damage to private and public property.</p>
Exemptions and Waivers	<p>Agriculture</p> <p>Forestry</p> <p>Single family homes that are not part of a plat</p>
Preferred practices	<p>None promoted within the regulations. Require a site specific stormwater plan that uses appropriate BMPs. BMPs allowed include wet detention, swales, filters, catch basin inserts, oil-water separators, coalescing plate separators. Infiltration practices are not allowed because of the City’s slowly percolating soils and past</p>

experience with clogging.

Practices installed	<u>Practice</u>	<u>1992</u>	<u>1993</u>
	Filtration	1	
	Extended dry detention	4	4
	Biofiltration	6	7

Design criteria are specified in Chapter 4, City of Bellevue Development Standards, which are being revised to provide better guidance.

Performance Standards and Design Criteria

Water Quality	No specified performance std.	Treat the runoff from a 6 month, 24 hour storm using BMPs appropriate for the site.
Peak Discharge	100 year storm protection	Sites < 5 acres, < 0.2 cfs/acre Sites > 5 acres, post-development can not exceed pre-development for a 2-yr. and 10-yr, 24-hr storm
Volume	100 year storm protection	For detention systems, require a multiple release rate

Downstream evaluation is required with maximum velocity specified to assure protection of downstream channel stability.

Available Publications	<i>BP How to Manual</i> <i>Water Quality Protection for Bellevue Businesses</i> <i>Consumer Choices - Car Care, Lawn & Garden Care, Home & Maintenance</i>
Bldg	<i>Business Partners Brochure</i> <i>Stream Team Guidebook or Brochure</i> <i>Storm Drain Stenciling Brochure</i> <i>IPM Notebook</i>

Source Controls	The City has monitored the effectiveness of source controls and encourages their uses, especially for construction activities and for gasoline-related and food-related businesses. Guidance is available through publications such as “Business Partners for Clean Water”, “Car Care”, “Lawn and Garden Care”, “IPM Notebook”, “Stream Team”, etc.
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Erosion and Sediment Control Program

Program goal/objective	To prevent water quality impacts and destruction of stream and
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	aquatic life habitats by preventing off-site sediment transport.
Exemptions and waivers	None
Preferred Practices	<p>Sediment basins and traps which are designed to contain the runoff volume from:</p> <ul style="list-style-type: none"> · a 10-yr storm for sites < 5 acres or > .25 mile from waters · a 20-yr storm for sites > 5 acres or < .25 mile from waters <p>Other practices allowed include seasonal limits on disturbed area, silt fence, gravel construction entrance and wheel washes, slope protection, temporary and permanent vegetative stabilization.</p>
Design Criteria	Specified in <i>Bellevue Development Standards, Chapter 2 and Construction and Water Quality</i> , King County Conservation District, April 1981.

Program Authority and Implementation

Both the erosion/sediment control program and the stormwater management program are implemented using state and local criteria which are administered by the local government program. Within the Puget Sound watershed, erosion/sediment control and stormwater management programs are required at the local level as of January 1, 1995.

Project Permitting	Individual permit issued as part of the development approval process which includes discretionary permits for commercial projects or plat approval for residential projects.
Review process	<p>The preliminary erosion/sediment control plan and stormwater management plan are reviewed as part of the development approval process. The construction drawings for the ES Control Plan are reviewed and approved by the Dept. of Community Development as part of the issuance of a clearing and grading permit. The construction drawings for the approved stormwater system are reviewed by the Utilities Department as part of the storm extension permit.</p> <p>A detailed checklist is used for reviewing both the erosion/sediment control plan and the stormwater plan.</p>

Erosion/sediment control and stormwater management approval is required before issuance of a building permit or a grading permit.

Inspections

Erosion/Sediment Controls	Required as needed, usually conducted daily by the Dept. of Community Development.
Stormwater systems	Required as needed, usually conducted daily during construction and periodically afterwards by inspectors from the Utilities Department.

Program Enforcement and Compliance

Penalty provisions are a program component. They include civil and criminal penalties. Criminal penalties for failure to maintain a stormwater system includes fines of up to \$500 or imprisonment in City jail for up to 90 days with each day of violation a separate offense.

Other enforcement procedures	Stop work order (found to be very effective) Withhold occupancy permits Withhold other permits
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As-built certifications are required for all stormwater management systems.

Final inspection of stormwater systems is performed by Utilities Department inspector with assistance from the maintenance and operations staff.

Maintenance of Stormwater Systems

Maintenance of completed stormwater systems is required.

Legal entities include	City for BMPs serving public lands, systems accepted for Operation/Maintenance by the City, and detention systems. Private owner for commercial/industrial systems. Property owners association for residential systems.
Inspection frequency	Once every two years
Oversight agency	City Utilities Department
Operation/Maintenance activities	Not specified, depends on type of system. Must maintain the function and integrity of the system.
Funding source	Stormwater utility fee
Enforcement mechanism	Private maintenance inspector ordinance. City notifies owner of needed maintenance which must

be performed within specified time

Program Resources

The erosion/sediment control and stormwater management programs are separate budget entities.

<u>Program Funding</u>	<u>Source</u>	<u>Amount</u>
Erosion/sediment control	Permit fees	\$450,000
Stormwater management	Stormwater utility fee + Permit fees	\$500,000

<u>Program Staffing</u>	<u>Position</u>	<u>Full Time</u>	<u>Part Time</u>	<u>Needed</u>
ES/SW	Administrative	1/1		
	Devel. Review	2/1	1/3	
	Supervisor		2/1	
	Inspector	3/1	1/1	
	Support	1/1		
	Other	1		

Educational Programs

Educational programs are a voluntary component of the two programs. Brochures, presentations, exhibits, storm sewer stenciling, demonstration projects, and education/training workshops are used to educate the targeted audience of contractors, consultants, developers, businesses, residents, and schools. During a typical year the program will include one general workshop for industry with about 60 attendees; one-on-one workshops for certain business categories (i.e., property managers, landscapers, automobile businesses, restaurants) with about 10 attendees at each; three to four sessions for the general public with about 30 residents at each; and about 30 general audience programs throughout the year.

Program Coordination

There is close coordination between the City’s erosion/sediment control and stormwater management programs.

The City programs also are integrated with local land use planning, zoning, wetlands protection, tree protection, floodplain management, wastewater management, water supply, land acquisition, and building approval programs.

The City programs have conflicts with other City programs including:

- Land Use Code landscaping requirements conflict with biofiltration requirements
- Transportation Code promotes paving and use of storm sewers which conflict with stormwater program’s promotion of swales and pervious areas.

Program Evaluation

Measures of success	City has performed extensive water quality monitoring which shows that the City's programs have been effective in reducing the effects of urbanization on environmental quality.
Research projects	Sampling the following BMPs: <ul style="list-style-type: none">· Wet detention ponds to determine P removal· Calcitic sand filters to determine P removal· Alum injection into a stormwater vault to enhance P removal· Water quality rate structure· Regional detention facilities to optimize water quality
Monitoring	Water chemistry, sediment, flow rates

Program Evolution into Watershed Approach

In 1974, the city implemented its Storm and Surface Water Utility in response to citizen concerns that urbanization was destroying the city's streams and threatening properties adjacent to streams. In 1976, a Drainage Master Plan was prepared to address the most immediate issues of flooding and in-stream scour. The plan relied on on-site and regional controls with emphasis on using open stream channels, as opposed to storm sewers, to convey runoff. With successful flood control systems in place, recent emphasis has shifted to stormwater quality with special focus on proper maintenance of practices. An extensive public education program has been implemented to gain citizen support for the program and to teach citizens and businesses how they can reduce stormwater pollutants at the source.

Retrofitting is required for some redevelopment projects to help decrease water quality and stream channel erosion impacts.

Watershed approaches are being used including regional stormwater management systems, water body targeting, and emphasis on nonstructural BMPs.

**SEDIMENT CONTROL AND STORMWATER MANAGEMENT
PROGRAM SUMMARY**

JURISDICTION: **CITY OF FORT COLLINS, COLORADO**
 Stormwater Utility Department
 235 Matthews Street
 Fort Collins, Colorado 80526

The erosion/sediment control program and the stormwater management program are integrated programs.

The primary impetus for the program includes flooding, water quality, and stream channel erosion.

The program’s legal authority is established in:

1. Chapter 26, Article VII, Ft. Collins City Code (Stormwater Utility)

Stormwater Management Program

Program Goals/Objectives	To properly drain and control storm and surface waters so as to reduce pollution and enhance the environment, and to safeguard and protect the health, property, safety, and welfare of the city and its inhabitants.
Exemptions and Waivers	Agriculture and forestry not covered by ordinance
Preferred practices	None

Design criteria for peak flow and erosion/sediment controls are provided in the Fort Collins Storm Drainage Design Criteria and Construction Standards.

Performance Standards and Design Criteria

Water Quality	None	
Peak Discharge	Depends on basin, can require detention with no increase in rate	Post-development rate for 100-yr, 1 to 3hr. storm can not exceed historic rate for a 2-yr, 1to3 hr storm.
Volume	None	

Downstream evaluation is required for discharges to master planned facilities but there are no criteria for downstream channel stability.

Available Publications	Ordinances Brochures - Stormwater Utility Community Streams - Clean or Under Attack Irrigation Ditches
Source Controls	They will be encouraged as part of the city's NPDES MS4 permit program which will favor pollution prevention for all land uses. Passive treatment methods will be incorporated into master planned drainages to promote habitat protection and restoration.

Erosion and Sediment Control Program

Program goal/objective	None listed - see stormwater program. Performance standard during construction is an erosion rate no greater than 115% of the historic rate while post-development must not exceed historic erosion rate.
Exemptions and waivers	Single family homes
Preferred Practices	Sediment basins and traps which are designed for 100 yd ³ /acre. Other practices allowed include straw bales, surface roughening, diversions, gravel filters, filter fence, inlet barriers, terraces, and temporary and permanent vegetative stabilization.
Design Criteria	<i>Fort Collins Storm Drainage Design Criteria and Construction Standards.</i>

Program Authority and Implementation

Both the erosion/sediment control program and the stormwater management program are implemented using local criteria administered by the local government program.

Project Permitting	Erosion/sediment control and stormwater management approval are part of the City's development approval process. An individual permit also is required for any stormwater discharge to the city's NPDES permitted system.
Review process	Erosion/sediment control and stormwater (drainage) management plans along with supplemental technical information and supporting calculations are reviewed and approved by the city's development review staff. A detailed checklist is used for reviewing both the erosion/sediment control plan and the stormwater (drainage) plan.

Erosion/sediment control and stormwater management approval is required before issu-

ance of a building permit.

Inspections

Erosion/sediment controls	None required
Stormwater systems	None required during construction

Program Enforcement and Compliance

Penalty provisions are a program component. They include civil and criminal penalties. Civil penalties are a misdemeanor with a maximum fine of \$1,000 per occurrence of code violation. Performance bonds are required for erosion control while criminal penalties can be used for water quality impacts.

Other enforcement procedures	Stop work order Withhold occupancy permits
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As-built certifications are required for all stormwater (peak discharge) systems.

Final inspection of stormwater systems is not performed.

Maintenance of Stormwater Systems

Maintenance of completed stormwater systems is required.

Legal entities include	City (stormwater utility) Developers until vegetation well established
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Inspection frequency	Annually
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Oversight agency	Stormwater utility
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Operation/Maintenance activities	Utility maintains a map and inventory of all facilities. Mowing is done by city crews and private contractors, repairs such as structural, sediment removal, and vegetation are done as part of the minor capital improvements program.
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Funding source	Stormwater utility fee
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Enforcement mechanism	Failure to perform vegetation maintenance is a violation of the city’s Vegetative Management Ordinance. City can also perform needed maintenance and place a tax lien on the property.
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Program Resources

<u>Program Funding</u>	<u>Source</u>	<u>Amount</u>
Erosion/sediment control	Stormwater utility fee	\$20,000 (Inspections)
Stormwater management (FY95 proposed budget with \$4.2 million for capital improvements)	Stormwater utility fee	\$6,600,000

<u>Program Staffing</u>	<u>Position</u>	<u>Full Time</u>	<u>Part Time</u>	<u>Needed</u>
ES/SW	Administrative	0/1		
	Engineer	0/9	0.25/0	
	Scientist	0/0		0/1
	Inspector	1/1	0.75/0	0/1
	Clerical	0/2		
	Support	0/1		0/2

NOTE: Engineering staff is divided among development review (3), master planning (2), floodplain management (1), capital projects (1), water quality (1), and business management (1).

Educational Programs

Educational programs are a voluntary component of the program. Brochures, presentations, exhibits, monitoring, and storm sewer stenciling are used to reach the general public target audience. From ten to fifteen educational programs are conducted annually for the general public.

Program Coordination

There is close coordination within the City’s integrated erosion/sediment control and storm-water management program.

The City programs also are integrated with local wetlands protection, floodplain management, tree protection, land acquisition, and building approval programs.

Conflicts observed are the fundamental conflicts between wanting to develop as much land as possible and floodplain management and environmental protection of wetlands and riparian areas.

There is effective communication from federal agencies on the nonpoint source programs through “NPS News Notes” but communication on the NPDES stormwater permitting program, especially on the concept of MEP, needs to be improved.

Program Evaluation

Measures of success	City has initiated a limited water quality monitoring network.
Monitoring	Water chemistry, biological, and flow rates.

Program Evolution into Watershed Approach

The city's stormwater utility was implemented in 1980 with a rate structure based on drainage basins. The primary focus is flood control with water quality receiving attention since 1983. Erosion control criteria were implemented in 1990. Expansion of the program into environmental and water quality protection will be expanded in 1994 with the adoption of a new watershed management strategy.

Retrofitting is being pursued to help decrease flooding and improve water quality.

Watershed approaches are being used including regional stormwater management systems, water body targeting, and emphasis on nonstructural BMPs.

SEDIMENT CONTROL AND STORMWATER MANAGEMENT PROGRAM SUMMARY

JURISDICTION: ***CITY OF OLYMPIA, WASHINGTON***

Water Resources
P.O. Box 1967
Olympia, Washington 98507

The erosion/sediment control program and the stormwater management program are integrated programs. The program is required by the Puget Sound Water Quality Management Plan.

The impetus for the program includes flooding, stream channel erosion, water quality, ground water recharge, protection of aquatic habitat, and mandates from federal or state government.

The program's legal authority is established in:

1. Chapter 13.16, Olympia City Code (Storm and Surface Water Utility).

Stormwater Management Program

Program Goals/Objectives	To treat stormwater. To mitigate the impacts of increased runoff due to urbanization. To maximize infiltration on and minimize runoff from developed property. To facilitate ground water recharge such that stream/wetland baseflows can be adequately maintained year-around.
Exemptions and Waivers	Agriculture Forestry Single family homes (must do abbreviated plan) Other minor projects
Preferred practices	Hierarchy of treatment practices established: <ul style="list-style-type: none">· Constructed wetland for sites > 12 acres impervious.· Wet pond and sand filters for sites < 12 acres impervious.· Biofiltration for sites < 12 acres impervious.· Wet detention vaults for sites < 2 acres impervious.

Practices installed	<u>Practice</u>	<u>1992</u>	<u>1993</u>
	Infiltration basins	5	5
	Infiltration trenches	5	5
	Wet detention	10	10
	Biofiltration	20	20
	Peak dry detention	10	10

Design criteria and guidance are given in the *Olympia Drainage Design and Erosion Control Manual*. Experimental BMPs are allowed after review and approval.

Performance Standards and Design Criteria

Water Quality	80% removal of suspended solids	Treat the runoff volume from a 6-month 24-hour storm.
Peak Discharge	No increase in rate.	Post-development rate can not exceed pre-development rate for a 2- and 100-yr, 24-hr storm. Maximum release rates of 0.04 cfs/acre for 2-yr and 0.35 cfs/acre for 100-yr storm.
Volume	Maintain 100-yr volume on-site	Must infiltrate all of the 100-yr volume if percolation rate > 6 in/hr on-site. If percolation rate is 0.5 to 6.0 in/hr, must infiltrate part of volume.

Downstream evaluation is required with maximum velocity specified to assure protection of downstream channel stability.

Source Controls The City encourages all land uses to use source controls and requires all maintenance plans to include a pollution source control section specifically developed for the type of site. The pollution source control section must incorporate relevant information from the *Stormwater Management Manual for the Puget Sound Basin* (February 1992). Specific practices encouraged include roofing operations or storage areas, placing berms around barrels to provide secondary containment, directing wash water to sanitary sewer system, proper waste disposal, good housekeeping especially around outside dumpsters.

Erosion and Sediment Control Program

Program goal/objective To prevent sediment from crossing a project's boundaries or entering water bodies.

	To emphasize erosion prevention first, then sediment treatment Performance standard is to retain sediment on-site.
Exemptions and waivers	Agriculture Forestry Public works and private sector projects within the right-of-way which do not add impervious surface. Grading projects for which no grading permit is required.
Preferred Practices	Sediment basins and traps designed to hold the 2-yr, 24-hr storm volume. Other practices allowed include seasonal limits on disturbed area, silt fence, straw bales, gravel construction entrance, slope protection, inlet protection, and temporary and permanent vegetative stabilization.
Design Criteria	Specified in <i>Olympia Drainage Design and Erosion Control Manual</i> and in <i>Stormwater Management Manual for the Puget Sound Basin, Volume II</i> (February 1992).

Program Authority and Implementation

Both the erosion/sediment control program and the stormwater management program include state criteria with regional and local implementation, regional criteria with regional and local implementation, and local criteria which are administered by the local government program. Within the Puget Sound watershed, erosion/sediment control and stormwater management programs are required at the local level as of January 1, 1995.

Project Permitting	Individual permit issued as part of the development approval process.
Review process	The erosion/sediment control plan and stormwater management plan are reviewed as part of the development approval process. Engineering drawings, specifications, calculations, site investigations, and maintenance plans must be submitted for review by the City staff to determine compliance with local requirements. A detailed checklist is not used. However, chapter 3 of the Manual serves as a checklist.

Erosion/sediment control and stormwater management approval is required before any development, building, or other related permit is issued. Grading/clearing permits often are granted at the same time as erosion/sediment control plan approval but before final stormwater plan approval to allow installation of ES controls.

	source control plan.
Funding source	Stormwater utility fee, \$600,000 dedicated to O&M.
Enforcement mechanism	For those systems built after 1991 when maintenance agreements were required, city can perform necessary O&M after notification and waiting period, then bill property owner.

Program Resources

<u>Program Funding</u>	<u>Source</u>	<u>Amount</u>
Erosion/sediment control	Permit fees	\$10,000 (50%)
	Stormwater utility fees	\$10,000 (50%)
Stormwater management	Permit fees	\$10,000 (33%)
	Stormwater utility fees	\$50,000 (67%)

<u>Program Staffing</u>	<u>Position</u>	<u>Full time</u>	<u>Needed</u>
ES/SW	Engineer	0.05/0.15	
	Inspector	0.20/0.2	0.3/0
	Clerical	0.05/0.05	
	Support	0.10/0.2	

Educational Programs

Educational programs are a required component of the program. Brochures, seminars, exhibits, demonstration projects, monitoring, and storm sewer stenciling are used to educate the targeted audience of contractors, developers, consultants, inspectors, plan reviewers, elected officials, and the general public. During the past year three programs attracted a total of 40 contractors, 15 developer, 25 consultants, and 20 inspectors. Twenty plan reviewers attended one of four seminars while the ten Stream Team activities reached over 200 citizens.

Program Coordination

There is close coordination within the City’s integrated erosion/sediment control and storm-water management program.

The City’s program also is integrated with local land use planning, zoning, wetlands protection, floodplain protection, tree protection, land acquisition, wellhead protection, water supply, and building approval programs.

Conflicts arise between the stormwater management program's environmental protection goals and the Community Development Department's goal of economic development and raising revenues by issuing building permits. The Water Resources Department staff wrote the program's standards but they are administered by the Community Development Department staff which does not fully understand them. Long-range planning, especially for transportation, does not always consider stormwater impacts.

Program Evaluation

Measures of success	Design and implementation of better designed projects which comply with the City's requirements
Research projects	Testing experimental sidewall infiltration system Test recommendations from the Impervious Surface Reduction Study.
Monitoring	Water chemistry, sediments, and flow rates

Program Evolution into Watershed Approach

The program was started in 1990. Coordination between the Water Resources Program and the Community Planning and Development Department, which is responsible for plan reviews, permits, and inspections, has been very challenging.

The program addresses retrofitting developed areas to reduce flooding, water quality degradation, and stream channel erosion.

Watershed approaches are being used including regional stormwater management systems, water body targeting, and emphasis on nonstructural BMPs.

SEDIMENT CONTROL AND STORMWATER MANAGEMENT PROGRAM SUMMARY

JURISDICTION: **CITY OF ORLANDO, FLORIDA**

Stormwater Utility Bureau
400 S. Orange Avenue
Orlando, Florida 32801

The erosion/sediment control program and the stormwater management program are integrated programs.

The primary impetus for the program includes flooding, water quality, stream channel erosion, ground water recharge, and protection of water and soil resources.

The program's legal authority is established in:

1. Chapter 403, Florida Statutes (Environmental Act)
2. City Code, Chapter 31, Stormwater Utility Code
 Chapter 60, Subdivision and Landscaping
 Chapter 63, Environmental Protection
3. City Comprehensive Plan, Stormwater and Aquifer Recharge Element

Stormwater Management Program

Program Goals/Objectives To provide protection from flooding, improve the water quality in the City's lakes, and to improve the effectiveness of stormwater management practices.

Exemptions and Waivers Single family homes that are not part of a subdivision

Preferred practices Off-line retention, filtration, dry and wet detention.

Design criteria and guidance are given in the *Orlando Urban Stormwater Management Manual*.

Performance Standards and Design Criteria

Water Quality	Reduce the average annual TSS loading by 80%.	Treat the first half inch of runoff or the runoff from the first inch of rainfall, whichever is greater
Peak Discharge	No increase in rate	Post-development peak rate shall not exceed pre-development rate for a 25-yr, 24-hr storm.
Volume	In closed basins	Ret. runoff from 100-yr, 24-hr storm

Downstream evaluation is required to assure protection of downstream channel stability.

Available Publications *Orlando Urban Stormwater Management Manual.*

Source Controls City encourages source controls on all land uses with guidance provided in the *Orlando Urban Stormwater Management Manual.*

Erosion and Sediment Control Program

Program goal/objective To minimize siltation and water quality degradation from construction activities in drainageways, swamps, and lakes.

Performance standard is to control erosion on-site and limit off-site sedimentation to pre-development amounts.

Exemptions and waivers Single family homes that are not part of a subdivision.

Preferred Practices Sediment basins and traps which are designed to capture the 2.33-yr, 6-hr storm. Other practices include silt fence, gravel construction entrance, inlet protection, temporary and permanent vegetative stabilization, and limiting exposed areas.

Design Criteria Specified in *Orlando Urban Stormwater Management Manual* and the *Florida Development Manual: A Guide to Sound Land and Water Management (FDEP, 1988).*

Program Authority and Implementation

Both the erosion/sediment control program and the stormwater management program are implemented using federal criteria with EPA implementation (NPDES), state and regional criteria with regional implementation (WMD), and local criteria which are administered by the local government program.

Project permitting Individual stormwater permits are issued which include erosion and sediment control and stormwater management requirements.

Review process Erosion/sediment control and stormwater management plans, construction drawings, specifications, calculations, and other supporting technical information are reviewed by the City Engineering staff.

A detailed checklist is not used.

Erosion/sediment control and stormwater management approval is required before issuance of a site improvement permit.

Inspections

Erosion/sediment controls	Required daily, performed by project engineer. The Construction Management Bureau also conducts inspections.
Stormwater systems	Required daily, performed by project engineer and by inspectors from the Construction Management Bureau.

Program Enforcement and Compliance

Penalty provisions are a program component. Civil penalties include fines of up to \$1,000, with each day of violation a separate offense.

Other enforcement procedures	Stop work order Withhold occupancy permits Withhold other permit applications
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As-built certifications are required for all detention systems. The state program implemented by the FDEP and the WMDs requires as-built certifications for all stormwater systems.

Final inspection of stormwater systems is performed by staff from the Construction Management Bureau.

Maintenance of Stormwater Systems

Maintenance of completed stormwater systems is required.

Legal entities include	City for BMPs serving public lands and those dedicated to the City. Private owner Property owners association
Inspection frequency	As needed but no less than once every two years.
Oversight agency	Orlando Stormwater Utility
O/M activities	Design engineer must provide an operation and maintenance plan which specifies actions needed to assure that the system continues to function as designed.

Funding source	Stormwater utility fees (Currently \$3/ month/ERU)
Enforcement mechanism	Code enforcement board issues citations which can lead to fines if required maintenance is not done.

Program Resources

<u>Program Funding</u>	<u>Source</u>	<u>Amount</u>
Erosion, sediment, and stormwater management	Permit fees, gas taxes Stormwater utility fee (90%)	\$1,250,000 Total

NOTE: Permit fees include a project inspection cost which is to pay for all city inspections.

For private projects, the fee is 2.25% of the construction cost estimate. For public projects, the Stormwater Utility pays for inspection services.

<u>Program Staffing</u>	<u>Position</u>	<u>Full Time</u>	<u>Part Time</u>	<u>Needed</u>
	Administrative	4		
	Engineer	4		
	Inspector	18		
	Scientist	2		
	Clerical	5		

NOTE: Inspectors are with the Construction Management Bureau and are responsible for more than erosion, sediment, and stormwater management.

Educational Programs

Educational programs are a voluntary component of the program. Brochures, exhibits, demonstration projects, and monitoring are used to reach the target audience of contractors, consultants, inspectors, and the general public. At the pre-construction meeting, the city's Construction Manager briefs the Contractor on erosion and sediment control requirements. Additionally, inspectors meet weekly to discuss problems or learn about solutions. Storm sewer stenciling programs are planned. The Stormwater Utility staff conduct about 40 programs each year to educate the general public about stormwater management. The City also participates in the Florida Lake Watch program, a citizen volunteer monitoring program.

Program Coordination

There is close coordination within the City's erosion/sediment control and stormwater management program.

The City program also is integrated with local land use planning, wetlands protection,

floodplain management, wastewater management, and wellhead protection programs.

Communication from the EPA on related federal programs is good.

Program Evaluation

Measures of success	Limited monitoring program to evaluate water quality in City's lakes
Research projects	Evaluating the treatment effectiveness of the Greenwood Urban Wetland, a regional stormwater system; vertical volume recovery filter system; a packed bed wetland filter; and, alum injection systems.
Monitoring	Water chemistry, flow rates

Program Evolution into Watershed Approach

The city's stormwater management program began in the early 1960s in response to floods associated with unusually high rainfall. A long range flood control plan was prepared and implemented. Citizen concern about the increasing degradation of water quality in the City's lakes led to the expansion of the program into stormwater quality management. In 1984, the Orlando Stormwater Management Manual was prepared establishing requirements and design criteria for stormwater treatment. In the mid-1980s, the City began a retrofitting program in priority watersheds to reduce the pollutant loading from older developments. This program has used regional systems such as the Lake Greenwood Urban Wetland which provide multiple benefits including open space and recreation. The City also has been a leader in using innovative stormwater treatment technologies such as alum injection and wetland filters. The City's stormwater management program received EPA's national stormwater award in 1990.

Retrofitting is being pursued to reduce flooding, water quality degradation, and to protect aquatic resources.

Watershed approaches are being used including regional stormwater management systems, waterbody targeting, and emphasis on nonstructural controls.

**SEDIMENT CONTROL AND STORMWATER MANAGEMENT
PROGRAM SUMMARY**

JURISDICTION: CITY OF SEATTLE, WASHINGTON

Drainage and Wastewater Utility
710 Second Avenue
Seattle, Washington 98104

The erosion/sediment control program and the stormwater management program are integrated programs. The program is required by the Puget Sound Water Quality Management Plan.

The impetus for the program includes flooding, stream channel erosion, water quality, and community interest in protecting its streams.

The program's legal authority is established in:

1. Chapter 22.800, Seattle Municipal Code (Stormwater, Grading and Drainage Control)
2. Rule 93-3, Seattle Engineering Department Director's Rule. (Runoff Criteria).
3. DCLU 6-93/SED 93-2, Joint Director's Rule (BMPs for ES Control).

Stormwater Management Program

Program Goals/Objectives

To protect life, property, and the environment from loss, injury and damage by pollution, erosion, flooding, and other potential hazards.

Protect surface waters from pollution, mechanical damage, excessive flow, and other conditions in their drainage basins which will increase the rate of downcutting, streambank erosion, and the degree of turbidity, siltation, or pollution, or reduce ground water recharge, or endanger aquatic or benthic life within the surface waters.

Exemptions and Waivers

Agriculture
Forestry except projects which convert lands to other uses.
Washington DOT projects provided they comply with the requirements of the Puget Sound Highway Runoff Program.

If discharged directly to a receiving water or to a piped storm drain (under certain conditions)

Projects with < 750 ft² new impervious surface or

with < 2000 ft² total impervious surface

Preferred practices None

Design criteria and guidance are specified in the regulations.

Performance Standards and Design Criteria

Water Quality	No specified performance std.	Treat the runoff from a 6 month, 24 hour storm
Peak Discharge	No increase in rate.	Rate shall not exceed 0.2 cfs per acre for the 25-yr, 24-hr storm for projects under 9000 ft ² . For projects over 9000 ft ² , rate also shall not exceed 15 cfs per acre a 2-yr, 24-hr storm.
Volume	None	

Downstream evaluation is required with maximum velocity specified to assure protection of down stream channel stability.

Available Publications

Source Controls The City encourages all land uses to use source controls and has targeted its inspection program at commercial and industrial businesses in the part of the City served by separate storm sewers. Specific practices encouraged include roofing operation or storage areas, placing berms around barrels to provide secondary containment, directing wash water to sanitary sewer system, proper waste disposal, good housekeeping especially around outside dumpsters. Guidance is provided in *City of Seattle Pollution Control Guidelines for Construction Sites: Appendix B, Guidelines for Controlling Pollutants Other Than Sediment on Construction Sites*.

Erosion and Sediment Control Program

Program goal/objective See stormwater program goals/objectives.

Exemptions and waivers Same as stormwater program.

Preferred Practices Sediment traps are designed to detain the runoff volume from a 2-yr, 24-hr storm. Sediment basins must be sized to settle medium silt soil particles (0.02 mm) during the peak discharge

from a 10-yr, 24-hr storm. Other practices allowed include silt fence, gravel construction entrance and wheel wash, slope protection, inlet protection, and temporary and permanent vegetative stabilization.

Design Criteria Specified in *City of Seattle Pollution Control Guidelines for Construction Sites: Appendix A, Erosion and Sedimentation Control BMPs (April 1993)*.

Program Authority and Implementation

Both the erosion/sediment control program and the stormwater management program include federal criteria with state implementation, state criteria with state implementation, and local criteria which are administered by the local government program. Within the Puget Sound watershed, erosion/sediment control and stormwater management programs are required at the local level as of January 1, 1995.

Project Permitting Separate erosion/sediment control or stormwater management permits are not issued but are approved as part of the development review process or, when required, as part of the grading permit.

Review process Submittal requirements and type of review vary depending on the size of the project with five categories established in the Joint Director's Rule.

A detailed checklist is used for erosion/sediment control and for stormwater management.

Erosion/sediment control and stormwater management approval is required before issuance of a building permit, grading permit, street use permit, master use permit, or city construction contract.

Inspections

Erosion/sediment Controls None required

Stormwater systems None required

Performed by Rules allow the Director of the Department of Construction and Land Use and the Director of Engineering to establish inspection requirements for erosion/sediment control and stormwater management respectively, but none have been implemented.

Program Enforcement and Compliance

Penalty provisions are a program component. Civil penalties include fines for each day of violation which begin at \$100 on the first day of violation and then increase \$100 per day until the fifth day and beyond when the fine is \$500 per day. Penalties may be tripled for repeat violations. Criminal penalties include a fine of not more than \$5000 per day, or imprisonment for not more than one year, or both, for each violation.

Other enforcement procedures

- Notice of violation
- Stop work order
- Withhold occupancy permits
- Suspend or revoke permits

As-built certifications are required for all stormwater management systems. The owner must submit a signed "Memorandum of Drainage Control" that describes the types of controls per the minimum requirements set forth in SMC 22.80.

Final inspection of stormwater systems is not performed

Maintenance of Stormwater Systems

Maintenance of completed stormwater systems is required.

Legal entities include	City Private owner
Inspection frequency	Once a year minimum or as needed
Inspected by	Seattle Engineering Department
Oversight agency	Seattle Engineering Department
Operation/Maintenance activities	Not specified, depends on type of system
Funding source	Stormwater utility fees
Enforcement mechanism	After notification and waiting period, City can perform necessary O/M and bill property owner.

Program Resources

The erosion/sediment control and stormwater management programs are not separate budget entities but are buried within the overall Department budget.

<u>Program Funding</u>	<u>Source</u>	<u>Amount</u>
	Permit fees	Unknown
	Stormwater utility fees	Unknown

There are many people who work at least part time in these programs. If the city's own construction projects are included, there are several hundred people who are partly responsible for ensuring that erosion and sediment are controlled properly.

Educational Programs

Educational programs are a required component of the program. Brochures, exhibits, demonstration projects, monitoring, and storm sewer stenciling are used to educate the targeted audience of contractors, developers, consultants, inspectors, and the general public.

Program Coordination

There is close coordination within the City's integrated erosion/sediment control and storm-water management program.

The City's program also is integrated with local wetlands protection and building approval programs.

Conflicts arise within the program since the stormwater program's primary objective is flood control which conflicts with water quality considerations.

Communication from federal or state agencies on the NPDES stormwater permitting program has been inadequate, especially with the continually changing "guidance" that makes it difficult to meet the program's requirements.

Program Evaluation

Measures of success	None
Research projects	BMPs being studied to evaluate their treatment effectiveness includes catch basin filters, biofiltration swales, and filtration systems using crushed glass. Sediment accumulation within storm sewers is being monitored.
Monitoring	Water chemistry, sediments, biological, and flow rates

Program Evolution into Watershed Approach

Retrofitting developed areas is being pursued to reduce flooding, water quality degradation, and stream channel erosion.

Watershed approaches being used include regional stormwater management systems, water body targeting, and emphasis on nonstructural BMPs.

SEDIMENT CONTROL AND STORMWATER MANAGEMENT PROGRAM SUMMARY

JURISDICTION: ***DISTRICT OF COLUMBIA***
Department of Consumer and Regulatory Affairs
2100 Martin Luther King Jr. Avenue, S.E.
Washington, D. C. 20020

The erosion/sediment control program and the stormwater management program are separate programs.

The primary impetus for the programs includes flooding, water quality, stream channel erosion, protection of the Potomac and Anacostia Rivers, and the requirements imposed by federal law.

The program's legal authority is established in:

1. D.C. Law 2-23 (Erosion and Sediment Control Act of 1977)
2. D.C. Law 5-188 (Stormwater Pollution Control Act of 1984)
3. D.C.M.R. Title 21, Chapter 5 (Erosion/sediment control regulations)

Stormwater Management Program

Program Goals/Objectives	To control nonpoint source pollution by requiring developers to control the quantity and quality of stormwater leaving their site. To meet the goals of the 1983 Chesapeake Bay Agreement and the 1984 Anacostia Restoration Agreement between the District and the State of Md.												
Exemptions and Waivers	Agriculture Forestry Single family homes on lots of 2 acres or more Projects disturbing 5000 sf or less of land												
Preferred practices	Infiltration is the first choice but scarcity of land often precludes it use with sand filtration generally used. Other practices include wet and dry detention, swales, dry wells, rooftop detention, underground detention												
Practices installed	<table><thead><tr><th style="text-align: left;"><u>Practice</u></th><th style="text-align: center;"><u>1992</u></th><th style="text-align: center;"><u>1993</u></th></tr></thead><tbody><tr><td>Dry well</td><td style="text-align: center;">1</td><td style="text-align: center;">71</td></tr><tr><td>Sand filter</td><td style="text-align: center;">6</td><td style="text-align: center;">4</td></tr><tr><td>Extended dry detention</td><td style="text-align: center;">2</td><td></td></tr></tbody></table>	<u>Practice</u>	<u>1992</u>	<u>1993</u>	Dry well	1	71	Sand filter	6	4	Extended dry detention	2	
<u>Practice</u>	<u>1992</u>	<u>1993</u>											
Dry well	1	71											
Sand filter	6	4											
Extended dry detention	2												

Design criteria and guidelines are given in guidance documents and handouts.

Performance Standards and Design Criteria

Water Quality	Oil and grease < 10 mg/l, Reduce organic waste by at least 85% from confined animal operations	Treat first half-inch of runoff or the difference in runoff volume from the 15-yr (post-development) and the 2-yr (pre-development) storm.
Peak Discharge	No increase in peak rate	Post-development peak rate shall not exceed pre-development rate for 2, 10, and 100-yr, 24-hr storm.
Volume	None	

Downstream evaluation is required to assure protection of downstream channel stability.

Available Publications

Source Controls Oil recycling, good housekeeping, street sweeping, and conservation of natural systems are encouraged on all land uses. Guidance is provided in two publications: “The D.C. Urban Homeowner’s Guide on Ground Maintenance” and “Oil Recycling”.

Erosion and Sediment Control Program

Program goal/objective	To eliminate and prevent blight and conditions detrimental to buildings and to improve waterways and the sewerage system by controlling soil erosion and sedimentation from land disturbing activities.
Exemptions and waivers	Agriculture Forestry Activities disturbing 500 ft ² or less of area or with a total project cost of under \$2500.
Preferred Practices	Sediment basins and traps which are designed for 1800 cf/acre DA. Other practices include silt fence, vehicle wash area, straw bales, stabilized construction entrance, inlet protection, temporary and permanent vegetative stabilization.
Design Criteria	Specified in <i>District of Columbia Erosion and Sediment Control Handbook</i> .

Program Authority and Implementation

The erosion/sediment control program is administered by the local government using local criteria. The stormwater management program is implemented using federal criteria with

local implementation (NPDES), and by using regional and local criteria which are administered by the local government program.

Project permitting A separate permit is not issued. Erosion/sediment control plan and stormwater management plan approval is part of the process of obtaining a D.C. construction permit.

Review process The erosion/sediment control plan is reviewed by the Erosion and Sediment Control Plan Review Section. The stormwater management plan is reviewed by the Stormwater Management Section.

A detailed checklist is used for review of stormwater plans but not for erosion/sediment control plan review.

Erosion/sediment control and stormwater management approval is required before issuance of a building permit or a grading permit, and before approval of plumbing/mechanical, electrical, structural, or water and sewer availability.

Inspections

Erosion/sediment controls Required as needed, conducted by project engineer and by D.C. staff inspectors.

Stormwater systems Required as needed, conducted by project engineer and by D.C. staff inspectors.

Program Enforcement and Compliance

Penalty provisions are a program component. Criminal penalties are those associated with a misdemeanor. For erosion and sediment control violations, penalties are fines of up to \$300 or imprisonment for up to 10 days, or both. Violations for stormwater management are fines of up to \$1000 or imprisonment for up to 6 months, or both. Each day of violation is a separate offense.

Other enforcement procedures Stop work order
 Withhold occupancy permits
 Revoke or suspend permits
 Request police enforcement for tracking sediment

As-built certifications are required for all stormwater management systems.

Final inspection of stormwater systems is performed by staff from the Stormwater Management Branch.

Maintenance of Stormwater Systems

Maintenance of completed stormwater systems is required.

Legal entities include	City for BMPs serving public lands Private owner Property owners association
Inspection frequency	Theoretically, three inspections per year during the first five years of operation and then once every two years. In practice, inspections are conducted once every six months to a year.
Oversight agency	Department of Consumer and Regulatory Affairs
O/M activities	Not specified, depends on type of system
Funding source	Depends on maintenance entity. No dedicated source
Enforcement mechanism	After notification and waiting period, City can perform necessary O/M and place a tax lien on property owner.

Program Resources

<u>Program Funding</u>	<u>Source</u>	<u>Amount</u>
Erosion/sediment control	General appropriation	\$975,000 (FY93)
Stormwater management	Chesapeake Bay program grants	\$975,000

<u>Program Staffing</u>	<u>Position</u>	<u>Full Time</u>	<u>Part Time</u>	<u>Needed</u>
ES/SW	Administrative	0/1	1/0	1/0
	Engineer	1/4		1/2
	Inspector	2/1		2/2
	Scientist	1/0		
	Clerical	1/0	0/1	1/1
	Support	0/1		1/1

Educational Programs

Educational programs are a required component of the two programs. Brochures, shows, exhibits, demonstration projects, monitoring, and storm sewer stenciling are used to reach the target audience of contractors, consultants, developers, inspectors, and the general public. Once every two years workshops are held which attract about 50 contractors, consultants, and developers. Programs are held periodically for inspectors and the general public.

Program Coordination

There is close coordination between the City's erosion/sediment control and stormwater management program.

The City programs also are integrated with local land use planning, wetlands protection, floodplain management, wastewater management, and building approval programs.

Communication from EPA on related federal programs is good.

Program Evaluation

Measures of success	BMP tracking system
Research projects	Treatment effectiveness of the D.C. sand filter. Land use monitoring to quantify pollutants from specific urban land uses.
Monitoring	Water chemistry, sediments, and flow rates

Program Evolution into Watershed Approach

The erosion/sediment control program began in 1977 while the stormwater management program was implemented in 1985. The stormwater program was developed in response to the 1983 Chesapeake Bay program and the 1984 Anacostia Restoration Agreement. The regulations and guidebook were implemented in January 1988. The program is funded on a 50/50 basis by the District of Columbia and the EPA through the Chesapeake Bay program.

Retrofitting is being pursued to reduce flooding, water quality degradation, stream channel erosion, and to restore or protect aquatic resources.

Watershed approaches being used include waterbody targeting and emphasis on non-structural controls.

**Sediment Control and Stormwater Management
Program Summary**

JURISDICTION: **CITY OF WINTER PARK, FLORIDA**
 Stormwater Utility
 401 Park Avenue South
 Winter Park, Florida 32789

The erosion/sediment control program and the stormwater management program are integrated programs.

The primary impetus for the program includes flooding, water quality, stream channel erosion, ground water recharge, and protection of water and soil resources.

The program’s legal authority is established in:

1. Chapter 403, Florida Statutes (Environmental Act)
2. City Ordinance 1816 (Stormwater Management Requirements for Construction)
3. City Ordinance 1832 (Stormwater Utility)
4. City Ordinance 2046 (Management of Stormwater)

Stormwater Management Program

Program Goals/Objectives of the	To treat stormwater to prevent the continued degradation of the Winter Park chain of lakes.
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Exemptions and Waivers	Single family homes that are not part of a subdivision
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Preferred practices	Retention
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Design criteria and guidance are given in Ordinance 1816 and in the *Florida Development Manual: A Guide to Sound Land and Water Management (FDEP, 1988)*.

Performance Standards and Design Criteria

Water Quality	Reduce the average annual TSS loading by 80%.	Treat the first inch of runoff by way of retention.
Peak Discharge	None - rely upon SJRWMD requirements	Post-development rate can not exceed pre-development rate for a 25-yr, 24-hr storm.
Volume	None	

Downstream evaluation is not required to assure protection of downstream channel stability.

Available Publications

Source Controls City encourages source controls such as good housekeeping, landscaping, education on commercial and multifamily residential projects with guidance provided by the city's stormwater engineer. Lakefront residential units must direct runoff onto pervious areas.

Erosion and Sediment Control Program

Program goal/objective To prevent erosion and off-site sedimentation that fills curbs, streets, inlets, conveyances, and water bodies.

Performance standard is to retain sediment on-site.

Exemptions and waivers None

Preferred Practices Sediment basins and traps which are designed to capture 67 cy per acre DA. Other practices allowed include silt fence, straw bales, inlet protection, slope protection, and temporary and permanent vegetative stabilization.

Design Criteria Specified in the *Florida Development Manual: A Guide to Sound Land and Water Management (FDEP, 1988)*.

Program Authority and Implementation

Both the erosion/sediment control program and the stormwater management program are implemented using federal criteria with EPA implementation (NPDES), state and regional criteria with regional implementation (WMD), and local criteria which are administered by the local government program.

Project permitting Erosion/sediment control requirements and stormwater retention requirements are approved as part of the city's building permit procedure.

Review process Erosion/sediment control and stormwater management plans, construction drawings, specifications, calculations, and other supporting technical information are reviewed by the stormwater utility staff.

A detailed checklist is not used.

Erosion/sediment control and stormwater management approval is required before issuance of a building permit, grading permit, or zoning approval.

Inspections

Erosion/sediment controls	No specified frequency, performed by project engineer and by City Building/Engineering inspectors as part of building inspections. The City stormwater engineer provides assistance as needed.
Stormwater systems	No specified frequency, performed by project engineer and by City Building/Engineering inspectors as part of building inspections. The City stormwater engineer provides assistance as needed.

Program Enforcement and Compliance

Penalty provisions are a program component. Civil penalties include fines of up to \$500, with each day of violation a separate offense.

Other enforcement procedures	Stop work order Withhold occupancy permits
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As-built certifications are not required. The state program implemented by the FDEP and the WMDs requires as-built certifications for all stormwater systems.

Final inspection of stormwater systems is performed by the city stormwater engineer.

Maintenance of Stormwater Systems

Maintenance of completed stormwater systems is required.

Legal entities include	City for BMPs serving public lands. Private owner Property owners association
Inspection frequency	Only done in response to complaints
Oversight agency	Winter Park Stormwater Utility
O/M activities	Design engineer must provide an operation and maintenance plan which specifies actions needed to assure that the system continues to function as designed.
Funding source	Stormwater utility fees (SF rate varies from \$2 to \$6 per month depending on impervious surface area. 25% of funds from fee are dedicated to stormwater operation and maintenance.

Enforcement mechanism

Code enforcement board issues citations which can lead to fines if required maintenance is not done.

Program Resources

<u>Program Funding</u>	<u>Source</u>	<u>Amount</u>
Erosion, sediment, and stormwater management	General appropriation	\$1,200,000 (60%)
	Stormwater utility fee	\$ 940,000 (40%)

NOTE: Funds from stormwater utility fees are used for capital improvement projects (75%) and operation/maintenance (25%).

<u>Program Staffing</u>	<u>Position</u>	<u>Full Time</u>	<u>Part Time</u>	<u>Needed</u>
ES + SW	Engineer	1		
	Clerical	1		

Educational Programs

Educational programs are a voluntary component of the program. Brochures, exhibits, demonstration projects, and monitoring are used to reach the target audience of the general public. The Stormwater Utility staff conduct about two programs each year to educate the general public about stormwater management. The City also participates in the Florida Lake Watch program, a citizen volunteer monitoring program.

Program Coordination

There is close coordination within the City’s erosion/sediment control and stormwater management program.

The City program also is integrated with local land use planning, zoning, floodplain management, and building approval programs.

Communication from the EPA on related federal programs is good.

Program Evaluation

Measures of success	None
Research projects	Evaluating the treatment effectiveness of alum injection systems, wet detention, algal turf scrubber system, and stormwater reuse systems.
Monitoring	Water chemistry

Program Evolution into Watershed Approach

The city's stormwater management program began in the 1974 because of community concern about the increasing degradation of water quality in the City's lakes. Ordinance 1816 was implemented requiring all new development and redevelopment to retain the first inch of runoff on-site. In 1989 the city's stormwater utility was implemented.

Retrofitting is being pursued to reduce water quality degradation.

Watershed approaches are not being used.

SEDIMENT AND STORMWATER MANAGEMENT PROGRAM SUMMARY

JURISDICTION: *BALTIMORE COUNTY, MARYLAND*

Environmental Office
401 Bosley Avenue, Suite 416
Towson, Maryland 21204

The erosion/sediment control program and the stormwater management program are separate programs implemented by the Baltimore County Soil and Water Conservation District and the Baltimore County Dept. of Environmental Protection and Resource Management, respectively.

The impetus for the program includes flooding, water quality, stream channel erosion, groundwater recharge, and wetland creation and habitat protection. Program is required by state law.

The program's legal authority is established in:

1. Environmental Article, Title 4, Subtitle 1, Annotated Code of Maryland (ES Control)
2. Environmental Article, Title 4, Subtitle 2, Annotated Code of Maryland (SW Mgmt)
3. Chapter 26, Code of Maryland Regulations
4. Title 14, Articles 5 and 6, Baltimore County Code

Stormwater Management Program

Program Goal/Objective To comply with federal, state, and local laws

Exemptions and Waivers agriculture
 forestry
 residential less than 2 acre lot size and under 5,000 ft²
 disturbed

Preferred Practices Infiltration is the most preferred and must be used when the soil percolation rate exceeds 0.17 inch per hour. Other practices allowed include extended dry detention, wet detention, and sand filters.

Design Criteria Specified in regulations

Performance Standards and Design Criteria

Water quality	Remove at least 80% of the average annual TSS loading.	Treatment of the first one-half inch of runoff from a site's impervious area using BMPs appropriate for the site.
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Peak discharge No increase in rate. Post-development rate can not exceed the pre-development rate for 2-yr and 10-yr, 24 hour storms.

Volume None.

Downstream evaluation is required to assure there is a suitable outfall and to assure downstream channel stability.

Available Publications None provided

Source Controls Are encouraged for all land uses, especially limiting impervious areas and using buffers to protect streams and wetlands.

Erosion and Sediment Control Program

Program goal/objective To protect, maintain, and enhance the public health, safety, and general welfare by establishing minimum requirements and procedures to control the adverse impacts associated with accelerated soil erosion and sedimentation from public and private construction projects.

Exemptions and waivers Agriculture
Activities disturbing < 5000 ft²

Preferred Practices Sediment traps and basins are designed to contain 1800 yd³ of runoff from the drainage area. Other practices allowed include staged construction, silt fence, straw bales, inlet protection, slope protection, and temporary and permanent vegetative stabilization.

Design Criteria Specified in *Maryland Standards and Specifications Handbook*.

Program Authority and Implementation

The erosion/sediment control program is implemented using state and local criteria with local implementation while the stormwater management program is implemented by the county using state, regional, and state approved local criteria.

Project permitting Individual permits for all activities which disturb over 5000 ft²

Review process Sediment control, grading, stormwater management, and conservation plans may be required depending on the activity. Individual building permits are allowed provided sediment control is done in accordance with a standard plan. The SWCD

reviews and approves erosion/sediment control plans in accordance with state law while the County approves stormwater management plans.

A detailed checklist is used for erosion/sediment control and stormwater management plan review.

Erosion/sediment control and stormwater management approvals are required before issuance of a building permit or a grading permit.

Inspections

Erosion and sediment control	Required every 15 days and performed by the Baltimore County DEPRM.
Stormwater management	Required daily by engineer in charge, with the final inspection performed by Baltimore County DEPRM.

Program Enforcement and Compliance

Penalty provisions are a program component. Civil penalties include fines equal to double the cost of installing and maintaining the controls. Criminal penalties include a fine not exceeding \$1,000, or imprisonment not exceeding 90 days, or both, with each day a separate offense.

Other enforcement mechanisms	Stop work order Withhold occupancy permits Withhold building permits Forfeit security deposited (all projects over 20,000 ft ²)
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As-built certifications are required for all stormwater practices.

Final inspection of stormwater systems is performed by the Baltimore County DEPRM.

Maintenance of Stormwater Systems

Maintenance of completed stormwater systems is required.

Legal entities include	Public Works Department Private entity Property owners association
Inspection frequency	Performed after first year, then triennially
Inspected by	Baltimore County Environmental Inspector

Oversight agency	Baltimore County Environmental Department
O/M responsibilities	Specified by design engineer in O/M manual.
Funding source	Depends on legal entity, county has no dedicated source.
Enforcement mechanism	Exercise rights within maintenance agreement.

Program Resources

The erosion/sediment control and stormwater management programs are combined budget entities.

<u>Program Funding</u>	<u>Source</u>	<u>Amount</u>
Erosion/sediment control	General appropriations	Unknown
Stormwater management	General appropriations	\$650,000

<u>Program Staffing</u>	<u>Position</u>	<u>Full Time</u>	<u>Needed</u>
ES/SW	Administrative	1/0	
	Engineer	0/7	
	Engineer associate	0/3	
	Inspector	8/0	
	Clerical	1/2	
	Support	2/0	Maintenance crew

Educational Programs

Educational programs are a voluntary component of the program. Brochures, and exhibits are used to educate the targeted audience of contractors, consultants, developers, inspectors, and the general public. Most training conducted by state agency.

Program Coordination

There is close coordination between the erosion/sediment control program and the storm-water management program.

These programs also are coordinated with the county's land use planning, zoning, wetlands protection, floodplain management, tree protection, land acquisition, wellhead protection, water supply, wastewater management, and building approval programs.

No conflicts with other programs prevent or hinder effective program implementation.

Program Evaluation

Measures of success	None
Research projects	None
Monitoring	None

Program Evolution to Watershed Management

The county's erosion/sediment control program was initiated in 1969 by executive order in response to the passage of state legislation. In 1977 the first county ordinance was enacted establishing erosion and sediment control requirements, procedures, and penalties. In 1984, state stormwater legislation was enacted establishing a comprehensive stormwater management program which is administered primarily by local governments.

Retrofitting of developed areas is being pursued to improve water quality.

Watershed approaches are not being used.

**SEDIMENT CONTROL AND STORMWATER MANAGEMENT
PROGRAM SUMMARY**

JURISDICTION: **CLARK COUNTY, WASHINGTON**
 P.O. Box 9810
 Vancouver, Washington 98668

The erosion/sediment control program and the stormwater management program are separate programs.

The impetus for the program includes flooding, stream channel erosion, water quality, and community interest in protecting its fisheries and wetlands.

The program’s legal authority is established in:

1. Chapter 13.25, Clark County Code (Stormwater Control Ordinance)
2. Chapter 13.27, Clark County Code (Erosion Control Ordinance)

Stormwater Management Program

Program Goals/Objectives Prevent flooding and protect the beneficial uses of water resources. Stormwater ordinance lists nine goals.

Exemptions and Waivers Agriculture
 Forestry
 Projects with < 2000 ft² impervious surface
 Industrial or commercial projects with < 1000 ft² new impervious surface

Preferred practices Infiltration basins or trenches are preferred and required in A and B soils. Other treatment practices include biofiltration swales, wet detention ponds, filter strips, constructed wetlands, and sand filters.

Practices Installed	<u>Practice</u>	<u>1992</u>	<u>1993</u>
	Swales	10	10
	Dry wells	500+	500+
	Wet detention	10	25
	Wetlands	1	3
	Biofiltration	50	100+

Design criteria are specified in the “*Stormwater Management Manual for the Puget Sound Basin*”, February 1992, published by the Washington Department of Ecology.

Performance Standards and Design Criteria

Water Quality	No specified performance std.	Use appropriate BMPs to treat the runoff from a six-month, 24-hour storm.
Peak Discharge	No specified performance std.	Post-development rate can not exceed pre-development rate for 2, 10, and 100-year, 24-hr storm.
Volume	Maintain ground water recharge	Post-development volume can not exceed pre-development volume for 2-yr, 24-hr storm.
	Maintain existing flows and levels in downstream channels conveyances at capacity)	Post-development volume can not exceed pre-development volume for (for 10-yr and 100-yr, 24-hr storms.

Downstream evaluation of the capacity of the conveyance system is required if pre-development runoff calculations do not assume undisturbed forest in determining the runoff curve number.

Available Publications County Ordinances.

Source Controls As specified in the Puget Sound Manual, source controls are recommended for specific land uses including manufacturing, transportation and communication, wholesale or retail sales, service businesses and activities on public lands. General source controls include fueling stations, vehicle or equipment washing areas, storage or loading of solid or liquid materials, and vegetative management practices.

Erosion and Sediment Control Program

Program goal/objective To prevent sediment from reaching surface waters, adjacent properties, or public right-of-ways.

Exemptions and waivers Agriculture
Forestry
Projects disturbing < 2000 sf

Preferred Practices Sediment traps are sized to hold the 2-yr, 24-hr storm runoff while basins must treat the 10-year, 24-hour storm. Other practices include seasonal limits on disturbed areas, stabilized construction entrance and tire wash, slope drain, straw bales, silt fence, mulching, and temporary and permanent vegetative

cover.

Design Criteria Specified in Volume II of the *Stormwater Management Manual for the Puget Sound Basin (1992)* and in Section 3 of the *Erosion Control Plans Technical Guidance Handbook for Portland and Washington County, Oregon (November 1989)*.

Program Authority and Implementation

Both the erosion and sediment control program and the stormwater management program are implemented using local criteria implemented by the local government program.

Project Permitting Permits aren't issued. Plans for both erosion/sediment control and for stormwater management are approved if they comply with requirements set in applicable ordinances

Review process Applicants must submit erosion/sediment control and stormwater management plans along with supporting information such as calculations, geotechnical data, and analysis which is reviewed by the program's staff.

A detailed checklist is used for stormwater management only.

Erosion/sediment control approval is required before issuance of a grading permit while both the stormwater management and erosion/sediment control plans must be approved before subdivisions or site plans are approved.

Inspections

Erosion/sediment controls Required "regularly" by site workers with maintenance for two years done by the property owner or permittee to ensure continued performance. Inspected by Clark County stormwater staff also.

Stormwater systems Required before developer turns over to county or to private maintenance entity, with inspection done by Clark County stormwater program staff.

Program Enforcement and Compliance

Penalty provisions are a program component. They include civil penalties with fines of \$25 per day in addition to the remedies set forth in Title 32 of the Clark County Code.

Other enforcement procedures Stop work order
Withhold occupancy permits
Withhold other permit applications

As-built certifications are required and must be submitted prior to the issuance of building permits for single family residential subdivisions, the issuance of occupancy permits for projects subject to site plan review, and within 60 days following completion of construction for other projects.

Final inspection of stormwater systems is not performed.

Maintenance of Stormwater Systems

Maintenance of completed stormwater systems is required. The applicant must maintain the stormwater system for the first two years after construction is completed.

Legal entities include	Clark County for BMPs within public road right-of-ways and for BMPs dedicated to the County. Private owner for commercial or industrial systems Property owners association for residential systems (seldom used)
Inspection frequency	None. Stormwater ordinance states that the county shall inspect privately maintained systems.
Inspected by	Clark County
Oversight agency	Clark County
O/M responsibilities	Engineer must provide a Maintenance and Operations Manual for all systems to be privately maintained.
Funding source	Primarily Road Fund revenues
Enforcement mechanism	Ordinance allows County to issue a written notice specifying actions needed to bring stormwater system into compliance and, if owner does not undertake corrective actions in a timely manner, allows the County to perform the maintenance and bill the responsible parties in accordance with Clark County Code Chapter 32.04.060.

Program Resources

<u>Program Funding</u>	<u>Source</u>	<u>Amount</u>
Erosion/Sediment control	Permit fees	\$225,000 (100%)
Stormwater management	Permit fees	\$445,000 (100%)

<u>Program Staffing</u>	<u>Position</u>	<u>Full Time</u>	<u>Needed</u>
ES/SW	Administrative	.33/.67	
	Engineer	.67/1.33	
	Inspector	1/2	
	Scientist	.33/.67	
	Clerical	.33/.67	
	Support	.67/1.33	

Educational Programs

Educational programs are a voluntary component of the program. Brochures and storm sewer stenciling, which is required for all new structures by the County stormwater ordinance, are used to educate the intended audience of contractors, consultants, developers, and inspectors.

Program Coordination

There is close coordination between the County's separate erosion/sediment control and stormwater management programs.

These programs also are integrated with local land use planning, zoning, wetlands protection, floodplain management, wellhead protection, and building approval programs.

No conflicts arise with other programs.

Communication from the Washington Department of Ecology on NPDES and other state and federal programs needs to be improved.

Program Evaluation

Measures of success	None
Research projects	BMP evaluation program to determine the treatment effectiveness of dry wells.
Monitoring	Water chemistry, sediments, biological, and flow rates

Program Evolution into Watershed Approach

The Clark County Water Quality Division was created in July 1992 by merging the county's development review, water quality management, and drainage engineering groups with an independent regional water quality research/planning organization.

Retrofitting of developed areas is not being pursued.

Watershed approaches are not being used.

SEDIMENT CONTROL AND STORMWATER MANAGEMENT PROGRAM SUMMARY

JURISDICTION: **KING COUNTY, WASHINGTON**
King County Surface Water Management
700 Fifth Avenue, Suite 2200
Seattle, Washington

The erosion/sediment control program and the stormwater management program are integrated programs.

The impetus for the program includes flooding, stream channel erosion, water quality, and community interest in protecting its fisheries and wetlands.

The program's legal authority is established in:

1. Title 9, King County Code
2. Title 16, King County Code
3. 1991 SWM Division Strategic Plan adopted by County Council

Stormwater Management Program

Program Goals/Objectives	Promoting public health and safety by controlling the quality and quantity of surface water runoff. Protecting and enhancing the natural drainage system comprised of rivers, streams, wetlands, and lakes. Protecting the public and reducing property damage. Obtaining the commitment of the citizens, businesses, and public agencies in cooperatively addressing regional surface water issues.
Exemptions and Waivers	Single family homes that are not part of a plat Projects with < 5000 ft ² impervious surface Projects with a discharge of < 0.5 cfs
Preferred practices	Source controls including forest retention, and erosion control. Treatment practices including grass swales, wet detention ponds, filter strips, and wet vaults.

Performance Standards and Design Criteria

Water Quality	No specified performance std.	Treat one-third of the runoff from a 2-year, 24-hour storm.
Peak Discharge	Base protection standard	Post-development rate can not exceed pre-development for a 2-yr and 10-yr storm.
	Stream protection standard	Post-development rate can not exceed pre-development for a 100-yr storm. Control duration for 2 to 50-yr storm.
Volume	None-under study	

Downstream evaluation is required for at least one-quarter mile or 15% of the drainage system with downstream channel stability evaluated when stream protection standard applies.

Available Publications

Source Controls The County encourages the use of the following management and source control practices:

- urban - citizen and business education
- agriculture - density limits on livestock, limit animal access to streams
- construction - clearing limitations in the wet season

Technical assistance on the use of these controls is available. The agriculture controls are required by the livestock and water quality ordinances.

Erosion and Sediment Control Program

Program goal/objective To prevent erosion first, control coarse and fine sediments second, and minimize damage to downstream fisheries habitat and spawning gravel.

Performance goal is to retain sediment on-site with discharges having a turbidity < 5 NTU.

Exemptions and waivers Agriculture
Single family homes exempt from detailed ES control plan.

Preferred Practices Sediment traps are designed to treat the 2-yr, 24-hr storm runoff while sediment basins are sized for the 10-yr, 24-hr storm. Other practices include seasonal limits on disturbed area, mulching, silt fence, gravel construction entrance, slope drains,

and temporary and permanent vegetative cover.

Design Criteria Specified in *Stormwater Management Manual for the Puget Sound Basin (1992)*.

Program Authority and Implementation

Both the erosion/sediment control program and the stormwater management program are implemented using federal criteria with state implementation, state criteria with regional and local implementation, and local criteria implemented by the local government program. Within the Puget Sound watershed, erosion/sediment control and stormwater management programs are required at the local level as of January 1, 1995.

Project Permitting General and Individual permits are used, depending on the “applicant” and the type of industry, especially for stormwater.

Review process Limited by staff constraints

A detailed checklist

Erosion/sediment control approval is required before issuance of a building permit or a grading permit while the stormwater management approval is required before issuance of a building permit or zoning approval.

Inspections

Erosion/sediment controls Required 2 or 3 times during the project with maintenance required assured by Restoration Bond. Inspected by site engineer or by County staff.

Stormwater systems Required at sign off. Performed by staff from either Surface Water Management or Dept. of Developmental and Environmental Services.

Program Enforcement and Compliance

Penalty provisions are a program component. They include civil penalties with fines of \$100 to \$500 per day.

Other enforcement procedures Stop work order (used infrequently)
Withhold occupancy permits

As-built certifications are required for infiltration practices, filtration practices, biofiltration but not for detention ponds.

Final inspection of stormwater systems is performed by Dept. of Developmental and

Environmental Services inspector.

Maintenance of Stormwater Systems

Maintenance of completed stormwater systems is required.

Legal entities include	King County SWM for BMPs serving residential Private owner for commercial systems Property owners association in limited cases
Inspection frequency	Once a year
Inspected by	King County SWM Department
Oversight agency	King County SWM Department
O/M responsibilities	Public facility maintenance performed by Public Works crews. Commercial facility maintained by owner, usually by a private vendor. County sends "correction notices" to commercial owners if annual inspection finds O/M needs.
Funding source	Stormwater Utility Fee (Currently \$85/yr/SFU)
Enforcement mechanism	Fines for owners of commercial facilities

Program Resources

<u>Program Funding</u>	<u>Source</u>	<u>Amount</u>
Erosion/Sediment control	Permit fees	Highly variable (90%)
	Stormwater utility fee	(10%)
Stormwater management	Stormwater utility fee	\$16-17 million (1994)
	State stormwater grants	\$1.5-3 million
	Contract services to cities	unknown

<u>Program Staffing</u>	<u>Position</u>	<u>Full Time</u>	<u>Needed</u>
ES/SW	Administrative	/30	
	Engineer	/50	
	Inspector	25/ 4	25/0
	Scientist	/30	
	Clerical	/10	
	Support	/25	ES Plan reviewers
	Maintenance	/25	

Educational Programs

Educational programs are a voluntary component of the program. Brochures, shows, exhibits, monitoring, demonstration projects, and storm sewer stenciling are used to educate the targeted audience of contractors, consultants, developers, inspectors and the general public. During the past year, two programs were given for contractors with 30 attending, one inspector program was held with 80 attendees, monthly programs are given for the public with 10 to 40 attending, and miscellaneous programs were held for developers and consultants that attracted up to 180 individuals.

Program Coordination

There is close coordination within the County's integrated erosion/sediment control and stormwater management program.

The program also is integrated with local land use planning, zoning, wetlands protection, tree protection, floodplain management, wellhead protection, and building approval programs.

Conflicts arise with land use planning since zoning and density decisions often are based on transportation corridors and infrastructure availability without consideration of the natural landscape features, leading to incompatible zoning and loss of important resources.

Communication with the Washington Department of Ecology on NPDES and other state and federal programs is pretty good, but conflicts arise quite often.

Program Evaluation

Measures of success	Adopted basin plans Completed capital improvement projects Successful education and public involvement activities Basin stewardship program
Research projects	BMP evaluation program to determine the treatment effectiveness of wet ponds, swales, sand filters, catch basin inserts, wetlands. Comprehensive sediment and phosphorus budget for a small catchment to examine relative contribution from construction sites, built up areas, and instream erosion.
Monitoring	Water chemistry, sediments, biological, and flow rates

Program Evolution into Watershed Approach

The surface water management program began in 1986 when the stormwater utility fee was initiated. The initial focus was on basin plans and their associated capital improve-

ment projects. Major floods in 1990 led to a fee increase in 1991 which allowed an expansion of the program to include stormwater quality (in response to NPDES), public education, and monitoring. New initiatives included regionalization of services, "Quality Urban Environment", Small Habitat Restoration Program, and Neighborhood Drainage Assistance Program.

Retrofitting of developed areas is being pursued to reduce flooding, water quality degradation, stream channel erosion, and to restore/protect aquatic resources.

Watershed approaches are being used including regional stormwater management systems, water body targeting, and emphasis on nonstructural BMPs.

SEDIMENT CONTROL AND STORMWATER MANAGEMENT PROGRAM SUMMARY

JURISDICTION: ***KITSAP COUNTY, WASHINGTON***
Kitsap County Public Works
614 Division Street, MS-26
Port Orchard, Washington 98366-4699

The erosion/sediment control program and the stormwater management program are integrated programs. They will be implemented in January 1995 in response to requirements set forth in the Puget Sound Water Quality Management Plan.

The impetus for the program includes flooding, stream channel erosion, water quality, ground water recharge, and mandates from federal or state government.

The program's legal authority is established in:

1. Ordinance 156-1993 (Surface and Stormwater Management Program Establishment)
2. Ordinance 165-1994 (Surface and Stormwater Management Rate Structure)
3. Ordinance 148-1992 (Interim Ordinance for Construction Site Erosion and Sediment Control)
4. Ordinance XXX-1995 (Comprehensive Stormwater Management Ordinance - pending)

Stormwater Management Program

Program Goals/Objectives	<p>Promote sound, practical, and economical development policies and construction practices which respect and preserve the County's water courses.</p> <p>Minimize water quality degradation and control sedimentation of streams, lakes, and other waters.</p> <p>Decrease stormwater damage to public and private property and protect life and property from stormwater.</p> <p>Protect ground water resources.</p>
Exemptions and Waivers	<p>Agriculture - use BMPs endorsed by local SWCD, voluntary</p> <p>Forestry - use ES controls during and after harvest</p> <p>Single family homes < 5000 ft² impervious exempt from rate control must have ES control, and roof runoff</p>

infiltration often required

Preferred practices Wet detention and biofiltration. Others found in the *Stormwater Management Manual for the Puget Sound Basin* or the King County Manual may be used including infiltration, extended dry detention, constructed wetlands, and sand filtration.

Design criteria are specified in the “*Stormwater Management Manual for the Puget Sound Basin*”, February 1992, published by the Washington Department of Ecology.

Performance Standards and Design Criteria

Water Quality	No specified performance std.	Treat the runoff from the 6-month, 24-hour storm per WDOE requirements.
Peak Discharge	No specified performance std.	Post-development peak rate can not exceed 50% of the pre-development rate for the 2-yr, 24-hr storm, and the pre-development rate for the 10-yr and 100-yr, 24-hr storms using SBUH analysis.
Volume	Only for certain downstream waters	Post-development volume can not exceed pre-development volume for the 100-yr, 7-day storm using SBUH analysis.

Downstream evaluation is required for at least one-quarter mile with downstream channel stability evaluated, and flooding and water quality impacts evaluated.

Available Publications Ordinance, Stormwater Program booklet and brochure

Source Controls As specified in the Puget Sound Manual, source controls are recommended for specific land uses including manufacturing, transportation and communication, wholesale or retail sales, service businesses and activities on public lands. General source controls include fueling stations, vehicle or equipment washing areas, storage or loading of solid or liquid materials, and vegetative management practices.

Erosion and Sediment Control Program

Program goal/objective	None stated
Exemptions and waivers	Agriculture - Kitsap SWCD stormwater related activities funded by county stormwater program.
Preferred Practices	Sediment traps and basins are designed to treat the runoff from a 2-yr, 24-hr storm. Other practices allowed include seasonal limits on land disturbance, gravel construction entrance and tire wash, silt fence, straw bales, slope drains, mulching, and temporary and permanent vegetative stabilization.
Design Criteria	Specified in Chapter II of " <i>Stormwater Management Manual for the Puget Sound Basin</i> ", February 1992, published by the Washington Department of Ecology.

Program Authority and Implementation

Both the erosion and sediment control program and the stormwater management program are implemented by the local government using state and local criteria. Within the Puget Sound watershed, erosion/sediment control and stormwater management programs are required at the local level as of January 1, 1995. The Puget Sound manual is being used until Kitsap County's revised stormwater management ordinance, with its associated manual, is adopted.

Project Permitting	Currently, plans are approved. New ordinance requires Site Development Activity Permits for activities which clear > 1 acre, grade > 150 yd ³ , are on slopes > 25%, or install > 5,000 ft ² impervious surface.
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Review process	Erosion and sediment control, construction, and stormwater plans are reviewed by county staff. Field visits done before approval.
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A detailed checklist is used for both erosion/sediment control and stormwater management.

Erosion/sediment control and stormwater management plans must be approved before issuance of a building permit (for projects > 5000 sf), a grading permit, zoning approval, clearing permit, conversion from forest land, or connection to the public stormwater system.

Inspections

Erosion/sediment controls/
Stormwater systems Inspected by county staff, no set frequency

Program Enforcement and Compliance

Penalty provisions are a program component. They include civil penalties with fines of up to \$1000 per day.

Other enforcement procedures Stop work order
 Withhold occupancy permits
 Withhold other permit applications

As-built certifications are required for all systems.

Final inspection of stormwater systems is performed by Kitsap County Construction Division.

Maintenance of Stormwater Systems

Maintenance of completed stormwater systems is required.

Legal entities include	City, County, State, Ports Private owner for commercial systems Property owners association
Inspection frequency	No specified frequency
Inspected by	Kitsap County
Oversight agency	Kitsap County
O/M responsibilities	Remove debris and accumulated sediments, mowing and vegetation management, vector catch basins and oil-water separators
Funding source	Stormwater Utility Fee (Currently \$3.75/ft ² lot/month)
Enforcement mechanism	Required maintenance covenant allows County to inspect systems, notify owner of required maintenance. If owner does not perform within 30 days, County can maintain and bill the owner.

Program Resources

The erosion/sediment control stormwater management programs are combined budget entities.

<u>Program Funding</u>	<u>Source</u>	<u>Amount</u>
Erosion/Sediment control	Permit fees	(8%)
	Road Dept. funding	(92%)
Stormwater management	Permit fees	\$ 60,000
	Road Dept. funding	\$ 750,000
	Utility fees	\$4,700,000

<u>Program Staffing</u>	<u>Position</u>	<u>Full Time</u>	<u>Needed</u>
	Administrative	1	1.5
	Engineer	2	2
	Inspector	5	*
	Scientist	1	1
	Clerical	1	1
	Support	0.5	1
	Technicians	8	8* (will inspect)

Current staff are in Development Review and Permitting, staff listed as needed are those for the new surface and stormwater management program.

Educational Programs

Educational programs will be a voluntary component of the program if the proposed stormwater utility is implemented. The proposed program includes the use of brochures, exhibits, public presentations, monitoring, and storm sewer stenciling. Two workshops per year are planned for contractors with six workshops planned each year to educate the general public.

Program Coordination

There is close coordination within the County's integrated erosion/sediment control and stormwater management program.

The program also is integrated with local land use planning, zoning, wetlands protection, tree protection, wellhead protection, and building approval programs.

Communication from the Washington Department of Ecology on NPDES and other state and federal programs needs to be improved.

Program Evaluation

Measures of success	Annual program evaluation by County Commission.
Research projects	None. Program work plan includes BMP and ambient monitoring.
Monitoring	Water chemistry, sediments, biological, and flow rates are proposed to be monitored under the County's stormwater work plan.

Program Evolution into Watershed Approach

The county's program began in September 1987 when the Flood Control Ordinance (No. 117) was adopted. In September 1992, the Erosion and Sedimentation Control Ordinance (No. 148-1992) was adopted. The County's Surface and Stormwater Management Program Ordinance (No. 156-1993) was adopted in October 1993 which authorizes the development and implementation of a comprehensive program. The Washington Dept. of Ecology currently is reviewing the County's proposed stormwater management ordinance. Ordinance 165-1994. "Surface and Stormwater Management Program Rate Structure", was adopted recently allowing implementation of the county surface and stormwater management program. The program proposed in the work plan will require approximately \$4.7 annually which equates to a monthly stormwater utility fee of \$3.75 for single family residences.

Retrofitting of developed areas is proposed in the work plan to reduce flooding, water quality degradation, stream channel erosion, and to restore/protect aquatic resources.

Watershed approaches are proposed in the work plan, especially development of basin plans, which will include regional stormwater management systems, water body targeting, and emphasis on nonstructural BMPs.

SEDIMENT AND STORMWATER MANAGEMENT PROGRAM SUMMARY

JURISDICTION: **MARICOPA COUNTY, ARIZONA**

Flood Control District
2801 West Durango Street
Phoenix, Arizona 85009

The erosion/sediment control program and the stormwater management program are separate programs. The Flood Control District implements a stormwater quantity management program while the stormwater quality and erosion/sediment control programs are administered by the Arizona NPDES program.

The impetus for the program includes flooding, stream channel erosion, water quality, and mandates from federal or state governments.

The program's legal authority is established in:

1. Flood Control Ordinance
2. ARS 11-251 (Section 30 and 36)

Stormwater Management Program

Program Goals/Objectives	Provide flood control management and leadership throughout Maricopa County. Assure that floors are protected from the 100 year storm and regulate construction in the floodplain in the unincorporated part of the county.
Exemptions and Waivers	Agriculture Mining Single family homes that are not part of a plat
Preferred practices	Infiltration practices since retention is required for all new development.

Design guidance includes methods for calculating retention volumes and computer modeling inputs for peak discharge calculations.

Performance Standards and Design Criteria

Water Quality	No specified performance std.	Follow state NPDES regulations.
Peak Discharge	No increase in velocity and peak rates of washes	Site specific analysis required.

Volume	No increase allowed, to prevent flooding	Must retain the runoff volume from a 100-yr, 2-hr storm.
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Downstream evaluation is required for any off-site discharges to prevent any increase in downstream flooding potential. Evaluation of downstream channel stability is required if potential problem exists.

Available Publications	<p><i>Drainage Design Manual for Maricopa County</i> <i>Volume I: Hydrology</i> <i>Volume II: Hydraulics</i> <i>Volume III: Erosion Control</i></p>
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Source Controls	The Arizona NPDES stormwater regulations require pollution prevention plans that emphasize source controls such as general housekeeping and using less toxic materials.
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Erosion and Sediment Control Program

Program goal/objective	None - State NPDES program seeks to reduce sedimentation of receiving waters.
Exemptions and waivers	Not applicable - State NPDES program exempts projects disturbing five acres or less.
Preferred Practices	None
Design criteria	None

Program Authority and Implementation

The erosion/sediment control program is implemented using federal criteria with federal implementation, while the stormwater management program uses state and regional criteria with regional implementation.

Project Permitting	State NPDES general permit for erosion, sediment, and stormwater control on construction sites. Flood Control District uses individual permits for stormwater quantity.
Review process	None listed A detailed checklist is not used.

Stormwater quantity management approval is required before issuance of a building permit, grading permit, or zoning approval.

Inspections

Erosion/sediment controls	NPDES requires contractor to inspect and maintain.
Stormwater systems	No frequency specified for inspections performed by Maricopa County Flood Control District.

Program Enforcement and Compliance

Penalty provisions are a program component for stormwater quantity. They include civil penalties with fines. Criminal penalties are those associated with a Class II misdemeanor which includes a fine, imprisonment, or both.

Other enforcement procedures	Stop work order (used infrequently) Withhold occupancy permits Withhold other permit applications
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As-built certifications are not required.

Final inspection of stormwater systems is performed by the Flood Control District.

Maintenance of Stormwater Systems

Maintenance of completed stormwater systems is required.

Legal entities include	Maricopa County Flood Control District Private owner for commercial systems Property owners association
Inspection frequency	None specified. District inspects private systems only upon receiving complaint
Inspected by	Maricopa County Flood Control District Municipalities
Oversight agency	Maricopa County Flood Control District Municipalities
O/M responsibilities	The District has maintenance crews assigned to its' structures. Maintenance includes debris removal, repair of eroded areas, repairs to structures.
Funding source	Special taxing district Cost share agreements with municipalities

Enforcement mechanism

For private systems, the District can request the County Attorney Office to enforce violation notices. District can conduct maintenance, bill the responsible party, and place a lien to recover costs.

Program Resources

The District only implements a stormwater quantity management program.

<u>Program Funding</u>	<u>Source</u>	<u>Amount</u>
Erosion/Sediment control	General appropriations	
Stormwater management	Special taxing district	
	General appropriations	
	Permit fees	

<u>Program Staffing</u>	<u>Position</u>	<u>Full Time</u>	<u>Part Time</u>	<u>Needed</u>
ES/SW	Administrative	1/2		
	Engineer	1/4		1/0
	Inspector	4/7		2/0
	Scientist	1/		
	Clerical	2/		
	Support	1/	1/1	1/0

Educational Programs

Educational programs are proposed as a voluntary component of the program. The District is preparing a plan for a three year stormwater pollution prevention education campaign as required for the municipalities which are receiving NPDES stormwater permits. The planned program includes the use of brochures, exhibits, monitoring, demonstration projects, and monitoring. The target audience includes contractors, consultants, developers, inspectors, and the general public.

Program Coordination

There is not close coordination between the County’s stormwater quantity management program and the federal NPDES erosion, sediment, and stormwater management program which is implemented through the Arizona NPDES Program.

The District’s flood control program is integrated with local land use planning, zoning, floodplain management, and building approval programs.

No conflicts arise with other programs.

Communication from EPA on NPDES and other related federal programs needs to be improved.

Program Evaluation

Measures of success	Number of municipalities requiring use of the District's Drainage Design Manual for all public work projects
Research projects	Testing the treatment effectiveness of vegetative treatment facility (bacteria and plants) to remove oil and grease in runoff from a vehicle maintenance facility. Vegetative treatment system for agricultural tailwater is being designed and will be constructed in the future.
Monitoring	Water chemistry, sediments, biological, and flow rates

Program Evolution into Watershed Approach

Retrofitting of developed areas is proposed with plans being developed to reduce flooding, water quality degradation, stream channel erosion, and to restore/protect riparian and wetland resources.

Watershed approaches are being used including regional stormwater management systems, water body targeting, and emphasis on nonstructural BMPs.

**SEDIMENT AND STORMWATER MANAGEMENT
PROGRAM SUMMARY**

JURISDICITON: **MONTGOMERY COUNTY, MARYLAND**
 Department of Environmental Protection
 250 Hungerford Drive
 Rockville, Maryland 80850

The erosion/sediment control program and the stormwater management program are integrated programs.

The impetus for the program includes flooding, stream channel erosion, water quality, ground water recharge, and mandates from federal or state government.

The program’s legal authority is established in:

1. Chapter 26.09, Code of Maryland Regulations
2. Chapter 19, Montgomery County Code

Stormwater Management Program

Program Goals/Objectives	<p>To protect, maintain, and restore high chemical, physical, and biological conditions in the County’s waters and wetlands.</p> <p>To maintain and restore a natural waterway environment in county streams with habitat supporting varied wildlife and aquatic life along with appropriate recreational, water supply, and other uses.</p>
Exemptions and Waivers	<p>Agriculture Forestry Single family homes with lots of two or more acres</p>
Preferred practices	<p>Infiltration (when feasible) and sand filters, in combination with dry detention, for projects discharging to thermally sensitive waters. Wet detention/wetland ponds, perhaps in combination with other practices, in other areas. Extended detention in combination with other practices.</p>

Practices constructed	<u>Practice</u>	<u>1992</u>	<u>1993</u>
	Infiltration trench	35	40
	Sand filter	0	5
	Wet detention pond	8	6
	Extended dry detention	4	6
	Peak dry detention	2	3
	Wetlands	7	8
	Biofiltration	8	13

Design criteria and guidelines are specified in the County's stormwater regulations, check-lists, and design guidances.

Performance Standards and Design Criteria

Water Quality	Meet state WQ standards	Treat the first half inch of runoff using appropriate practices
Peak Discharge	No specified performance std.	Post-development peak rate can not exceed pre-development rate for the 2-yr, 24-hr storm and, when necessary, for the 10-yr and 100-yr, 24-hr storm.
Volume	None	

Downstream evaluation is required with downstream channel stability evaluated.

Available Publications

Source Controls	General public information, education about proper use of fertilizers and pesticides, proper disposal of oil, antifreeze, and other hazardous wastes, and improving the health of riparian zones are encouraged for all land uses, especially those within the proposed special protection areas.
	Activities just beginning. Will be done in coordination and cooperation with the Maryland Cooperative Extension Service and the Maryland-National Park and Planning Commission.

Erosion and Sediment Control Program

Program goal/objective	To protect downstream waters and adjacent property from sedimentation and erosion caused by land disturbing activities.
	Just beginning work on developing a specific performance standard.

Exemptions and waivers	Agriculture Projects disturbing < 5000 ft ²
Preferred Practices	Sediment basins and traps currently are designed to capture 1800 ft ³ /acre, but this will be changed to 3600 cf/acre. Mulching, sodding, staged clearing, silt fence, gravel construction entrance, temporary and permanent vegetative cover.
Design Criteria	Specified in <i>Maryland Standards and Specifications Handbook</i>

Program Authority and Implementation

Both the erosion and sediment control program and the stormwater management program are implemented by the local government using state and local criteria.

Project Permitting	Individual sediment control permit includes stormwater management requirements. Stormwater management concept must be approved before permit application is accepted.
Review process	Erosion and sediment control, construction, and stormwater plans along with supporting technical information are reviewed by county. A detailed checklist is used for both erosion/sediment control and stormwater management.

Erosion/sediment control and stormwater management plans must be approved before issuance of a building permit, a grading permit, or a floodplain district permit.

Inspections

Erosion/sediment controls	Inspected twice monthly by county staff
Stormwater systems	Inspected daily at critical stages of construction by county staff

Program Enforcement and Compliance

Penalty provisions are a program component. Civil penalties include fines of \$500 per day (for initial violation), or \$750 per day (for repeat violations). Criminal penalties are a \$1000 fine or six months in jail for each day in violation.

Other enforcement procedures	Stop work order Withhold other permit applications Confiscate bond Obtain court order
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As-built certifications are required only for pond systems.

Final inspection of stormwater systems is performed by Montgomery County DEP inspector.

Maintenance of Stormwater Systems

Maintenance of completed stormwater systems is required.

Legal entities include	City, County, State Private owner for commercial/industrial systems Property owners association for residential systems
Inspection frequency	Until now, no specified frequency with inspections performed in response to complaints. With new inspection staff, annual inspections are planned.
Inspected by	Montgomery County DEP
Oversight agency	Montgomery County DEP
O/M responsibilities	Maintain structures for structural integrity and for functional level of performance.
Funding source	No dedicated funding
Enforcement mechanism	DEP notifies owner of required maintenance, if not performed then DEP does it and assesses the responsible party through tax billings.

Program Resources

<u>Program Funding</u>	<u>Source</u>	<u>Amount</u>
Erosion/sediment/stormwater control program (FY95)	General appropriation	\$528,630 (36%)
	Permit fees	\$869,400 (60%)
	Capital improvement fund	\$ 56,000 (4%)

<u>Program Staffing</u>	<u>Position</u>	<u>Full Time</u>	<u>Needed</u>
ES/SW	Administrative	.8/1	
	Engineer/scientist	1.7/7.25	1/2-3
	Inspector	10.5/2.9	2/1
	Clerical	1/1.2	
	Support	2.9/0.95	2/2

Educational Programs

Educational programs are a voluntary component of the program which are just being developed. The proposed program includes the use of brochures, and storm sewer stenciling. Targeted audiences include contractors, consultants, developers, and the general public.

Program Coordination

There is close coordination within the County’s integrated erosion/sediment control and stormwater management program.

The program also is integrated with local land use planning, zoning, wetlands protection, floodplain management, tree protection, and building approval programs.

Conflicts arise at times with various environmental programs (stormwater, wetlands, tree protection) because of conflicting goals. Overall coordination is difficult because of the number of agencies involved. Also have conflicts with other programs such as transportation, economic development, and housing.

Communication from the Maryland Department of Environment on NPDES and other state and federal programs is good.

Program Evaluation

Measures of success	Work load evaluations including measurement of needs and actual output. Number of enforcement actions.
Research projects	None
Monitoring	Developing program now to improve current efforts. Have volunteer monitoring network. Will include water chemistry, sediments, biological, and flow rates.

Program Evolution into Watershed Approach

The Montgomery County Soil and Water Conservation District began the erosion and sediment control program in the late 1960s with the stormwater management program starting in 1971. With passage of the Maryland Stormwater Management Act in 1984, the county implemented a stormwater management program for quantity and quality. In the late 1980s a MOU between the SWCD and the County gave the County responsibility for the erosion and sediment control program.

Retrofitting of developed areas is being done under a separately funded program to reduce flooding, water quality degradation, stream channel erosion, and to restore/protect aquatic resources.

Watershed approaches being used include regional stormwater management systems, water body targeting, and emphasis on nonstructural BMPs.

SEDIMENT CONTROL AND STORMWATER MANAGEMENT PROGRAM SUMMARY

JURISDICTION: ***PRINCE GEORGE'S COUNTY, MARYLAND***

Watershed Protection Branch
9400 Peppercorn Place, Suite 600
Landover, Maryland 20785

The erosion/sediment control program and the stormwater management program are separate yet integrated programs. The stormwater management review is done separately but enforcement of erosion/sediment control and stormwater are done together.

The impetus for the program is flooding, stream channel erosion, water quality, ground water recharge, floodplain protection, and mandates from federal or state government.

The program's legal authority is established in:

1. Article 29, Title 4, subtitles 1 and 2, Annotated Code of Maryland
2. Chapter 26.09, Code of Maryland Regulations
3. County Code Subtitle 4 (Building), Division 2 (Floodplain)
Division 3 (Grading, Drainage and Pollution Control)
Division 4 (Stormwater Management)

Stormwater Management Program

Program Goals/Objectives	To reduce, control, or eliminate the adverse results of stormwater, erosion, and sedimentation on water quality and flooding.
Exemptions and Waivers	Agriculture Forestry
Preferred practices	Infiltration, extended dry or wet detention, bioretention, and grit and oil separators.

Practices constructed	<u>Practice</u>	<u>1992</u>	<u>1993</u>
	Infiltration trench	57	43
	Infiltration basin	1	1
	Grit/oil separators	38	38
	Wet detention pond	20	23
	Extended dry detention	6	4
	Peak dry detention	12	4
	Underground detention	5	4

Design criteria are specified in *County Stormwater Management Design Manual, 1991*, Department of Environmental Resources, and in *Design Manual for use of Bioretention in Stormwater Management, 1993*.

Performance Standards and Design Criteria

Water Quality	Meet state WQ standards	Treat the first half inch of runoff from impervious areas using appropriate practices.
Peak Discharge	No increase in rate	Post-development peak rate can not exceed pre-development rate for the 2-yr and 10-yr, 24-hr storms and for the 100-yr, 24-hr storm if potential for downstream flooding.
Volume	None	Must use infiltration practices if soils have percolation rate greater than 0.17 inches per hour.

Downstream evaluation is required with downstream channel stability evaluated.

Available Publications	<i>County Stormwater Management Design Manual, 1991.</i> <i>Design Manual for use of Bioretention in Stormwater Management, 1993.</i>	
Source Controls	As required by the County's NPDES municipal separate storm sewer system permit. Guidance is available through pamphlets on subjects such as lawn care, car care, etc.	

Erosion and Sediment Control Program

Program goal/objective	To reduce sedimentation and erosion caused by land disturbing activities.	
Exemptions and waivers	Agriculture	
Preferred Practices	Sediment basins and traps currently are designed to capture 1800 ft ³ /acre, but this will be changed to 3600 ft ³ /acre. Other practices allowed include mulching, sodding, staged clearing, silt fence, gravel construction entrance, temporary and permanent vegetative cover.	
Design Criteria	Specified in <i>Maryland Standards and Specifications Handbook</i>	

Program Authority and Implementation

Both the erosion/sediment control program and the stormwater management program are implemented by the local government using state and local criteria.

Project Permitting Individual sediment control permit and stormwater management permit.

Review process Erosion and sediment control, construction, and stormwater plans along with supporting technical information are reviewed by county staff.

A detailed checklist is used for both erosion/sediment control and stormwater management.

Erosion/sediment control and stormwater management plans must be approved before issuance of a building permit or a grading permit. Stormwater management plans must receive conceptual approval before preliminary plat submission and approval with final technical approval prior to final plat approval.

Inspections

Erosion/sediment controls Inspected every 14 days by project engineer and county staff

Stormwater systems Inspected during construction at key milestones or phases by project engineer and county staff.

Program Enforcement and Compliance

Penalty provisions are a program component. Civil penalties include fines of \$250 per day (for initial violation), \$500 per day (for second offense), \$750 per day (for third violation), and \$1000 per day for additional violations. Criminal penalties are a \$1000 fine or six months in jail, or both, for each day in violation.

Other enforcement procedures Stop work order
 Withhold occupancy permits
 Withhold other permit applications
 County conduct corrective work, place tax lien on property

As-built certifications are required for all stormwater management systems.

Final inspection of stormwater systems is performed by County inspector and by project engineer.

Maintenance of Stormwater Systems

Maintenance of completed stormwater systems is required.

Legal entities include	City, County, State Private owner for commercial/industrial systems Property owners association for residential systems
Inspection frequency	Private systems are inspected every three years with public systems inspected annually.
Inspected by	Prince George's County Watershed staff (private systems). PGC Public Works & Transportation staff (public systems)
Oversight agency	Prince George's County DER and Dept. Public Works and Transportation.
O/M responsibilities	Established in County design manual. Maintain structures for structural integrity and for functional level of performance.
Funding source	County ad valorem taxes.
Enforcement mechanism	County DER notifies owner of required maintenance, if not performed then county does it and places a tax lien on the property.

Program Resources

<u>Program Funding</u>	<u>Source</u>	<u>Amount</u>
Erosion/sediment	Permit fees	\$ 400,000 (80%)
	Special taxing district	\$ 100,000 (20%)
Stormwater management	Permit fees	\$ 300,000 (5%)
	Special taxing district	\$8,000,000 (95%)

<u>Program Staffing</u>	<u>Position</u>	<u>Full Time</u>	<u>Needed - SW Review</u>
ES/SW Inspection	Administrative	2	Administrative 1
	Inspector	17	Reviewers 10
	Clerical	1	Clerical 2

Educational Programs

Educational programs are a component of the program which is required by the County's NPDES MS4 stormwater permit. Brochures, demonstration projects, monitoring, exhibits, and storm sewer stenciling are used to educate the targeted audiences of contractors, consultants, developers, and the general public. Two educational programs are conducted annually, each attracting about 80 individuals.

Program Coordination

There is close coordination within the County's integrated erosion/sediment control and stormwater management program.

The program also is integrated with local land use planning, wetlands protection, floodplain management, tree protection, land acquisition, and building approval programs.

Conflicts arise with the programs administered by the Soil and Water Conservation District which creates duplicative permitting.

Communication from the Maryland Department of Environment on NPDES and other state and federal programs is good but there is little communication from federal agencies.

Program Evaluation

Measures of success	County pilot studies
Research projects	None
Monitoring	Biological

Program Evolution into Watershed Approach

The Prince George's County Soil and Water Conservation District began the erosion and sediment control program in the late 1960s. With passage of the Maryland Stormwater Management Act in 1984, the county implemented a stormwater management program for quantity and quality in 1985.

Retrofitting of developed areas is being pursued to reduce flooding, water quality degradation, stream channel erosion, and to restore/protect aquatic resources.

Watershed approaches being used include regional stormwater management systems and emphasis on nonstructural BMPs.

SEDIMENT CONTROL AND STORMWATER MANAGEMENT PROGRAM SUMMARY

JURISDICTION: SNOHOMISH COUNTY, WASHINGTON

Surface Water Management
Wall Street Building, Suite 101
2930 Wetmore Avenue
Everett, Washington 98201

The erosion/sediment control program and the stormwater management program are integrated programs. They also are integrated with the county's rivers and watershed management program.

The impetus for the program includes flooding, stream channel erosion, water quality, and protecting aquatic habitats.

The program's legal authority is established in:

1. Chapter 36, Revised Code of Washington (Counties)
2. Title 25, Snohomish County Code (Storm and Surface Water Management)

Stormwater Management Program

Program Goals/Objectives	To work in partnership with the citizens to protect and enhance water quality and aquatic habitats, to minimize damage from flooding and erosion, and to preserve a water resource legacy for future generations.
Exemptions and Waivers	Agriculture Projects which create < 5,000 ft ² impervious surface or which collect stormwater from more than 5,000 ft ² of drainage area.
Preferred practices	Infiltration if soils are appropriate. Other practices allowed include filtration, biofiltration, and wet detention.

Design criteria currently are specified in the County Engineering Standards. The Snohomish County Stormwater Management Manual is in preparation and is based on the *Puget Sound Stormwater Management Manual* (Washington Dept. of Ecology).

Performance Standards and Design Criteria

NOTE: Performance standards and design criteria for stormwater quality and volume are pending adoption.

Water Quality	No specified performance std.	Use appropriate BMPs to treat the post-development runoff volume from a 6-month, 24-hour storm.
Peak Discharge	No increase in rate	If can not infiltrate runoff, then the detained volume can be released at no greater than 50% of the pre-development rate. Post-development rate can not exceed pre-development for the 10-yr, 24-hr and 100-yr, 24-hr storms.
Volume	No specified performance std.	Infiltrate the runoff from a 2-yr, 24-hr storm to the extent site conditions allow.

Downstream evaluation is required with downstream channel stability evaluated.

Available Publications Numerous publications including watershed management plans for several watersheds and regional detention siting or design reports. Specific publications of interest include *State of the Waters: 1993 Assessment (Oct. 1993)*, *Stormwater Characterization and Pollution Load Estimates (May 1994)*, and *1993-94 Watershed Education Program Final Report and Evaluation (Sept. 1994)*.

Source Controls Commercial and industrial land uses are encouraged to use applicable source controls included in the Washington Dept. of Ecology's *Stormwater Management Manual for the Puget Sound Basin* such as material handling, roofing, and proper plumbing.

Erosion and Sediment Control Program

Program goal/objective To minimize on-site erosion and off-site sedimentation.

Exemptions and waivers Agriculture

Preferred Practices Sediment basins and traps which are designed to capture the runoff from a 10-yr, 24-hr storm. Other practices include mulching, seasonal limits on disturbed area, silt fence, gravel construction entrance, slope drains, and temporary and permanent vegetative stabilization.

Design Criteria Specified in *Snohomish County Stormwater Management Manual* which is based on the criteria within the Puget Sound Manual.

Program Authority and Implementation

Both the erosion and sediment control program and the stormwater management program are implemented using state, regional, and local criteria with implementation by the local government program. Within the Puget Sound watershed, erosion/sediment control and stormwater management programs are required at the local level as of January 1, 1995.

Project Permitting Noticed exemptions and Individual permits are used for both erosion/sediment control and stormwater management.

Review process Detailed plans and supporting documentation are reviewed by County staff to assure compliance with County requirements.

A detailed checklist is used for both erosion/sediment control and stormwater management.

Erosion/sediment control and stormwater management approval is required before land clearing begins.

Inspections

Erosion/sediment controls Required as needed, performed by site engineer or County staff.

Stormwater systems Required as needed. Performed by Dept. of Community Development.

Program Enforcement and Compliance

Penalty provisions are a program component. They include civil penalties with fines of \$100 to \$500 per day.

Other enforcement procedures Stop work order (used infrequently)

As-built certifications are required for infiltration practices, filtration practices, biofiltration but not for detention ponds.

Final inspection of stormwater systems is performed by Dept. of Community Development inspector.

Maintenance of Stormwater Systems

Maintenance of completed stormwater systems is required.

Legal entities include	Private owner for commercial systems Property owners association in limited cases
Inspection frequency	Detention systems are inspected once every five years
Inspected by	Public Works Department
Oversight agency	Public Works Department
O/M responsibilities	Public facility maintenance performed by County Road Maintenance crews.
Funding source	Stormwater utility with SF rate of \$22 per year
Enforcement mechanism	Fines for owners of commercial facilities

Program Resources

<u>Program Funding</u>	<u>Source</u>	<u>Amount</u>
Erosion/Sediment control	Permit fees	Highly variable (90%)
Stormwater management	WMA Fees	\$1,880,000
	REET	597,000
	DOE grants	1,047,000
	SRL Fund	200,000
	Other	1,425,000

<u>Program Staffing</u>	<u>Position</u>	<u>Full Time</u>	<u>Needed</u>
ES/SW	Administrative	4	3
	Engineer	9	10
	Scientist	2	2
	Clerical	3	
	Support	1	5
	Engineering Technicians	11	10
	Planner	6	6
	Water Quality Technicians	1	2
	Watershed stewards	3	3

Educational Programs

Educational programs are a required component of the program. Brochures, shows, exhibits, monitoring, and storm sewer stenciling are used to educate the target audience of contractors, consultants, developers, inspectors, and the general public. A formal education program currently is under development.

Program Coordination

There is close coordination within the County’s integrated erosion/sediment control and stormwater management program.

The program also is integrated with local land use planning, zoning, wetlands protection, tree protection, floodplain management, land acquisition, and building approval programs.

Communication with the Washington Department of Ecology on NPDES and other state and federal programs is good.

Program Evaluation

Measures of success	Number of citizen complaints and drainage problems
Research projects	BMP evaluation program to determine the treatment effectiveness of different filter media.
Monitoring	Water chemistry and flow rates

Program Evolution into Watershed Approach

The surface water management program began in 1988.

Retrofitting of developed areas is being pursued as part of the NPDES MS4 permit to reduce flooding and water quality degradation.

Watershed approaches being used include regional stormwater management systems, water body targeting, and emphasis on nonstructural BMPs.

SEDIMENT CONTROL AND STORMWATER MANAGEMENT PROGRAM SUMMARY

JURISDICTION: **SOMERSET COUNTY, NEW JERSEY**

Engineering Department
20 Grove Street, P.O. Box 3000
Somerville, New Jersey 03876

This is a stormwater management program. The erosion and sediment control program is completely separate from the stormwater program and administered by the New Jersey State Soil Conservation Committee.

The impetus for the program includes flooding, stream channel erosion, water quality protection, protection of county roads and stormwater facilities, and requirements imposed by federal and state governments.

The program's legal authority is established in the State's county enabling legislation which creates county authority over county roads and stormwater systems and empowers county planning boards to review any development that may affect them.

Stormwater Management Program

Program Goals/Objectives	<p>To prevent increases in peak flow rates, depths, and velocities in channels and at bridges caused by development activities.</p> <p>To protect environmental quality of streams while balancing need for growth.</p>
Exemptions and Waivers	<p>Agriculture Forestry</p> <p>Waivers may be granted to developments that will not contribute to immediate downstream impacts. However, these developments must contribute the cost of constructing on-site stormwater facilities to the county regional stormwater fund.</p>
Preferred practices	<p>Dry detention basins - most common Vegetated swales Wet detention ponds - where depth of permanent pool, dry weather flow, and proper O/M can be achieved at site. Constructed wetlands - where dry weather flow and proper O/M can be achieved. Not preferred in residential areas.</p>

Infiltration practices are not allowed.

Practices installed	<u>Practice</u>	<u>1992</u>	<u>1993</u>
	Wet detention	2	0
	Wetlands	2	0
	Extended dry detention	24	0

Design criteria are given within the regulations.

Performance Standards and Design Criteria

Water Quality	Treat 1.25 inch/2 hour storm	Discharge 90% total inflow volume within 18 hours (SF residential) or within 36 hours (MF residential, non-resid)
Peak Discharge	Performance standards set by county watershed models	Post-development rate is allowed to be a set percentage of existing rate: 2 yr storm = 50%, 10 yr storm = 75% 100 year storm = 80%
Volume	To offset increased runoff volumes and flow durations which may create or add to channel erosion	Reduce 2 year peak rate by 50%

Downstream evaluation may be required and downstream channel stability is considered

Available Publications Source controls, fertilizer, and pesticide use by residents.

Source Controls Are encouraged on all land uses. Preferred practices include material protection and storage to reduce exposure to rainfall and runoff, spill prevention and clean up, and fertilizer and pesticide use and management. Guidance available for residential use of fertilizers and pesticides.

Erosion and Sediment Control Program

See program summary for the New Jersey State Soil Conservation Committee.

Program Authority and Implementation

The stormwater program is implemented using state criteria for stormwater quality and local criteria for stormwater quantity.

	Sediment and debris removal Structural repairs
Funding source	General tax revenues
Enforcement mechanism	After notification and waiting period, county can perform necessary O/M and bill responsible party

Program Resources

<u>Program Funding</u>	<u>Source</u>	<u>Amount</u>
SW	General appropriations	\$100,000
	Application fees	\$ 5,000
	Inspection fees	Hourly basis + travel

Note: Application fee amount represents stormwater management portion. Total site plan or subdivision application fees were \$29,000 in 1993.

<u>Program Staffing</u>	<u>Position</u>	<u>Full Time</u>	<u>Part Time</u>	<u>Needed</u>
	Administrative	1		
	Engineer	2	2	1-2
	Inspector	1		1
	Clerical	1		
	Support		1	
	Scientist			1

Educational Programs

Educational programs are a voluntary component of the stormwater management program. Activities include demonstration projects, exhibits, and monitoring.

Intended audience includes consultants, local government planning boards, environmental commissions, and engineers. One educational program per year is conducted for consultants (approximately 30) and one is conducted for the local government staff.

Program Coordination

There is close coordination between the County Stormwater Program and the State Erosion and Sediment Control Program.

Because of the local institutional framework, the County Stormwater Program is integrated with local land use planning, zoning, wetlands protection, floodplain management, and building approval programs.

There are conflicts with state wetland and floodplain management programs which often prevent or require siting of stormwater facilities, outfall, or maintenance access routes in locations which hinder construction, maintenance, performance or safety.

Program Evaluation

Measures of success	Review of as-built plans to assure correct construction. Limited flow monitoring to check performance. Annual or bi-annual O/M inspections.
Research projects	Sampling shopping mall detention basin for WQ treatment ability. Sampling effluent quality at county recycling center detention pond. Constructed wetland pilot and demonstration projects. Rainfall and runoff gaging and analysis.
Monitoring	Water chemistry, sediment, biological, flow rates

Program Evolution into Watershed Approach

The stormwater program began in 1975 with a focus on flood protection in response to destructive and deadly flooding in 1971 and 1973.

Retrofitting of developed areas is not being pursued.

Watershed approaches being used include regional stormwater management systems, waterbody targeting, and emphasis on nonstructural BMPs.

**SEDIMENT CONTROL AND STORMWATER MANAGEMENT
PROGRAM SUMMARY**

JURISDICTION: **WASHINGTON COUNTY, OREGON**
 Unified Sewerage Agency of Washington County
 155 N. First Avenue, Suite 270
 Hillsboro, Oregon 97724

The erosion/sediment control program and the stormwater management program are integrated programs.

The impetus for the program is flooding and water quality.

The program's legal authority is established in:

1. Information was unavailable
- 2.
- 3.

Stormwater Management Program

Program Goals/Objectives	Protect and improve storm/flood protection and surface water quality in urban part of county.												
	Comply with Total Maximum Daily Load requirements on jurisdictions in the Tualatin River basin set in State Administrative Rule.												
	Comply with requirements of NPDES MS4 permit.												
Exemptions and Waivers	Agriculture Forestry Single family homes that are not part of a plat												
Preferred practices	None specified in regulations. Swales, extended dry detention, wetland ponds are favored while infiltration practices are not allowed.												
Practices installed	<table border="0" style="width: 100%;"> <tr> <td style="text-align: left;"><u>Practice</u></td> <td style="text-align: center;"><u>1992</u></td> <td style="text-align: center;"><u>1993</u></td> </tr> <tr> <td>Extended dry detention</td> <td style="text-align: center;">2</td> <td style="text-align: center;">8</td> </tr> <tr> <td>Swales (biofiltration)</td> <td style="text-align: center;">10</td> <td style="text-align: center;">15</td> </tr> <tr> <td>Leaf compost filters</td> <td style="text-align: center;">2</td> <td style="text-align: center;">2</td> </tr> </table>	<u>Practice</u>	<u>1992</u>	<u>1993</u>	Extended dry detention	2	8	Swales (biofiltration)	10	15	Leaf compost filters	2	2
<u>Practice</u>	<u>1992</u>	<u>1993</u>											
Extended dry detention	2	8											
Swales (biofiltration)	10	15											
Leaf compost filters	2	2											

Design criteria guidance is provided in *Portland/USA Water Quality Facility Technical Guidance Handbook*.

Performance Standards and Design Criteria

Water Quality	Remove 65% of TP	Treat 0.36 inch of runoff (4 hr storm) from new impervious areas using appropriate BMPs.
Peak Discharge	No increase in rate	Post-development rate can not exceed pre-development rate for the 25-yr, 24-hr storm.
Volume	None	

Downstream evaluation is required to prevent any increase in downstream flooding potential with detention or increased conveyance capacity used as mitigation. No evaluation of downstream channel stability.

Available Publications *Erosion Control Plans Technical Guidance Handbook*
Portland/USA Water Quality Facilities Technical Guidance Handbook
King County Hydrology/Hydraulics Method Handbook

Source Controls The County encourages the use of source control practices such as 25 feet wide buffers along stream corridors and wetlands on all new developments. Cover practices are emphasized for erosion control. Technical assistance on the use of controls is available.

Erosion and Sediment Control Program

Program goal/objective To comply with the requirements of State Administrative Code for the Tualatin river basin.

Performance standard is no visible/measurable (< one cubic foot) off-site erosion or visible silty runoff.

Exemptions and waivers None

Preferred Practices Sediment basins and traps are designed to capture the runoff from a 10-yr, 24-hr storm but they are rarely used. Other practices used include silt fence, gravel construction entrance, diversions, bio-bags, straw, compost, and temporary and permanent vegetative cover.

Design Criteria Specified in *Erosion Control Plans Technical Guidance Handbook*

Program Authority and Implementation

The erosion/sediment control program is implemented using state criteria with local imple-

mentation, while the stormwater management program uses state and local criteria with local implementation.

Project Permitting	Individual permits are used, with the Agency also issuing the State NPDES stormwater permit for construction activities disturbing over 5 acres.
Review process	Preliminary review conducted at the land use action stage with a detailed review performed at the construction plan approval stage. Super detailed analysis is conducted at the inspection stage. A detailed checklist is not used.

Erosion/sediment control approval is required before issuance of a grading permit while the stormwater management approval is required before issuance of a building permit.

Inspections

Erosion/sediment controls	Required at least once a week to assure proper maintenance and operation, with inspections performed by staff from the USA.
Stormwater systems	No specified frequency, with inspections performed as needed by staff from the USA.

Program Enforcement and Compliance

Penalty provisions are a program component. They include civil penalties with fines of \$100 to \$500 per day.

Other enforcement procedures	Stop work order. Performance bond requirements.
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As-built certifications are not required.

Final inspection of stormwater systems is performed by USA inspector.

Maintenance of Stormwater Systems

Maintenance of completed stormwater systems is required.

Legal entities include	USA or city for BMPs serving SF residential Private owner for other systems Property owners association in limited cases
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Inspection frequency	Once or twice a year for facilities USA maintains.
Inspected by	USA, cities, owner depending on facility ownership.
Oversight agency	USA or cities
O/M responsibilities	Public facility maintenance includes mowing, debris and sediment removal, which is performed by USA. Private facilities must submit operation and maintenance plan as part of permitting process.
Funding source	Stormwater Utility Fee (Currently \$36/ yr/ SFU)
Enforcement mechanism	None

Program Resources

<u>Program Funding</u>	<u>Source</u>	<u>Amount</u>
Erosion/sediment control	Permit fees Stormwater utility fee	Highly variable (90%) (10%)
	Permit fee is \$80+\$20/acre (\$165) or % of construction value.	
Stormwater management	Stormwater utility fee Permit fees System development charge	Permit fee is 5% of project cost for plan review and inspections. System development charge is \$280 per 2640 ft ² of impervious surface area.

<u>Program Staffing</u>	<u>Position</u>	<u>Full Time</u>	<u>Part Time</u>	<u>Needed</u>
ES/SW	Administrative	0/2	2/0	
	Engineer	0/3	1/0	
	Inspector	4/3	0/0	Several
	Clerical	1/0		
	Support	0/0	1/0	Plan reviewers Maintenance

Educational Programs

Educational programs are a mandatory component of the program. Brochures, shows, demonstration projects, and storm sewer stenciling are used to educate the targeted audience of contractors, consultants, developers, inspectors, school children, and the general public. During the past year, one program was given for contractors with 50 attending, one inspector program attracted 40 attendees, and 25 developers attended one program. Regular programs are given for the public and about 5000 school children attend Tualatin

River Ranger programs.

Program Coordination

There is close coordination within the County's integrated erosion/sediment control and stormwater management program.

The program also is integrated with local land use planning, wetlands protection, floodplain management, wastewater management, and building approval programs.

Conflicts arise with local land use and transportation planning programs, and building departments, which are administered by different local county and city government agencies, because of inadequate communication and coordination.

Communication with the Oregon Department of Ecology on NPDES issues is adequate. Implementation of the Tualatin River Basin Water Quality Management Program involves many entities which meet regularly to discuss and coordinate implementation activities.

Program Evaluation

Measures of success	Public maintenance activities are tracked and evaluated annually. Participation in public education programs. Monitoring of some BMPs and receiving waters.
Research projects	BMP evaluation program to determine the treatment effectiveness of leaf compost filter systems, swales, and wet detention ponds. Collecting baseline water quality data upstream and downstream of proposed regional water quality enhancement projects.
Monitoring	Water chemistry and flow rates.

Program Evolution into Watershed Approach

The program has been in existence for four years. Its original focus was solving flooding problems but has evolved to include water quality considerations because of requirements of the Clean Water Act, especially the establishment of a TMDL for the Tualatin River.

Retrofitting of developed areas currently is being not being pursued but stream restoration projects are planned and will be implemented in the near future.

Watershed approaches being used include regional stormwater management systems and emphasis on nonstructural BMPs.

SEDIMENT CONTROL AND STORMWATER MANAGEMENT PROGRAM SUMMARY

JURISDICTION: ***URBAN DRAINAGE AND FLOOD CONTROL DISTRICT (DENVER)***
2480 West 26th Avenue, Suite 156B
Denver, Colorado 80209

The erosion/sediment control program and the stormwater management program are separate programs. The UDFCD is a regional authority responsible for flood protection in the greater Denver area, covering 36 local jurisdictions and 1608 square miles. The District plans, constructs, and maintains multi-jurisdictional stormwater systems into which it can control discharges. Local governments within the District's area may establish stormwater management programs. Currently, 33 local governments have implemented stormwater quantity (flood control) requirements, 7 require stormwater treatment for new development, and 10 require erosion and sediment control at new development sites.

The impetus for the program includes flooding and stream channel erosion.

The program's legal authority is established in the 1969 state law establishing the Urban Drainage and Flood Control District for the Denver metropolitan area.

Stormwater Management Program

Program Goals/Objectives	To protect the life and property of citizens from flooding and to minimize flood damages.	
Exemptions and Waivers	Not applicable. Local governments may have permitting programs.	
Preferred practices	Extended detention basins and retention ponds. Also allow modular porous pavement, wetland basins and channels.	

Performance Standards and Design Criteria (Recommended by UDFCD, but must be adopted by locals)

Water Quality	Treat 80th percentile runoff event volume	Treatment volume depends on imperviousness and detention time, maximum value for 100% imperviousness is 0.5" runoff.
Peak Discharge	Performance standard depends upon storm and location	Peak rate for 2, 5, 10, 50, and 100 -yr storm can't exceed historic (undeveloped) rate for 5-yr and larger storms.

Volume No specified performance standard

Downstream evaluation may be required, especially if master plan is not available for the area, and downstream channel stability is required using grade control or bank erosion control.

Design criteria are specified in Urban Storm Drainage Criteria Manual

Available Publications Urban Storm Drainage Criteria Manual, Volumes 1 and 2, Revised 1991 (\$75)
Urban Storm Drainage Criteria Manual, Volume 3 - BMPs, 1992 (\$40)

Source Controls Minimizing DCIA, grass buffers, swales, good housekeeping practices are encouraged for all land uses with guidance available in the District's manual.

Erosion and Sediment Control Program

Program goal/objective To reduce erosion and control sediment at construction sites.

Performance Standard Implement recommended practices.

Exemptions and waivers Depends on regulations of the 10 local government programs. The State NPDES permit exempts activities disturbing five acres or less.

Preferred practices Sediment basins and traps designed for 0.25 inch of runoff from the site. Temporary and permanent vegetative cover, mulching, silt fence.

Design Criteria Recommended in Volume 3 of the Urban Storm Drainage Manual.

Program Authority and Implementation

Both the erosion/sediment control and stormwater management programs are implemented using regional criteria with regional and local implementation, with some localities using additional local criteria.

Project permitting UDFCD does not regulate stormwater discharges. Local governments review and approve stormwater management plans, and submit major drainageway projects to District for review.

Oversight agency	County, municipality, or District (for major facilities)
O/M activities	Grass and vegetation mowing and trimming, sediment and debris removal, structural repairs.
Funding source	District tax revenues raise \$4 million per year. Some local governments have established stormwater utilities.
Enforcement mechanism	None

Program Resources

<u>Program Funding</u>	<u>Source</u>	<u>Amount</u>
Stormwater program	District special taxing	\$10 million
NOTE: Erosion and sediment control is a secondary activity.		

<u>Program Staffing</u>	<u>Position</u>	<u>Full Time</u>	<u>Part Time</u>	<u>Needed</u>
	Administrative	1		1 (ES Control)
	Engineer	10		
	Inspector	2		4 (2 ES, 2 SW)
	Clerical	2		
	Support	2	6	

Educational Programs

Educational programs are a voluntary component of the stormwater management program. The intended audience includes contractors, consultants, developers, inspectors, and local government staff. One educational program per year is conducted which usually attracts from 100 to 150 persons.

Program Coordination

There is some coordination between the District’s Stormwater Program and the State Erosion and Sediment Control Program, with the state recognizing and supporting the District's BMPs and criteria.

The stormwater program is coordinated with local land use planning, zoning, wetlands protection, floodplain management, land acquisition, transportation, and building approval programs.

There are conflicts with federal regulatory attitudes and inflexibility.

Communication from federal agencies on related programs needs to be improved.

Program Evaluation

Measures of success	Major stormwater systems work well, provide multiple benefits including greenbelt making them popular with citizens.
Research projects	Constructing and monitoring detention ponds, constructed wetlands, sand filters, sediment vaults, and modular porous pavement to evaluate their effectiveness.
Monitoring	Water chemistry, sediment, flow rates, flood warning network.

Program Evolution into Watershed Approach

The stormwater program began in 1969 with enactment of the State law creating the District. The District has expanded its programs to include planning, designing, constructing, and maintaining major multi-jurisdictional drainageway facilities in support of local government needs.

Retrofitting is not being pursued.

All stormwater planning is done on a watershed basis with regional stormwater management systems and waterbody targeting being used.

SEDIMENT CONTROL AND STORMWATER MANAGEMENT PROGRAM SUMMARY

JURISDICTION: **NORTHEASTERN ILLINOIS PLANNING COMMISSION**
 222 South Riverside Plaza
 Suite 1800
 Chicago, Illinois 60606

The Northeastern Illinois Planning Commission, using Section 319 funds, developed a model erosion, sediment, and stormwater management program which is implemented voluntarily by local governments in the region. Numerous counties have implemented local programs based on the regional guidance.

The impetus for the program includes flooding, stream channel erosion, water quality, ground water recharge, protection of stream, lake, and wetland habitat.

The Planning Commission has no legal regulatory authority.

Stormwater Management Program

Program Goals/Objectives	<p>To develop consistent standards throughout the region, integrating historical flood prevention with emerging concerns over water quality and resource protection.</p> <p>To provide technical assistance to local governments, and the development community, on stormwater regulations, programs, and BMPs that can help avoid the adverse impacts of development on water resources.</p> <p>To educate elected officials on the merits of a holistic approach to stormwater management.</p>
Exemptions and Waivers	Model program exempts agriculture and forestry
Preferred practices	Extended detention basins are the preferred practice with swales, infiltration, and vegetative buffers encouraged, especially in combination with detention.

Design criteria are specified in *Urban Stormwater Best Management Practices for Northeastern Illinois (NEILL PC, 1993)*.

Performance Standards and Design Criteria

Water Quality	Minimize adverse impacts	Recommended treatment volume ranges from the six month storm for swales to the runoff from a two inch storm for other practices.
Peak Discharge	No increase in rate	Post-development rate can not exceed pre-development rate with a maximum of 0.15 cfs/acre for 100-yr, 24-hour storm.
Volume	Minimize increases to lessen downstream flooding, enhance recharge and base flow.	Promote minimizing imperviousness and maximizing infiltration.

Downstream evaluation is recommended as is a 2-yr storm peak discharge rate of less than 0.04 cfs/acre to minimize channel erosion.

Available Publications	Model Stormwater Drainage and Detention Ordinance (1990) <i>Urban Stormwater Best Management Practices for Northeastern Ill.</i>
Source Controls	Not emphasized in model ordinance but generally encouraged.

Erosion and Sediment Control Program

Program goal/objective	To provide technical assistance to local governments, and the development community, on effective regulations, programs, and practices to minimize the adverse impacts of construction site erosion.
Performance Standard	Minimize construction site erosion.
Exemptions and waivers (In Model Ordinance)	Agriculture Forestry Activities disturbing < 5000 ft ² or 500 ft ² if adjacent to water.
Preferred practices	Sediment basins and traps designed for runoff from the 10-yr storm. Other practices including temporary and permanent vegetative cover, mulching, seeding, sodding, erosion blankets, silt fence, gravel construction entrance, outlet stabilization.
Design Criteria	Specified in Best Management Practices for Northeastern Illinois, NIPC, April, 1993

Program Authority and Implementation

Local governments are encouraged to implement the erosion/sediment control and storm-water management program using regional criteria set forth in the NEIPC model ordinance. When implemented, local programs use:

Project permitting	Individual permits
Review process	Detailed erosion/sediment control plan and stormwater management plan are reviewed. Type of review varies with the local government.
	A detailed checklist is recommended and used by some local governments.

Local governments generally require erosion/sediment control and stormwater management approval before issuing a building or grading permit.

Inspections

Erosion/sediment controls	Varies with local government, generally 5-6 times during project.
Stormwater systems	Inspected as needed after construction by local government.

Program Enforcement and Compliance

Penalty provisions are a recommended program component which vary with the local government. Civil penalties generally include fines and performance bonds. Criminal penalties also vary and often are not explicitly stated.

Other enforcement procedures	Stop work order Withhold occupancy permits Fines or performance bonds
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As-built certifications are recommended, especially for detention facilities, with requirements set by local governments.

Final inspection of stormwater systems is recommended. Depending on the local government, they may be performed by the engineer or by untrained building inspectors.

Maintenance of Stormwater Systems

Maintenance of completed stormwater systems generally is required, depending on the local government.

Legal entities include	County or municipality Private owner Property owners association
Inspection frequency	Depends on need, none specified.
Oversight agency	None, depends on local government.
O/M activities	Not specified. Manual lists recommended activities for each practice.
Funding source	Varies with local government, no dedicated sources.
Enforcement mechanism	Performance bonds, but rarely used.

Program Resources

<u>Program Funding</u>	<u>Source</u>		<u>Amount</u>
<u>Program Staffing</u>	<u>Position</u>	<u>Full Time</u>	<u>Part Time</u>
	Administrative		
	Engineer		
	Inspector	Information was unavailable	
	Clerical		
	Support		

Educational Programs

Educational programs are a voluntary component of the recommended program. The Planning Commission and local governments conduct 10 to 20 seminars per year on various topics. Brochures, videos, and demonstration projects are use to educate the intended audience of contractors, consultants, developers, inspectors, engineers, and local government staff.

Program Coordination

Coordination between the stormwater program and the erosion/sediment control program varies depending on the local government.

Depending on the local government, the program may be coordinated with local wetlands protection, floodplain management, and building approval programs.

There generally are not conflicts with other programs which hinder effective implementation.

Communication from federal agencies on related programs needs to be improved.

Program Evaluation

Measures of success	Depends on local government
Research projects	Several Section 319 funded demonstration projects underway but most lack adequate monitoring
Monitoring	Flow rates

Program Evolution into Watershed Approach

The Northeastern Illinois Planning Commission was created in 1957 to provide advice and technical assistance to the region's local governments. In the 1960s and 1970s the Commission's stormwater management efforts focused on flood control and prevention with activities such as model ordinances, mapping, etc. A more holistic approach emphasizing erosion/sediment control, stormwater treatment practices, stream and wetland protection, and more stringent detention criteria has been pursued in the last five to ten years.

Retrofitting stormwater impacts from developed areas to reduce flooding, stream channel erosion, and impairment of water quality and aquatic resources is being pursued through demonstration projects.

Watershed approaches are being used including waterbody targeting and emphasis on nonstructural controls.

SEDIMENT CONTROL AND STORMWATER MANAGEMENT PROGRAM SUMMARY

JURISDICTION: **SOUTH FLORIDA WATER MANAGEMENT DISTRICT**

Surface Water Management Department

P.O. Box 24680

West Palm Beach, Florida 33416

The erosion/sediment control program and the stormwater management program are integrated programs. The District's program is integrated with and coordinated with the programs implemented by the Florida Department of Environmental Protection and three of the state's other water management districts.

The impetus for the program is flooding, water quality, groundwater recharge, resource protection, and federal or state mandates.

The program's legal authority is established in:

1. Chapter 373, Florida Statutes (Water Resources Act)
2. Chapter 403, Florida Statutes (Environmental Protection Act)
3. Chapters 62-40, 40E-4, 40, Florida Administrative Code

Stormwater Management Program

Program Goals/Objectives	Consideration of stormwater quantity (building floor and road elevation, discharge rate) and environmental (wetlands, endangered species, water quality) protection. To reduce the pollutant loading from existing drainage systems as needed to restore or maintain beneficial uses of water bodies.															
Exemptions and Waivers	Agriculture using closed water management systems															
Preferred practices	Treatment practices including retention, exfiltration trenches, grass swales, and wet detention ponds, which are the most widely used.															
Practices installed	<table><thead><tr><th><u>Practice</u></th><th><u>1992</u></th><th><u>1993</u></th></tr></thead><tbody><tr><td>Swales</td><td>200</td><td>200</td></tr><tr><td>Infiltration basin</td><td>100</td><td>100</td></tr><tr><td>Infiltration trench</td><td>50</td><td>50</td></tr><tr><td>Wet detention</td><td>300</td><td>300</td></tr></tbody></table>	<u>Practice</u>	<u>1992</u>	<u>1993</u>	Swales	200	200	Infiltration basin	100	100	Infiltration trench	50	50	Wet detention	300	300
<u>Practice</u>	<u>1992</u>	<u>1993</u>														
Swales	200	200														
Infiltration basin	100	100														
Infiltration trench	50	50														
Wet detention	300	300														

Design criteria are specified in the *Management and Storage of Surface Waters, Part IV, Applicant's Handbook*, especially within the "Basis of Review".

Performance Standards and Design Criteria

Water Quality	Remove at least 80% of the average annual TSS load and assure compliance with state water quality standards.	Treatment volume varies from 1.0 inch to 2.5 inches times % impervious area. Dry pretreatment required for discharge to sensitive waters.
Peak Discharge	No adverse impacts	The post-development rate can not exceed pre-development for the 25-yr, 3 day storm unless downstream system designed for higher rate.
Volume	Rules pending - no increase Maintain ground water recharge and downstream baseflow.	The post-development volume can not exceed pre-development for all storms up to 100 yr, 24 hour.

Downstream evaluation is required for natural systems with downstream channel stability evaluated.

Available Publications Applicant's Handbook

Source Controls Industrial and commercial land uses must provide dry pretreatment. No discharges of industrial waste or hazardous and toxic substances are allowed into a stormwater system.

Erosion and Sediment Control Program

Erosion control is part of the stormwater management program and implemented as part of post permit compliance.

Program goal/objective None listed

Exemptions and waivers Same as stormwater program

Preferred Practices None listed

Design Criteria None listed, but FDEP regulations and NPDES stormwater general permit for construction activities specifies Chapter 6 of the *Florida Development Manual: A Guide to Sound Land and Water Management*.

Program Authority and Implementation

The EPA implements the NPDES stormwater permitting program within Florida. The District implements a surface water management program within the south central and south-eastern part of the state using state criteria with regional implementation and regional criteria with regional and local implementation. Many local governments also have their

own criteria.

Project Permitting	No notice general permit for projects under 10 acres with less than two acres imperviousness, general permits for projects under an acreage threshold that varies, and individual permits for projects over the acreage threshold.
Review process	Permit application includes administrative forms, erosion and stormwater plans, operation and maintenance entity requirements, engineering calculations and drawings, standards and specs, etc. which are reviewed and approved. General permits are issued by staff while individual permits must be approved by the District's Governing Board.

A detailed checklist is used for stormwater management.

A stormwater permit is required before any land clearing begins. Local governments are encouraged to put in their Land Development Regulations a requirement that District stormwater permits be obtained before a building or grading permit is issued. A District stormwater permit is required before applying for NPDES stormwater GP for construction activities.

Inspections

Erosion/sediment controls	Compliance a part of post construction stormwater management.
Stormwater systems	Inspections are required as determined by site engineer and performed by the project engineer with the District inspecting sites during construction at option of staff.

Program Enforcement and Compliance

Penalty provisions are a program component. Civil penalties include fines of up to \$10,000 per day. Criminal penalties are those associated with a first degree misdemeanor which includes a fine of up to \$10,000 per day or six months in jail or both.

Other enforcement procedures	Stop work orders Notice of violation, followed by administrative and legal procedures can lead to consent order.
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As-built certifications and record drawings by the supervising construction engineer are required.

Final inspection of stormwater systems is performed by supervising engineer, and sometimes by a local government engineer.

Maintenance of Stormwater Systems

Maintenance of completed stormwater systems is required.

Legal entities include	Governmental agencies Public utility companies Special districts Private owner for commercial systems Property owners association
Inspection frequency	None specified, as needed to assure operation
Inspected by	Owner, contracted service company/engineer, local government.
Oversight agency	SFWMD. Local governments encouraged to establish operating permit system.
O/M responsibilities	Specified by design engineer in O/M manual, maintenance usually done to repair problems not prevent them.
Funding source	Depends on legal entity. State law encourages local governments to establish stormwater utility, over 60 implemented.
Enforcement mechanism	Civil and criminal penalties set forth above, notice of violation, consent order.

Program Resources

The erosion/sediment control and stormwater management programs are two components of the District’s Management and Storage of Surface Waters program which also includes wetland resources management.

<u>Program Funding</u>	<u>Source</u>	<u>Amount</u>
MSSW program	District advalorem tax	\$7,000,000 (86%)
	Permit fees	\$1,100,000 (14%)

<u>Program Staffing</u>	<u>Position</u>	<u>Full Time</u>	<u>Needed</u>
MSSW program	Administrative	39	
	Engineer	33	
	Scientist	25	
	Inspector	10	
	Clerical	15	
	Support	10	

Educational Programs

Educational programs are a voluntary component of the program. Brochures and workshops are used to educate consultants and developers. One or two workshops are conducted each year with anywhere from 50 to 200 individuals attending.

Program Coordination

Erosion/sediment control is a secondary aspect of the stormwater management program with little emphasis unless a water quality violation occurs. The erosion/sediment/stormwater management program also is integrated with the District's wetlands protection, floodplain management, water supply, wellhead protection, wastewater management, and land acquisition programs.

The State's stormwater regulatory program also is coordinated with the State's growth and land use management program, on-site wastewater program, land acquisition program, and water body targeting and management program (SWIM). The SWIM Program, implemented by each of the WMDs, develops watershed management plans and programs which include stormwater pollutant load reduction goals for existing drainage systems. The SFWMD's SWIM program has targeted 36 water bodies including the Everglades, Florida Bay, Biscayne Bay, and Lake Okeechobee.

Conflicts exist with the wetland programs of the FDEP and the US ACOE which use different wetland delineation methods. The 1994 wetlands legislation requires the FDEP and the water management districts to develop and implement one set of wetland delineation methods.

The NPDES stormwater permitting program is not delegated to FDEP but is implemented by the EPA Region 4 office in Atlanta. Communication occurs between the FDEP and the EPA but not between EPA and SFWMD.

Program Evaluation

Measures of success	Lack of water quality and flooding problems associated with permitted development. Survival of wetlands.
Research projects	Everglades research program investigating effects of agricultural runoff on environmental quality, treatment effectiveness of constructed wetlands. SWIM Program constructing and evaluating urban stormwater management systems.
Monitoring	District has a water quality ambient monitoring program for certain water bodies.

Program Evolution into Watershed Approach

The District's management and storage of surface waters regulatory program began in 1976, requiring detention for both stormwater quantity and quality objectives. In 1984, isolated wetland criteria were added in response to Henderson Wetlands Act. In 1993, in response to permit streamlining legislation, the state's wetland resource management permits and stormwater permits were merged into a single Environmental Resource Permit.

Retrofitting of developed areas is being pursued to address flooding, water quality, stream channel erosion, and protection of aquatic resources. Stormwater pollutant load reduction goals (to assure that the beneficial uses of water bodies are maintained or restored) for drainage systems serving developed areas are required by State Water Policy and are being established by the District's SWIM Program. Goals already have been established and implemented for discharges, primarily agricultural, to Lake Okeechobee and the Everglades.

Watershed approaches are being used including regional stormwater systems, water body targeting and emphasis on nonstructural BMPs. The State's land and water resource management programs have been coordinated into a fairly comprehensive watershed management approach. Key components include the stormwater program, wetlands program, SWIM program, local government growth management/land use planning program, and state and local government land acquisition programs.

SEDIMENT CONTROL AND STORMWATER MANAGEMENT PROGRAM SUMMARY

JURISDICTION: ***SOUTHWEST FLORIDA WATER MANAGEMENT DISTRICT***
2379 Broad Street
Brooksville, Florida 34609-6899

The erosion/sediment control program and the stormwater management program are integrated programs. The District's program is integrated with and coordinated with the programs implemented by the Florida Department of Environmental Protection and three of the state's four other water management districts.

The impetus for the program includes flooding, water quality and resource protection.

The program's legal authority is established in:

1. Chapter 373, Florida Statutes (Water Resources Act)
2. Chapter 403, Florida Statutes (Environmental Protection Act)
3. Chapters 62-40, 40D-4, 40, 45, 400, Florida Administrative Code

Stormwater Management Program

Program Goals/Objectives	<p>To regulate and control the management and storage of surface waters within the District to assure environmental resource protection of water quantity, water quality, and natural systems.</p> <p>To reduce the pollutant loading from existing drainage systems as needed to restore or maintain beneficial uses of water bodies.</p>
Exemptions and Waivers	<p>Agriculture provided a site specific Conservation Plan with appropriate BMPs are implemented (Notice Exemption).</p> <p>Forestry operations conducted in compliance with the requirements set forth in the "Florida Silviculture BMP Manual".</p> <p>Individual single family homes not part of a subdivision.</p>
Preferred practices	<p>Treatment practices including retention, exfiltration trenches, pervious pavement, grass swales, wet detention ponds, detention with filtration, and wetland systems. The "BMP Treatment Train" approach is encouraged.</p>

Practices installed	<u>Practice</u>	<u>1992</u>	<u>1993</u>
	Infiltration basins	698	759
	Exfiltration trenches	29	25
	Detention/filtration	246	261
	Wet detention	307	274
	Wetland detention	29	26

Design criteria are specified in the regulations, especially within the “Basis of Review”.
Performance Standards and Design Criteria

Water Quality	Remove at least 80% of the average annual TSS load and assure compliance with state water quality standards.	Treatment volume varies from 0.5 to 1.5 inch depending on the type of practice used, the type of receiving water, and the amount of impervious surface.
Peak Discharge	No adverse impacts	The post-development rate can not exceed pre-development for 25 yr, 24 hr storm.
Volume	In closed basins only, no increase for design storm.	The post-development volume can not exceed pre-development for all storms up to 100 yr, 24 hour.

Downstream evaluation is required with downstream channel stability evaluated.

Available Publications: Applicant’s Handbook

Source Controls Agricultural operations by achieve regulatory compliance by following a pre-application review process which leads to the development and implementation of a site specific farm plan which includes appropriate BMPs. Many of the BMPs are source controls such as irrigation management, nutrient and pesticide management, field layout, and wetland avoidance and buffers. Guidance is provide through the District’s Technical Guideline (SWP/TG-002.01), the USDA SCS Field Office Technical Guide, and from several Cooperative Extension Service publications prepared by the Institute of Food and Agricultural Sciences at the University of Florida.

Erosion and Sediment Control Program

Program goal/objective To protect water resources and off-site property by minimizing erosion and preventing off-site sedimentation.

Performance standard is to retain sediment on-site.

Water quality standard is discharges having a turbidity < 29 NTU above background.

Exemptions and waivers	Same as stormwater program
Preferred Practices	Sediment basins and traps which are designed to capture 67 yd ³ per acre. Other practices include mulching, sodding, staged clearing, silt fence, gravel construction entrance, temporary and permanent vegetative cover.
Design Criteria	Specified in Chapter 6 of the <i>Florida Development Manual: A Guide to Sound Land and Water Management</i> .

Program Authority and Implementation

The EPA implements the NPDES stormwater permitting program within Florida. The District implements both the erosion and sediment control and the stormwater management program within the south central and southwestern part of the state using state and regional criteria with regional and local implementation.

Project Permitting Notice exemption for agriculture, general permits for projects less than one hundred acres, and Individual permits for projects over one hundred acres.

Review process Permit application includes administrative forms, erosion and stormwater plans, operation and maintenance entity requirements, engineering calculations and drawings, standards and specs, etc. which are reviewed and approved. General permits are issued by staff while individual permits must be approved by the District's Governing Board.

A detailed checklist is used for stormwater but not erosion control.

A stormwater permit is required before any land clearing begins. Local governments are encouraged to put in their Land Development Regulations a requirement that District stormwater permits be obtained before a building or grading permit is issued. A District stormwater permit is required before applying for NPDES stormwater GP for construction activities.

Inspections

Erosion/sediment controls and stormwater systems Inspections by District staff are required by staff procedure but not by regulation which only requires inspections as needed by site engineer or crew. Maintenance required as needed to maintain operation. Inspections performed by project engineer or workers with District inspecting sites at option of staff.

Program Enforcement and Compliance

Penalty provisions are a program component. Civil penalties include fines of up to \$10,000 per day. Criminal penalties are those associated with a first degree misdemeanor including fines of up to \$10,000 per day or six months in jail or both.

Other enforcement procedures Notice of violation, followed by administrative and legal procedures can lead to consent order or stop work. Quick enforcement is rare, unless done voluntarily.

As-built certifications and record drawings by the supervising construction engineer are required.

Final inspection of stormwater systems is performed by supervising engineer, sometimes by District or local government inspector.

Maintenance of Stormwater Systems

Maintenance of completed stormwater systems is required.

Legal entities include	Governmental agencies Public utility companies Special districts Private owner for commercial/industrial systems Property owners association
Inspection frequency	Reports must be submitted every eighteen months for filtration systems and every two years for retention or detention systems
Inspected by	Owner, contracted service company/engineer
Oversight agency	SWFWMD. Local governments encouraged to establish operating permit system
O/M responsibilities	Specified by design engineer in O/M manual
Funding source	Depends on legal entity. State law encourages local governments to establish stormwater utility, over 60 implemented.
Enforcement mechanism	Fines, notice of violation, consent order

Program Resources

The erosion/sediment control and stormwater management programs are two components of the District’s Management and Storage of Surface Waters (MSSW) program which also includes wetland resources management.

<u>Program Funding</u>	<u>Source</u>	<u>Amount</u>
Erosion/Sediment/SW control	District ad valorem tax + permit fees	\$5,125,775

<u>Program Staffing</u>	<u>Position</u>	<u>Full Time</u>	<u>Needed</u>
ES + SW	Administrative	5	
	Engineer	35	0.5
	Scientist	16	0.5 (Soil Scientist)
	Inspector	22	
	Clerical	31	
	Information Specialist		1

Educational Programs

Educational programs are not a component of the program. District staff do participate in forums such as the Florida Chamber Environmental Permitting Schools which include classes on the MSSW programs of Florida’s water management districts.

Program Coordination

There is close coordination within the District’s integrated erosion/sediment control and stormwater management program.

The program also is integrated with the District’s wetlands protection, floodplain management, water supply, and land acquisition programs.

The state’s stormwater regulatory program also is coordinated with the State’s growth and land use management program, on-site wastewater program, land acquisition program, and water body targeting and management program (SWIM). The SWIM Program, implemented by each of the WMDs, develops watershed management plans and programs which include stormwater pollutant load reduction goals for existing drainage systems. The SWFWMD’s SWIM program has targeted nine water bodies including Tampa Bay, Crystal River, and the Winter Haven Chain of Lakes.

The NPDES stormwater permitting program is not delegated to FDEP but is implemented by the EPA Region 4 office in Atlanta. Communication occurs between the FDEP and the EPA but not between EPA and SWFWMD.

Program Evaluation

Measures of success	District’s stormwater research group selectively monitors and evaluates permitted stormwater practices.
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	Number of SWIM projects implemented
Research projects	BMP evaluation program to determine the treatment effectiveness of wet ponds, wetland detention, and agricultural systems.
Monitoring	Water chemistry (long term monitoring seldom used in permitting)

Program Evolution into Watershed Approach

The District's management and storage of surface waters regulatory program began in 1984 with the delegation of FDEP's stormwater quality permitting program. The 1984 Henderson Wetlands Act led to the creation of the District's stormwater quantity and wetland resource management components. In 1988, stormwater quality permitting and stormwater quantity (MSSW) permitting were combined into a single regulation and permit. In 1993, in response to permit streamlining legislation, the state's wetland resource management permits and stormwater permits were merged into a single Environmental Resource Permit.

Retrofitting of developed areas is being pursued to reduce flooding (local governments), water quality degradation, stream channel erosion, and to restore/protect aquatic resources. Stormwater pollutant load reduction goals (to assure the beneficial uses of water bodies are maintained or restored) for drainage systems serving developed areas are required by State Water Policy and are being established by the District's SWIM Program. Stormwater PLRGs will be implemented through basin-specific criteria adopted by the District or by inclusion in NPDES MS4 permits.

Watershed approaches are being used including regional stormwater management systems, water body targeting, and emphasis on nonstructural BMPs. The State's land and water resource management programs have been coordinated into a fairly comprehensive watershed management approach. Key components include the stormwater program, wetlands program, SWIM program, local government growth management/land use planning program, and State and local government land acquisition programs.

SEDIMENT CONTROL AND STORMWATER MANAGEMENT PROGRAM SUMMARY

JURISDICTION: **SUWANNEE RIVER WATER MANAGEMENT DISTRICT**
Rt 3 Box 64
Live Oak, Florida 32060

The erosion/sediment control program and the stormwater management program are integrated programs. The District's program is integrated with and coordinated with the programs implemented by the Florida Department of Environmental Protection and three of the State's four other water management districts.

The impetus for the program includes flooding, water quality, stream channel erosion, resource protection, and protection of wetlands and natural systems.

The program's legal authority is established in:

1. Chapter 373, Florida Statutes (Water Resources Act)
2. Chapter 403, Florida Statutes (Environmental Protection Act)
3. Chapters 62-40, 40B-4, Florida Administrative Code

Stormwater Management Program

Program Goals/Objectives	To prevent adverse impact or harm to water resources from development generated runoff. To reduce the pollutant loading from existing drainage systems as needed to restore or maintain beneficial uses of water bodies.
Exemptions and Waivers	Agriculture provided a site specific Conservation Plan with appropriate BMPs are implemented (Notice Exemption) Forestry operations conducted in compliance with the requirements set forth in the "Florida Silviculture BMP Manual" (Noticed Exemption) Individual single family homes that are not part of a larger plan of development.
Preferred practices	Treatment practices including retention, exfiltration trenches, pervious pavement, grass swales, wet detention ponds, detention with filtration, and wetland systems. The "BMP Treatment Train" approach is encouraged. Those specified in the Silviculture Manual.

Design criteria are specified in the regulations.

Program Authority and Implementation

The EPA implements the NPDES stormwater permitting program within Florida. The District implements both the erosion/sediment control program and the stormwater management program within the north-central part of the State using State and regional criteria with regional implementation.

Project Permitting Notice exemption for agriculture; general permits for forestry, projects less than one hundred acres; individual permits for projects over one hundred acres.

Review process Permit application includes administrative forms, erosion and stormwater plans, operation and maintenance entity requirements, engineering calculations and drawings, standards and specs, etc. which are reviewed and approved. General permits are issued by staff while individual permits must be approved by the District's Governing Board.

A detailed checklist (computer data base) is used for erosion/sediment control and for stormwater management.

A stormwater permit is required before any land clearing begins. Local governments are encouraged to put in their Land Development Regulations a requirement that District stormwater permits be obtained before a building or grading permit is issued. A District stormwater permit is required before applying for NPDES stormwater GP for construction activities.

Inspections

Erosion/sediment controls stormwater systems Inspections required as needed to maintain proper operation as determined by site engineer or crew. During construction, District staff inspect projects monthly or bimonthly depending on project. After construction, District staff may conduct inspections on an infrequent basis while engineer must submit performance certification every three years.

Program Enforcement and Compliance

Penalty provisions are a program component. Civil penalties include fines of up to \$10,000 per day. Criminal penalties are those associated with a first degree misdemeanor including fines of up to \$10,000 per day or six months in jail or both.

Other enforcement procedures Stop work orders
Notice of violation, followed by administrative and legal procedures can lead to consent order.

As-built certifications and record drawings by the supervising construction engineer are required.

Final inspection of stormwater systems is performed by supervising engineer, usually by a District field representative, and sometimes by a local government engineer.

Maintenance of Stormwater Systems

Maintenance of completed stormwater systems is required.

Legal entities include	Governmental agencies Public utility companies Special districts Private owner for commercial systems Property owners association
Inspection frequency	Reports must be submitted every eighteen months for filtration systems and every three years for retention or detention systems.
Inspected by	Owner, contracted service company/engineer, District field representative
Oversight agency	SRWMD. Local governments encouraged to establish operating permit system.
O/M responsibilities	Specified by design engineer in O/M manual.
Funding source	Depends on legal entity. State law encourages local governments to establish stormwater utility, over 60 implemented.
Enforcement mechanism	Civil and criminal penalties set forth above, notice of violation, consent order, corrective action and lien.

Program Resources

The erosion/sediment control and stormwater management programs are two components of the District’s Management and Storage of Surface Waters program which also includes wetland resources management.

<u>Program Funding</u>	<u>Source</u>	<u>Amount</u>
Erosion/Sediment/SW control FY1995	General appropriations	\$700,000
	Permit fees	\$120,000
	District ad valorem tax	\$110,000

<u>Program Staffing</u>	<u>Position</u>	<u>Full Time</u>	<u>Part Time</u>
ES + SW	Administrative	1	
	Engineer	3	
	Scientist	3	
	Inspector	4	
	Clerical	2	
	Support		

Educational Programs

Educational programs are a voluntary component of the program. Brochures, exhibits, and monitoring are used to educate contractors, consultants, developers, inspectors, elected officials, and the general public.

Program Coordination

There is close coordination within the District's integrated erosion/sediment control and stormwater management program.

The erosion/sediment/stormwater management program also is integrated with the District's wetlands protection, floodplain management, water supply, wastewater management, and land acquisition programs.

The state's stormwater regulatory program also is coordinated with the state's growth and land use management program, on-site wastewater program, land acquisition program, and water body targeting and management program (SWIM). The SWIM Program, implemented by each of the WMDs, develops watershed management plans and programs which include stormwater pollutant load reduction goals for existing drainage systems. The SRWMD's SWIM program has targeted six water bodies including the Suwannee River, Steinhatchee/Coastal Rivers, Santa Fe River, and Alligator Lake.

The NPDES stormwater permitting program is not delegated to FDEP but is implemented by the EPA Region 4 office in Atlanta. Communication occurs between the FDEP and the EPA but not between EPA and SRWMD.

Program Evaluation

Measures of success	Ambient monitoring program SWIM projects implemented
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Research projects

Monitoring Ambient monitoring program part of FDEP's statewide network with water chemistry, sediments, and biological communities sampled.

Program Evolution into Watershed Approach

The District's management and storage of surface waters regulatory program began in 1984 with its agriculture and forestry programs implemented pursuant to the Henderson Wetlands Act. In 1986, the District implemented a comprehensive surface water management program with stormwater quality permitting and stormwater quantity (MSSW) permitting combined into a single regulation and permit. In 1993, in response to permit streamlining legislation, the state's wetland resource management permits and stormwater permits were merged into a single Environmental Resource Permit.

Retrofitting of developed areas is not actively being pursued since the District's jurisdiction is mainly agriculture, forest, or rural residential with only a few small towns. Stormwater pollutant load reduction goals (to assure that the beneficial uses of water bodies are maintained or restored) for drainage systems serving developed areas are required by State Water Policy and are being established by the District's SWIM Program. The District's PLRGs are preservation oriented to prevent degradation of existing environmental quality.

Watershed approaches are being used including water body targeting and emphasis on nonstructural BMPs. The State's land and water resource management programs have been coordinated into a fairly comprehensive watershed management approach. Key components include the stormwater program, wetlands program, SWIM program, local government growth management/land use planning program, and State and local government land acquisition programs.

SEDIMENT CONTROL AND STORMWATER MANAGEMENT PROGRAM SUMMARY

JURISDICTION: STATE OF DELAWARE

Department of Natural Resources and Environmental Control
Division of Soil and Water Conservation
89 Kings Highway, P.O. Box 1401
Dover, Delaware 19903

The erosion and sediment control and stormwater management program are integrated programs. The program is implemented cooperatively by the DNREC and local agencies to which elements of the program are delegated.

The impetus for the program includes flooding and water quality.

The program's legal authority is established in:

1. Section 40, Title 7, Delaware Code (Sediment and Stormwater Act of 1990)
2. (Sediment and Stormwater Regulations)

Stormwater Management Program

Program Goals/Objectives To provide for the control and management of runoff to reduce adverse effects on the water and lands of the State.

To prevent existing water quantity and water quality problems from becoming worse and to reduce existing problems.

To implement a statewide program in cooperation with local governments with a strong focus on educational programs.

Exemptions and Waivers Agriculture (if using Farm Conservation Plan prepared by local Soil and Water Conservation District)

Forestry
Single family homes
Projects disturbing < 5000 ft²

Preferred Practices Wet detention ponds and constructed wetlands are the most preferred followed by extended dry detention and sand filter systems. Infiltration practices are the least preferred because of potential for failure.

Practices Installed

<u>Practice</u>	<u>1992</u>	<u>1993</u>	<u>Practice</u>	<u>1992</u>	<u>1993</u>
Infiltration basin	2-3	2-3	Infiltration trench	10	12
Swales	4-5	5-10	Sand filtration	5-10	10-20
Wet detention	50-75	75-100	Wetlands	1	3
Biofiltration	4	15-20			

Design criteria are specified in the regulations and in the *Delaware Stormwater Standards and Specifications Manual*.

Performance Standards and Design Criteria

Water quality	Remove at least 80% of the annual TSS loading	Treat the first inch of runoff using the approved BMPs
Peak discharge	No increase in rate	Statewide - post-development rate no greater than pre-development for the 2 year and 10 year, 24 hour storms. Northern 20% of state - same control but for 100 year, 24 hour storm.
Volume	No specific performance standard	

Available Publications *Delaware Stormwater Standards and Specifications Manual*

Erosion and Sediment Control Program

Program goal/objective	To control erosion at the source and to prevent sediment from moving off-site. To conduct education, training, and certification programs for the regulated community.
Exemptions and Waivers	Agriculture
BMPs Preferred	Sediment traps and basins designed to hold 3600 cf per acre of contributing drainage area. Other practices specified in the Handbook include silt fence, straw bales, gravel construction entrances, diversions, slope drains, and temporary and permanent vegetative stabilization.

Design criteria are specified in the *Delaware Erosion and Sediment Control Handbook (1989)*.

Maintenance of Stormwater Management Practices

Maintenance of completed stormwater systems is required.

Legal entities include	Public agencies Private entity Property owner association
Inspection frequency	Annually
Inspected by	Local government
Oversight agency	Delaware Department of Transportation and the New Castle County Dept. of Public Works. Final enforcement by DNREC.
O/M responsibilities	Not specified, depends on type of practice.
Funding source	Depends on local government, no dedicated funding sources.
Enforcement mechanism	DNREC can initiate legal actions if system not maintained.

Program Resources

The erosion, sediment, and stormwater management programs are combined budget entities.

<u>Program Funding</u>	<u>Source</u>	<u>1992 Annual Amount</u>
ES + SW	General appropriations	\$882,000 (63%)
	Permit fees	\$240,489 (17%)
	Local sources	\$286,441 (20%)

<u>Program Staffing</u>	<u>Position</u>	<u>Full time</u>	<u>Part time</u>	<u>Needed</u>	
ES + SW	Administrative	6		1	
	Engineer	11	2	1	
	Inspector	10	4	5	
	Clerical	5	1		
	Scientist				1
	Support				2

Educational Programs

Educational programs are a component of the program with a training and certification program for inspectors and contractors required by the program's statute and regulations.

In the last year, over 500 contractors attended one of six sessions while 65 inspectors attended the only session. Brochures, slide presentations, exhibits, and demonstration projects are used for education.

Program Coordination

There is close coordination within the integrated erosion, sediment and stormwater management program.

The program currently is not greatly coordinated with other programs. New emphasis on better coordination with state wetlands and NPDES programs.

Conflicts arise with the wetlands program concerning the use of or placement of stormwater facilities within wetlands and with the maintenance of wet detention ponds and wetlands constructed for stormwater treatment and management purposes. Conflicts arise with the NPDES program with respect to coordinating the state and NPDES stormwater permitting programs and with conflicting requirements for general permitting.

Communication with EPA on related programs needs to be improved.

Program Evaluation

Measures of success	By the number of individuals attending training courses and receiving their state certification.
Research projects	Evaluation of the treatment effectiveness of wet ponds, sand filters, and constructed wetlands.
Monitoring program.	Not a program component but state has NPS biomonitoring program.

Program Evolution to Watershed Management

The erosion and sediment control program was initiated in 1980. In 1990, the Sediment and Stormwater legislation was enacted which modified the existing erosion and sediment control program and established a comprehensive statewide stormwater management program. This program was implemented on July 1, 1991. Implementation is by the DNREC and by local entities (SWCDs or local governments) to which elements of the program have been delegated. The program statute allows designation of priority watershed upon request by local government. The Silver Lake watershed which includes Dover is the first. Monitoring and modeling of hydrology and environmental quality is underway for use in development of a watershed management plan which will address retrofitting existing land uses, treatment for new land uses, and the use of nonstructural and structural controls

Retrofitting of developed areas is being pursued to reduce flooding and water quality degradation.

Watershed approaches are just beginning to be used including regional stormwater management systems and emphasis on nonstructural BMPs

SEDIMENT CONTROL AND STORMWATER MANAGEMENT PROGRAM SUMMARY

JURISDICTION: **FLORIDA DEPARTMENT OF ENVIRONMENTAL PROTECTION**
Stormwater/Nonpoint Source Management Section
2600 Blair Stone Road
Tallahassee, Florida 32399-2400

The erosion and sediment control program and the stormwater management program are integrated programs. Additionally, the FDEP program is integrated with and coordinated with the programs implemented by four of the state's five regional water management districts.

The impetus for the program is water quality and resource protection.

The program's legal authority is established in:

1. Chapter 373, Florida Statutes (Water Resources Act)
2. Chapter 403, Florida Statutes (Environmental Protection Act)
3. Chapters 62-25, 62-312, and 62-400, Florida Administrative Code
(Note: These formerly were numbered as Chapters 17-25, 17-312, etc)

Stormwater Management Program

Program Goals/Objectives	<p>To minimize water quality problems caused by stormwater, either during construction or afterwards, by requiring proper treatment and management.</p> <p>To reduce the pollutant loading from existing drainage systems as needed to restore or maintain beneficial uses of water bodies.</p>
Exemptions and Waivers	<p>Agriculture provided a Conservation Plan with appropriate BMPs is implemented.</p> <p>Forestry operations conducted in compliance with the requirements set forth in the "Florida Silviculture BMP Manual".</p> <p>Single family homes that are not part of a larger plan of development.</p>
Preferred practices	<p>Treatment practices including retention, exfiltration trenches, pervious pavement, grass swales, wet detention ponds, detention with filtration, and wetland systems. The "BMP Treatment Train" approach is encouraged.</p>

Practices installed	<u>Practice</u>	<u>1993</u>	<u>Practice</u>	<u>1993</u>
	Infiltration	316	Detention/filtration	158
	Swales	53	Wet detention	15

Design criteria are specified in Chapter 62-25, FAC, and in the *Florida Development Manual: A Guide to Sound Land and Water Management (FDEP, 1988)*.

Performance Standards and Design Criteria

Water Quality	Remove at least 80% of the average annual TSS load	Treatment volume varies from 0.5 to 1.5 inches depending upon the type of practice used, type of receiving water, amount of impervious surface
Peak Discharge	None - set by local govt.	Typically the post-development rate can not exceed pre-development for a 10 to 25-yr, 24-hour storm .
Volume	None - set by local govt. seldom done except in closed basin	Typically the post-development volume can not exceed pre-development for a 25 to 100-yr, 24-hour storm.

Downstream evaluation is required with downstream channel stability evaluated.

Available Publications: *Florida Development Manual: A Guide for Sound Land and Water Management (BMP Design Manual)*
Florida Silviculture BMP Manual, 1993
Stormwater Management: A Guide for Floridians
Model Local Government Stormwater Management Program

Source Controls The state’s stormwater/nonpoint source/watershed management program encourages the use of pollution prevention and source control practices. Strong emphasis on education programs for students, citizens, businesses, elected officials, and practitioners which stress how they each contribute to and how they each need to help abate “Pointless Personal Pollution”. Many programs educate about environmentally friendly home landscaping (Florida Yards and Neighborhoods, **Environmental Landscape Management, Florida Agricultural Information Retrieval System**).

Erosion and Sediment Control Program

Program goal/objective To prevent off-site sedimentation, especially of water bodies and conveyances.
 Performance standard is to retain sediment on-site.
 Water quality standard is discharges having a turbidity < 29 NTU above background.

Exemptions and waivers	Same as stormwater program
Preferred Practices	Sediment basins and traps which are designed to capture 67 cy per acre of drainage area. Other practices include mulching, sodding, staged clearing, silt fence, gravel construction entrance, temporary and permanent vegetative cover.
Design Criteria	Specified in Chapter 6 of the <i>Florida Development Manual: A Guide to Sound Land and Water Management</i> .

Program Authority and Implementation

The EPA implements the NPDES stormwater permitting program within Florida. The FDEP implements both the erosion and sediment control program and the stormwater management program within the northwestern part of the state (the area served by the Northwest Florida Water Management District) using state criteria with state implementation. In the areas of the state served by the other four water management districts (Suwannee River, St. Johns River, Southwest Florida, South Florida), the state erosion, sediment, and stormwater management program is implemented cooperatively by FDEP and the WMDs using the district's regional criteria. Additionally, some local governments have adopted local criteria which are more stringent than FDEP or WMD criteria with these implemented by the local government program.

Project Permitting	General and Individual permits are used, depending on the type of stormwater treatment practices used. GPs allow construction to begin within 30 days and are available for swales, retention, wet detention, detention with filtration, or a combination of those. IPs required for wetland systems and for innovative BMPs.
Review process	Permit application includes administrative forms, erosion and stormwater plans, operation and maintenance entity requirements, engineering calculations and drawings, standards and specs, etc. which are reviewed and approved by stormwater engineer. A detailed checklist is used for both erosion/sediment control and stormwater management.

A stormwater permit is required before any land clearing begins. Local governments are encouraged to put in their Land Development Regulations a requirement that state (DEP or WMD) stormwater permits be obtained before a building or grading permit is issued. A state stormwater permit is required before applying for NPDES stormwater GP for construction activities.

Inspections

Erosion/Sediment Controls	Required as needed to assure proper operation; done by site engineer or staff.
Stormwater systems	Required as needed during construction to assure proper operation; done by site engineer or staff. FDEP inspects few sites, upon complaint

Program Enforcement and Compliance

Penalty provisions are a program component. Civil penalties include fines of \$10,000 per day. Criminal penalties include fines of up to \$50,000, or imprisonment for five years, or both.

Other enforcement procedures Notice of violation (can lead to stop work)

As-built certifications and record drawings by the supervising construction engineer are required.

Final inspection of stormwater systems is performed by supervising engineer, sometimes by FDEP or local government inspector.

Maintenance of Stormwater Systems

Maintenance of completed stormwater systems is required.

Legal entities include	Governmental agencies Public utility companies Special districts Private owner for commercial systems Property owners association
Inspection frequency	As needed
Inspected by	Owner, contracted service company/engineer Local government
Oversight agency	FDEP. Local governments encouraged to establish operating permit system with annual inspections.
O/M responsibilities	Specified by design engineer in O/M manual.
Funding source	Depends on legal entity. State law encourages local governments to establish stormwater utility, over 60

implemented.

Enforcement mechanism Fines, notice of violation, consent order

Program Resources

The erosion, sediment, and stormwater management program are a combined budget entity. Additionally, the budget includes portions of the wetland resource permitting program since all of these permits are combined when needed by a project.

<u>Program Funding</u>	<u>Source</u>	<u>Amount</u>
Erosion/Sediment/SW control	General appropriations Permit fees	Highly variable (90%)

<u>Program Staffing</u>	<u>Position</u>	<u>Full Time</u>	<u>Part time</u>	<u>Needed</u>
ES + SW	Administrative	2	1	1
	Engineer	12		3
	Inspector	3	1	8

<u>Program Staffing</u>	<u>Position</u>	<u>Full Time</u>	<u>Part time</u>	<u>Needed</u>
ES + SW	Scientist	6	2	3
	Clerical	1	3	
	Attorney		4	

Educational Programs

Educational programs are a voluntary component of the program. Brochures, slide shows/talks, exhibits, monitoring, demonstration projects, and storm sewer stenciling are used to reach the target audience of contractors, consultants, developers, and the general public. Workshops for design engineers are conducted cooperatively with the Florida Engineering Society and with local ASCE chapters. The Florida Department of Transportation Environmental Section annually conducts several workshops on erosion/sediment control and stormwater management. A voluntary training and certification course for stormwater system operators has been established in association with the Florida Water and Pollution Control Operators Association and the Florida Association of Stormwater Utilities. Currently, a training and certification program (modeled after the State of Delaware's successful program) is being developed for erosion, sediment, and stormwater inspectors and for supervising contractors. Implementation of the 32 hour course for inspectors and the eight hour course for contractors will begin in late 1995.

Program Coordination

There is close coordination within the integrated erosion/sediment control and stormwater management programs.

The program also is integrated with the Department's wetlands protection, wellhead pro-

tection, and environmental permitting programs for wastewater, drinking water, solid waste, and hazardous waste.

The state’s stormwater regulatory program also is coordinated with the state’s growth and land use management program, on-site wastewater program, land acquisition program, and water body targeting and management program (SWIM). The SWIM Program, implemented by the WMDs, develops watershed management plans and programs which include stormwater pollutant load reduction goals for existing drainage systems.

Conflicts arise with federal programs such as the ACOE Section 205 Flood Control Program which creates cooperative agreements with local governments to solve flooding problems by channelizing natural streams and creeks. Conflicts also arise with some state programs such as the newly revised stormwater requirements in the growth management program. Most recently, new requirements imposed by the solid waste program has led to problems in disposing of materials that accumulate in stormwater systems or that are collected by street sweepers.

The NPDES stormwater permitting program is not delegated to FDEP but is implemented by the EPA Region 4 office in Atlanta. Communication with the EPA NPDES program staff is very good. The EPA staff supported and cooperated with DEP’s desire to have the NPDES stormwater permitting program implemented on a county-wide basis, rather than on a population basis.

Program Evaluation

Measures of success	<p>Improved environmental quality measured through the Surface Water Ambient Monitoring Program which includes a NPS bioassessment component and estuarine sediment monitoring.</p> <p>Local government stormwater utilities implemented. Successful education and public involvement activities. SWIM projects implemented.</p>
Research projects	<p>BMP evaluation program to determine the treatment effectiveness of wet ponds, extended dry detention, sand filters, catch basin inserts, wetlands, packed-bed wetlands, regional systems.</p> <p>Development and refinement of bioassessment methods and metrics for rivers and lakes. Refinement of estuarine sediment assessment methods and ecological guidelines.</p>
Monitoring	Water chemistry, sediments, biological community

Program Evolution into Watershed Approach

Recognition in the mid-1970s of the importance of stormwater as a leading source of

pollutant loading to Florida's rivers, lake, and estuaries led to the implementation of Chapter 17-4.248, Florida Administrative Code in 1979. This rule required owners of stormwater discharges that were a significant source of pollution to obtain a permit and treat their runoff using appropriate BMPs. In February 1982, this rule was replaced by Chapter 17-25, FAC, (now Chapter 62-25) which requires owners of all new stormwater discharges to obtain a permit and treat their runoff to remove 80% of the pollutant loading using site-specific appropriate BMPs. The rule's design criteria are updated periodically as new information about the treatment effectiveness of BMPs is available. Implementation of the rule is delegated to four of the state's water management districts allowing the merger of DEP's stormwater quality requirements with the WMD's stormwater quantity (flood control) requirements. In 1993, in response to permit streamlining legislation, the state's wetland resource management permits and stormwater permits were merged into a single Environmental Resource Permit. As part of the development of the ERP regulations, more uniform, statewide stormwater requirements will be created leading to greater consistency and less confusion among the regulated public.

Retrofitting of developed areas is being pursued to reduce flooding, water quality degradation, stream channel erosion, and to restore/protect aquatic resources. Stormwater pollutant load reduction goals (to assure that the beneficial uses of water bodies are maintained or restored) for drainage systems serving developed areas are required by State Water Policy and are being established by the WMD's through the SWIM Program.

Watershed approaches are being used including regional stormwater management systems, water body targeting, and emphasis on nonstructural BMPs. The state's land and water resource management programs have been coordinated into a fairly comprehensive watershed management approach. Key components include the stormwater program, wetlands program, SWIM program, local government growth management/land use planning program, and state and local government land acquisition programs.

**SEDIMENT CONTROL AND STORMWATER MANAGEMENT
PROGRAM SUMMARY**

JURISDICTION: **MARYLAND DEPARTMENT OF THE ENVIRONMENT**
 Stormwater Management Program
 2500 Broening Highway
 Baltimore, Maryland 21224

The erosion and sediment control program and the stormwater management program are separate programs.

The impetus for the erosion and sediment control program is sedimentation while flooding, stream channel erosion, water quality, and ground water recharge were the impetus for the stormwater program.

The legal authority is established in:

1. Sediment Control
 - a. Environmental Article, Title 4, Subtitle 1, Annotated Code of Maryland
 - b. Code of Maryland Regulations (COMAR) 26
2. Stormwater Management
 - a. Environmental Article, Title 4, Subtitle 2, Annotated Code of Maryland
 - b. Code of Maryland Regulations (COMAR) 26.09.02

Stormwater Management Program

Program Goals/Objectives To preserve or recreate pre-development runoff characteristics.

Exemptions and Waivers Agriculture
 Single family homes with minimum lot size of 2 acres
 Developments which:
 · discharge directly to tidewaters
 · are served by existing storm drain system
 · cause < 10% increase in peak discharge rate for a 2-yr storm

Preferred practices In the following order: infiltration, swales, retention, detention

Practices installed	<u>Practice</u>	<u>1990</u>	<u>1991</u>	<u>1992*</u>	<u>1993*</u>
	Infiltration	264	223	36	8
	Swales	58	93	2	0
	Dry detention	104	75	9	2
	Extended detention	112	106	47	9
	Shallow marshes	19	23	5	0

Oil/grit separators	197	85	3	0
Other	249	206	33	1

* Funding cuts reduced data input into the Statewide BMP tracking system

Design criteria are specified in regulations.

Performance Standards and Design Criteria

Water Quality	No specified performance standard	Manage the difference between the pre-development and post-development 2 and 10 -yr storms.
Peak Discharge	No specified performance standard	The post-development rate can not exceed pre-development for a 2 and 10-yr storm.
Volume	No specified performance standard	

Downstream evaluation is required with downstream channel stability evaluated on a case-by-case basis.

Source Controls No answer

Erosion and Sediment Control Program

Program goal/objective	To minimize environmental impacts of construction To protect water quality
Exemptions and waivers	Agriculture Activities disturbing < 5000 ft ² or 100 yd ³
Preferred Practices	Sediment basins and traps which are designed for 1 inch of runoff from the disturbed area. Other practices include mulching, sodding, staged clearing, silt fence, gravel construction entrance, temporary and permanent vegetative cover.
Design Criteria	Specified in <i>Maryland Erosion and Sediment Standards and Specifications Manual</i> .

Program Authority and Implementation

The erosion and sediment control program is implemented by the Maryland Dept. of the Environment using state criteria (for state and federal projects). Most other projects are approved by the local Soil and Water Conservation District which is delegated this responsibility and which uses state criteria but can adopt additional local criteria. Administration of the stormwater program is similarly shared by the Maryland Dept. of the Environment and by local governments which are delegated responsibility for the program.

Project Permitting General permits available for single family homes and routine highway maintenance. Individual permits used primarily. State and federal projects permitted by Maryland Dept. Environment with most other projects approved by local SWCD (erosion and sediment control) and the local government (stormwater mgmt).

Review process Permit application includes administrative forms, erosion and stormwater plans, operation and maintenance entity requirements, engineering calculations and drawings, standards and specs, etc. which are reviewed and approved.

A detailed checklist is used for both erosion/sediment control and for stormwater management.

A sediment control permit and a stormwater permit are required before a building or grading permit is issued.

Inspections

Erosion/Sediment Controls Required every two weeks and performed by state or local government entity.

Stormwater systems Required as needed and performed by state or project engineer.

Program Enforcement and Compliance

Penalty provisions are a program component. Civil penalties include fines of \$5,000 per day. Criminal penalties include fines of \$5,000 per day, one year imprisonment, or both.

Other enforcement procedures Stop work orders
 Withholding occupancy permits
 Withholding other permits
 Notices of violation
 Permit and plan approval suspension
 Bond on property
 Place lien on property

As-built certifications by the supervising construction engineer are required.

Final inspection of stormwater systems is performed by local government or by supervising engineer.

Maintenance of Stormwater Systems

Maintenance of completed stormwater systems is required.

Legal entities include	Public agencies Private entity or owner Property owners association
Inspection frequency	Once every three years
Inspected by	Local government
Oversight agency	Local government
O/M responsibilities	Specified by local government at inspection
Funding source	Depends on legal entity, one local government has established an ad valorem tax
Enforcement mechanism	Fines Property liens after O/M contracted out

Program Resources

<u>Program Funding</u>	<u>Source</u>	<u>Amount</u>
Erosion/Sediment/SW control	General appropriations Permit fees Plan review fees NPDES construction GP fee	Highly variable (90%)

<u>Program Staffing</u>	<u>Position</u>	<u>Full Time</u>	<u>Part time</u>	<u>Needed ES/SW</u>
ES +SW	Administrative	6		3-4 / 3-4
	Engineer	6		6-8 / 6-8
	Inspector	25		20 / 24
	Scientist	6		6-8 / 10
	Clerical	6	2	

Educational Programs

Educational programs are a required component of the program. State and local agencies use brochures, slide shows, exhibits, demonstration projects, and storm sewer stenciling to educate the intended audience of contractors, consultants, developers, and inspectors. In a typical year, six training programs are held which attract 400-600 contractors, 200-400 developers, 20-40 consultants, and 50-100 inspectors.

Program Coordination

There is close coordination between the erosion and sediment control program and the stormwater management program.

These programs also are coordinated with the state's floodplain and wetlands protection, wellhead protection, wastewater management, water supply, and land acquisition programs and with local programs such as land use planning, zoning, tree protection, and building approval.

Conflicts arise between the wetlands and stormwater management programs at both the federal and state levels.

Communication from federal agencies on related programs such as NPDES and NPS needs to be improved.

Program Evaluation

Measures of success	Successful education and public involvement activities Water quality
Research projects	BMP evaluation program to determine the treatment effectiveness of sand/peat filters, and siphons for temperature mitigation. Third statewide survey of infiltration practices under way. Erosion and sediment control standards and specification being revised.
Monitoring	Water chemistry, sediments for NPDES MS4s

Program Evolution into Watershed Approach

The erosion and sediment control program was created by 1970 legislation authorizing local governments to establish ES control programs. In 1984, the legislation was revised to refine enforcement and penalty provisions giving the state responsibility for enforcement but allowing delegation to local governments with an approvable program. In 1984, the legislation also broadened the program's focus to include stormwater management, with most implementation by local governments.

Retrofitting of developed areas is being pursued in limited areas to reduce flooding, water quality degradation, stream channel erosion, and to restore/protect aquatic resources.

Watershed approaches being used include regional stormwater management systems implemented by local governments, water body targeting and tributary strategies as part of the Chesapeake Bay Program, and emphasis on nonstructural BMPs using the NPDES stormwater permitting program.

SEDIMENT CONTROL AND STORMWATER MANAGEMENT PROGRAM SUMMARY

JURISDICTION: STATE OF NEW JERSEY

Erosion and Sediment Control Program
State Soil Conservation Committee
CN 330
Trenton, New Jersey 08625

Stormwater Management Program
NJ Dept. Environmental Protection
CN 423
Trenton, New Jersey 08625

The erosion/sediment control program and the stormwater management program are separate programs. The N.J. Department of Environmental Protection (NJDEP) administers, in cooperation with local governments, the stormwater management program. The N.J. Department of Agriculture, State Soil Conservation Committee administers, in cooperation with local soil and water conservation districts, the erosion and sediment control program. An Interdepartmental Soil Conservation Agreement signed by the two agencies in 1990 sets forth coordination mechanisms for the two programs.

The impetus for the erosion and sediment control program includes stream channel erosion, water quality, and conservation of soil and water resources.

The impetus for the stormwater management program includes flooding, stream channel erosion, water quality, ground water recharge and protection of wetlands and stream corridors.

The programs' legal authority are established in:

1. Sediment Control
 - a. Program authority - N.J.S.A. 4:24-1 et. seq. (Soil Conservation Act)
 - b. Regulations - N.J.S.A. 4:24-39 et. seq.
2. Stormwater Management
 - a. Program authority - N.J.S.A. 40:55D-1 (Stormwater Mgmt Act)
 - b. Regulations - N.J.A.C. 7:8 (Stormwater Mgmt Regulations)

Stormwater Management Program

Program Goals/Objectives	To require the implementation of stormwater plans and ordinances at the local level which will: <ul style="list-style-type: none">· reduce flood damages.· minimize increased runoff rates and pollution from new development· reduce erosion from development and maintain the integrity of stream channels.
Exemptions and Waivers	Agriculture Forestry Single family homes not part of a larger plan of development.

- Developments which:
- are minor subdivisions (< 2 lots)
 - disturb < 100 ft²

Preferred practices Extended detention is used in most cases, with wet ponds with permanent pools used where dry weather flow is adequate. Infiltration basins are used where subsurface conditions are suitable. Vegetated filter strips are used also.

Design criteria are specified in the *N.J. Guide to Stormwater Management Practices*.

Performance Standards and Design Criteria

Water Quality	80% reduction in TSS	Use practices above to manage a storm of greater of 1.25" in 2 hours or the one year, 24 hour storm with an release outflow of 90% of the volume within 18 hours for residential projects and within 36 hours for all others.
Peak Discharge	Match pre-development conditions, non-erosive	The post-development rate and volume can not exceed pre-development for a 2, 10, and 100-year, 24-hour storm.
Volume	Proposed - approximate pre-development hydrology	Reduce post-development 2-yr peak to 50% of pre-development, reduce post-development 10 and 100-yr peak to 75% of existing.

Downstream evaluation is required to assure there is no increase in peak velocities with downstream channel stability evaluated to assure compliance with state erosion and sediment program requirements.

Available Publications: *N.J. Guide to Stormwater Management Practices (BMP Manual)*
 N.J. Nonpoint Source and Stormwater Best Management Practices Manual (In publication)

Source controls Will be included in revised stormwater management regulations. These will include site planning and design, preservation of natural features, minimum disturbance and impervious cover, natural landscaping, fertilizer and pesticide controls, and hazardous waste collection.

Erosion and Sediment Control Program

Program goal/objective Prevention and control of soil erosion and sedimentation from land disturbing activities.

Protect and enhance water quality.

Exemptions and waivers	Agriculture Forestry Single family homes not part of a larger plan of development Activities disturbing < 5000 ft ²
Preferred Practices	Sediment basins and traps which are designed for 1 inch of runoff from the disturbed area. Other practices include mulching, sodding, staged clearing, silt fence, gravel construction entrance, temporary and permanent vegetative cover.
Design Criteria	Specified in <i>Standards for Soil Erosion and Sediment Control in New Jersey</i> .

Program Authority and Implementation

The erosion and sediment control program is implemented by the State Soil Conservation Committee and by local governments (31 approved programs) and local Soil and Water Conservation Districts using state criteria. Administration of the stormwater program involves all levels of government. The N.J. DEP issues state stormwater permits and NPDES stormwater permits using federal and state criteria. Local governments can receive state grants (when funds are appropriated) to develop stormwater master plans and implement stormwater ordinances and programs. These local programs use state and local criteria.

Project Permitting	Erosion and sediment control plans are certified “in compliance”. Stormwater program uses noticed exemptions, general permits, individual permits, and approvals associated with other permits including NJPDES stormwater permits, stream encroachment, wetlands, or coastal permits. Regional stormwater entities must approve in special areas.
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Review process	Application for soil erosion and sediment control plan certification includes ES and SW plans, specifications, sequencing of activities, stability analysis of channels and structures, O/M plans.
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A detailed checklist is used for erosion/sediment control and, in some locales, for stormwater management.

Certification of the erosion and sediment control plan and a stormwater permit are required before a building or grading permit is issued.

Inspections

Erosion/Sediment Controls	As needed or determined by SWCD; performed by SWCD
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Program Resources

<u>Program Funding</u>	<u>Source</u>	<u>Amount</u>
Erosion and sediment control	General appropriations	Varies (0% now)
	Certification fees	\$2-3 million (100%)
Stormwater management	General appropriations	
	Permit fees, Fines	
	Bond Act	\$1 million

<u>Program Staffing</u>	<u>Position</u>	<u>Full Time</u>	<u>Part time</u>	<u>Needed</u>
ES Control	Administrative	21	1	2
	Engineer	2		2
	Inspector	42	3	
	Support			3
	Clerical	26	3	
SW Management (For MS4 Program)	Administrative	1		
	Engineer		1	2
	Scientist	1	1	2
	Clerical	1		
	Support			2

Educational Programs

Educational programs are a voluntary component of the erosion and sediment control program and a required component of the stormwater program. The erosion/sediment control program uses brochures, newsletters, exhibits, demonstration projects, and professional short courses to educate the intended audience of contractors, consultants, developers, inspectors, general public, students, and elected officials. In a typical year, three training programs are held which attract 100 developers and 150 consultants, with a single program for 88 inspectors, and four programs for 200-350 workers in cooperating agencies. The stormwater program’s educational efforts are less formal, relying upon brochures, exhibits, and demonstration grants and projects.

Program Coordination

There is close coordination between the erosion /sediment control program and the stormwater management program, with a formal interagency agreement.

The erosion/sediment control program is coordinated with the local floodplain management and building permit programs. Coordination between the stormwater program and other local programs varies depending upon the locale.

Conflicts arise between the erosion/sediment control program and the state wetlands protection program and the Coastal Area Facilities Review Act program, both of which

have technical criteria which conflict with ES standards and specifications. The stormwater program also notes conflicts with goals and regulations of other state environmental programs.

The stormwater program staff believe that communication from federal agencies on related programs such as NPDES and NPS needs to be improved.

Program Evaluation

Measures of success	None listed for either program.
Research projects	Bioengineering for streambank stabilization. Effectiveness of filter strips, use of wildflowers in detention pond. Runoff quantity and quality at various land uses. Whippany River Watershed Mgmt Plan developing TMDLs for point sources and BMPs for nonpoint sources.
Monitoring	Water chemistry, sediments, flow rates

Program Evolution into Watershed Approach

The erosion and sediment control program was created by 1976 legislation authorizing SWCD's to establish ES control programs if municipalities did not require developers to prepare ES control plans. In 1981, the Stormwater Management Act was enacted with state regulations adopted in 1983. The Act regulates management of stormwater from new developments; requires, if state funding is available for grants, local governments to prepare stormwater master plans and to implement stormwater ordinances; and, authorizes watershed level planning.

Retrofitting of developed areas is not being pursued.

Watershed approaches and plans are promoted by the Stormwater Management Act with regional stormwater management systems, water body targeting, and nonstructural BMPs encouraged.

SEDIMENT CONTROL AND STORMWATER MANAGEMENT PROGRAM SUMMARY

JURISDICTION: STATE OF PENNSYLVANIA

Erosion and Sediment Control Program
Dept. of Environmental Resources
Bureau Land & Water Conservation
400 Market Street
Harrisburg, Pa. 17105-8555

Stormwater Management Program
Dept. of Environmental Resources
Bureau Land & Water Conservation
400 Market Street
Harrisburg, Pa. 17105-8555

The erosion /sediment control program and the stormwater management program are separate programs. Both are directed at the state level by the Pennsylvania Department of Environmental Resources (PDER). However, program implementation rests primarily with local governments, with the stormwater program being a component of county watershed planning.

The impetus for the erosion/sediment control program is water quality, along with the recent NPDES stormwater permitting requirements for construction activities.

The impetus for the stormwater management program is flooding, specifically that associated with Hurricane Agnes in 1972.

The programs' legal authority are established in:

1. Erosion and Sediment Control
 - a. Program authority - Pa. Stream Cleans Law, 35PS691-1 et. seq.
 - b. Regulations - Pa. Erosion Control Code, Title 25, Chap. 102.1 et. seq.
2. Stormwater Management
 - a. Program authority - Stormwater Management Act, PS864, No. 167 and, 32PS ss680.1 et seq.
 - b. Regulations - Stormwater Management Grants and Reimbursement - Title 25, and Chapter 111.

Stormwater Management Program

Program Goals/Objectives	Encourage stormwater planning on a watershed basis Maintaining existing flow conditions Encourage local administration and management Encourage implementation of stormwater treatment BMPs for new development.
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Exemptions and Waivers	Agriculture Forestry Developments which have a specified amount of impervious area, depending on the watershed.
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ones.

Program Authority and Implementation

The erosion/sediment control program is implemented by the State DER and by 66 County Conservation Districts using federal, state, and local criteria. Administration of the storm-water program involves local governments which implement local and, at times, watershed criteria.

Project Permitting Erosion/sediment control plan authorization includes NPDES general permits for projects of 5 to 25 acres, and individual permits for projects greater than 25 acres or for projects with a high potential for violating water quality standards, discharging toxics, or discharging into a high quality or exceptional value water body watershed. Stormwater plans are not required or permitted .

Review process CCD reviews application which includes ES control plan, specifications, O/M plans, for completeness (GP) and technical compliance (IP). Stormwater requirements and review process vary with the local government, usually part of site plan review.

A detailed checklist is used for erosion/sediment control plan review.

Erosion/sediment control plan approval is required before a building or grading permit is issued for projects disturbing over 5 acres. Stormwater requirements depend on local government and stormwater plan.

Inspections

Erosion/sediment controls IPs have monthly inspections, GP inspections vary; performed by Conservation District.

Stormwater systems Requirements set by local government or stormwater plan.

Program Enforcement and Compliance

Penalty provisions are a component of both programs. The erosion/sediment control program has civil penalties with fines of up to \$10,000 per day with each day considered a separate violation. Criminal penalties include fines of \$100 to \$10,000 per day or 90 days in jail. The stormwater program allows the State DER, which oversees municipalities and counties developing and implementing watershed plans, to file suit forcing a local government to comply and can recommend withholding state funding for violators.

Other enforcement procedures Stop work orders
Erosion/sediment program Withholding other permits

Withholding building permits

As-built certifications are may be required by local programs.

Final inspection of stormwater systems is performed in some locales by the local government.

Maintenance of Stormwater Systems

Maintenance of completed stormwater systems is required.

Legal entities include	Public agencies Private entity or owner Property owners association
Inspection frequency	None - varies with local government
Inspected by	Local government
Oversight agency	Municipalities
O/M responsibilities	Specified by local government, typically include mowing, sediment and trash removal, structural repairs
Funding source	Depends on legal entity
Enforcement mechanism	Varies with local government, may include requiring long term bonds.

Program Resources

<u>Program Funding</u>	<u>Source</u>	<u>Amount</u>
Erosion/sediment control	General appropriations	\$4.5 million from counties \$1.5 million from DER
	Permit fees	\$204,000
	Plan review fees	\$550,000
Stormwater Management	General appropriations	\$595,000

<u>Program Staffing</u>	<u>Position</u>	<u>Full Time</u>	<u>Part time</u>	<u>Needed</u>
ES Control	Administrative	1		1
Average per CCD	Clerical	1		1
66 CCDs in state	ES Technician	1		1
	District Manager	1		
SW Management	Administrative	1		1
	Engineer	3		4
	Clerical	1		

Educational Programs

Educational programs are a voluntary component of both programs. The erosion/sediment control program uses brochures, slide shows, exhibits, demonstration projects, and monitoring to educate the intended audiences of contractors, consultants, developers, inspectors, general public, and elected officials. In 1993, 27 training programs were jointly held attracting 700 contractors, 600 developers, and 630 consultants. Additionally, 20 programs attracted 450 loggers, while two sessions were attended by 100 PennDOT employees, and a single program was held for 25 game commission staffers. The stormwater program conducts public meetings in each watershed during watershed planning process.

Program Coordination

The erosion/sediment control program and the stormwater management program are not well coordinated.

The erosion/sediment control program is coordinated with the local wetlands protection, wastewater management, water supply, and building permit programs. Coordination occurs between the stormwater program and other Departmental permitting programs and the DOT, along with the wetlands/floodplain management and wellhead protection programs.

Conflicts arise between the stormwater program and the wetland protection program which limits the use of land and discharge locations.

Communication from federal agencies on related programs such as NPDES and NPS is good.

Program Evaluation

Measures of success

- ES Control Program - CCD evaluation of compliance.
- SW Management Program -
 - 90% of municipalities in studied watersheds have implemented stormwater management ordinances.
 - 40 watershed plans encompassing 29 counties, 421 municipalities have been developed.

Research underway	Developed model for structural controls (PSRM-QUAL) Assessment of nutrient loadings in urban areas Evaluation of BMPs in urbanized watershed (Paxton Creek)
Monitoring	Water chemistry, flow rates, biology

Program Evolution into Watershed Approach

The erosion/sediment control program was created in the early 1980's as an earth disturbance permit program, which, in October 1992, was replaced by the current NPDES construction permit. The stormwater management program arose in response to flooding from Hurricane Agnes in 1972. In the mid-1980s, watershed level planning was encouraged with 56 plans current out of 356 watersheds.

Retrofitting of developed areas is being encouraged to correct flooding, water quality degradation, stream channel erosion, and protection of aquatic resources. Funding is provided through the "PENNVEST" program which provides loans to local governments for constructing infrastructure.

Watershed approaches are not being used but are being considered.

SEDIMENT CONTROL AND STORMWATER MANAGEMENT PROGRAM SUMMARY

Jurisdiction: **STATE OF SOUTH CAROLINA**

Stormwater Management
South Carolina Dept. of Health & Environmental Control
2600 Bull Street
Columbia, South Carolina 29201

The erosion and sediment control program and the stormwater management program are integrated programs.

The impetus for the program is flooding and water quality protection.

The program's legal authority is established in:

1. Title 48 Chapter 14 (Stormwater Management and Sediment Reduction Act of 1991)
2. Chapter 72-300 (Standards for Stormwater Management and Sediment Reduction)

Stormwater Management Program

Program Goals/Objectives	To reduce flooding and water quality problems caused by stormwater and sediment by establishing minimum standards for a uniform statewide program. To encourage implementation of the program at the local level.
Exemptions and Waivers	Agriculture Forestry Single family homes not part of a larger plan of development. Utilities operation activities conducted under a certificate of environmental compatibility issued by the Public Service Commission.
Preferred practices	Regulations discuss treatment practices including wet detention, dry detention, and infiltration.

Design guidelines are given in the regulations and in:

A Guide to Site Development and Best Management Practices For Stormwater Management and Sediment Control (May 1992).

S.C. Stormwater Management and Sediment Control Hand Book for Land Disturbing Activities (January 1994)

Practices installed	Swales	400	Wet detention	100
Oct 1992 - June 1994	Infiltration basins	325	Dry detention	150
	Infiltration trench	4	Extended dry det	25
	Wetlands	3	Peak detention	175

Performance Standards and Design Criteria

Water Quality	Remove at least 80% of the average annual TSS load.	Treatment volume varies from 0.5 half (wet ponds) to 1 inch (dry detention, retention) with drawdown within 24 hrs.
Peak Discharge	No increase in rate.	Post-development rate can not exceed pre-development for a 2-yr & 25-yr, 24-hr storm; must pass 100-yr, 24 hour.
Volume	None	

Downstream evaluation is required with maximum downstream channel velocity specified to assure stability.

Available Publications: *A Guide to Site Development and Best Management Practices For Stormwater Management and Sediment Control (May 1992)*

S.C. Stormwater Management and Sediment Control Hand Book for Land Disturbing Activities (January 1994)

Source Controls Covering loading docks or other places where sources are handled, street sweeping parking areas, dry cleaning of trash handling areas, and sequencing of construction are encouraged at truck stops, industrial or large commercial projects, multifamily residential projects

Erosion and Sediment Control Program

Program goal/objective To prevent erosion and then trap sediments.
Performance standard is 80% removal efficiency or 0.5 ml/L settable solids concentration at peak of 10-year, 24-hour design storm, whichever is less.

Exemptions and waivers Same as stormwater program.

Preferred Practices Sediment basins and traps are designed to achieve above performance standard for 10-yr, 24-hr storm. Other practices used include mulching, sodding, staged clearing, silt fence,

gravel construction entrance, temporary and permanent vegetative cover.

Design Criteria Specified in *A Guide to Site Development and Best Management Practices For Stormwater Management and Sediment Control (May 1992)*.
S.C. Stormwater Management and Sediment Control Handbook for Land Disturbing Activities (January 1994).

Program Authority and Implementation

The NPDES and State stormwater management and sediment reduction permitting programs are implemented by the South Carolina Department of Health and Environmental Control. The State erosion, sediment, and stormwater management program uses State criteria which can be implemented by local governments to which the program is delegated.

Project Permitting Individual permits are used. They incorporate erosion, sediment, and stormwater control requirements.

Review process Activities disturbing two acres or less which are not part of a larger plan of development submit simplified stormwater management and sediment control plan, not reviewed or approved. Submissions for projects over two acres include a complete stormwater management and sediment control plan with plans for activities disturbing two to five acres reviewed within ten days and within 20 days for projects over five acres.

A detailed checklist is used for erosion/sediment control and stormwater management.

Erosion/sediment control and stormwater management approval is required before issuance of a building or grading permit, or before issuance of a SCDOT encroachment permit.

Inspections

Erosion/sediment controls Required weekly or after each half-inch rain, done by permittee. Permitting agency inspects periodically. Repairs or maintenance required as needed.

Stormwater systems Same as erosion controls with inspections performed by the permitting agency.

Program Enforcement and Compliance

Penalty provisions are a program component. They include civil penalties with fines of

<u>Staffing</u>	<u>Position</u>	<u>Full Time</u>	<u>Needed</u>
ES +SW	Administrative	1	1
	Engineer	7	3
	Inspector	18	10
	Scientist	1	2
	Clerical	2	2

Educational Programs

Educational programs are a voluntary component of the program. Approximately six program a year are given with two programs each given for contractors, developers, and consultants. Each program typically attracts about 25 persons.

Program Coordination

There is close coordination within the integrated erosion/sediment control and stormwater management program.

The program is closely coordination with State wetlands protection and floodplain management programs.

Conflicts arise with the impoundment policy of the United States Fish and Wildlife Service.

Communication from federal agencies on related federal programs needs to be improved.

Program Evaluation

Measures of success Meeting permit time deadlines set by State law
Monthly inspections

Research projects Developed charts, nomographs and simplified calculation methods to size structural and nonstructural controls to achieve desired 80% sediment removal level. Developing model to route sediment through storm sewers.

Monitoring None

Program Evolution into Watershed Approach

Efforts began in 1983 to enact a statewide stormwater law with the first success being the State Lands Act of 1984 which required regulation of state lands. South Carolina's Stormwater Management and Sediment Reduction Act was enacted in May 1991 with the regulations adopted on June 26, 1992. Like Delaware's law, which it is patterned after, South Carolina's law allows for the selection of "designated watersheds" in which watershed management plans are to be prepared and implemented.

Retrofitting of developed areas is not being pursued. However, SCDOT is cooperating to retrofit problem areas when road systems are upgraded.

Watershed approaches are being used including regional stormwater management systems, water body targeting, and emphasis on nonstructural BMPs.

SEDIMENT CONTROL AND STORMWATER MANAGEMENT PROGRAM SUMMARY

Jurisdiction: STATE OF VIRGINIA

Erosion and Sediment Control Program
Dept. of Conservation & Recreation
203 Governor Street, Suite 206
Richmond, Virginia 23219

Stormwater Management Program
Dept. of Conservation & Recreation
203 Governor Street, Suite 206
Richmond, Virginia 23219

The erosion/sediment control program and the stormwater management program are separate programs. Both are directed at the state level by the Virginia Department of Conservation and Recreation, Division of Soil and Water Conservation. However, program implementation rests primarily with local governments.

The impetus for the erosion/sediment control program includes water quality and stream channel erosion.

The impetus for the stormwater management program includes flooding, stream channel erosion, ground water recharge, water quality, and to protect the physical, chemical, and biological characteristics of streams.

The programs' legal authority are established in:

1. Sediment Control
 - a. Program authority - Title 10.1, Chapter 5, Article 4, Code of Virginia
Erosion and Sediment Control Act
 - b. Regulations - Virginia Regulations 625-02-00, Erosion and Sediment Control

2. Stormwater Management
 - a. Program authority - Title 10.1, Chapter 6, Article 1.1, Code of Virginia
Stormwater Management Act
 - b. Regulations - Virginia Regulations 215-02-00, Stormwater Management

Stormwater Management Program

Program Goals/Objectives	Manage the quality and quantity of stormwater resulting from land conversion and development to protect water quality, living resources, and property.
Exemptions and Waivers	Single family homes not part of a larger plan of development Agriculture Forestry Projects disturbing less than one acre Mining and oil/gas operations permitted under Title 45.1

Preferred practices None, but regulations list design criteria for detention, retention, and infiltration.

Design criteria are specified in the regulations.

Performance Standards and Design Criteria

Water Quality	None at present. Draft ones proposed.	Treatment volume is 0.5 “ runoff from project area. Detention basins release over 30 hours, infiltration systems must percolate within 48 hours, retention basins must have a permanent pool at least three times the treatment volume.
Peak Discharge	No increase in rate	Post-development peak rate can't exceed pre-development rate for 2-year and 10-year storm. Duration is a 24-hour storm (SCS method) or the critical storm (Rational method).
Volume	No performance standard	

Downstream evaluation is not required but the discharge must not cause instability of the downstream channel.

Available Publications: *Stormwater Management Handbook* in preparation, available January 1996.

Source controls Encouraged in the regulations as an alternative to structural controls. Clustering land development, minimizing impervious surfaces and curbing, open space acquisition, floodplain management, and protection of wetlands, steep slopes, and vegetation are promoted.

Erosion and Sediment Control Program

Program goal/objective To control soil erosion, sedimentation, and stormwater from land disturbing activities to prevent unreasonable degradation of State waters, properties, stream channels and other natural resources.

To establish minimum statewide requirements and provide for delegation of the program to local governments.

Exemptions and waivers Agriculture
 Forestry
 Activities disturbing < 10,000 ft²
 Mining or oil/gas exploration activities

Preferred Practices	Sediment basins are designed for 134 yd ³ /acre. Other practices include sediment traps, silt fence, temporary and permanent vegetative cover, diversions, daily street cleaning
Design Criteria	Specified in <i>Virginia Erosion and Sediment Control Handbook (1992)</i> and <i>Erosion and Sediment Control Field Manual (1995)</i> .

Program Authority and Implementation

The erosion/sediment control program is implemented by the State Dept. of Conservation and Recreation and by local governments or local soil and water conservation districts using minimum state criteria. The stormwater program is implemented by the State Dept. of Conservation and Recreation which permits state projects and by local governments which have established approved local programs.

Project Permitting	Individual permits are used by both the erosion/sediment control and the stormwater management programs.
Review process	Application is thoroughly reviewed for completeness and accuracy. Information includes ES control plan, specifications, O/M plans; SW management plan, specifications, calculations, hydrology, O/M plans, etc. A detailed checklist is used for erosion/sediment control plan review. A checklist is under development for the stormwater program.

Erosion/sediment control plan approval and stormwater plan approval is required before a building or grading permit is issued.

Inspections

Erosion/sediment controls	At least once every two weeks, within 48 hours of a runoff producing storm event, at end of project prior to release of performance bond. Performed by certified inspector or by permitting agency.
Stormwater systems state	Periodic but no set schedule. Performed by local government or permitting agency.

Program Enforcement and Compliance

Penalty provisions are a component of both programs. The erosion/sediment control program has civil penalties with fines of \$100 to \$3000 per day and fines of \$1000 to \$10,000 per day for unpermitted sites, with each day considered a separate violation. Also can use administrative fines which can not exceed \$2,000 per violation. Criminal penalties include

a Class I misdemeanor with fines of \$2,500 per day or 30 days in jail. The stormwater program has civil penalties of up to \$2,000 per violation. Criminal penalties include a Class I misdemeanor with fines of \$1,000 per day or 30 days in jail or both.

Other enforcement procedures

Erosion/sediment program	Stop work orders Revoke permit Withholding other permits Withholding building permits Issue “notice to comply”
Stormwater program	Revoke permit

As-built certifications are not required.

Final inspection of stormwater systems are not performed.

Maintenance of Stormwater Systems

Maintenance of completed stormwater systems is required.

Legal entities include	Public agencies Private entity or owner Property owners association
Inspection frequency	Twice a year
Inspected by	Local government
Oversight agency	Dept. of Conservation and Recreation
O/M responsibilities	Depends on type of system.
Funding source	Depends on legal entity
Enforcement mechanism	Varies with local government, may include performing work and recovering costs from system owner.

Program Resources

<u>Program Funding</u>	<u>Source</u>	<u>Amount</u>
Erosion/sediment control	General appropriations Permit fees*	\$760,000

* Local government may charge administrative fees commensurate with services provided

Stormwater management General appropriations \$236,000

<u>Program Staffing</u>	<u>Position</u>	<u>Full Time</u>	<u>Needed</u>
ES Control	Administrative	1	1
	Engineer		
	Scientist	11	33
	Trainer	2	
	Clerical	1	1
SW Management	Engineer	5	4

Educational Programs

Educational programs are a mandated component of the erosion and sediment control program and a voluntary component of the stormwater program. The erosion/sediment control program uses brochures, slide shows, demonstration projects, and monitoring to educate the intended audience of contractors, consultants, developers, inspectors, and local program staff. State training and certification programs are held for erosion and sediment control program inspectors, plan reviewers, and administrators. In 1993, six training programs were jointly held for contractors, developers, and consultants with an average of ten individuals per session; eight training programs were attended by 320 inspectors; six programs attracted over 200 citizens; and four sessions attracted 160 other persons, many being local program staff.

Program Coordination

There is close coordination between the erosion/sediment control program and the stormwater management program.

The erosion/sediment control program is coordinated with local land use planning, zoning, building permit, and water supply programs. Coordination occurs between the stormwater program and the land use planning and wetlands/floodplain management programs.

Conflicts arise between specific design or permitting requirements of the state erosion and sediment control program and the Virginia PDES general permit for construction activities. The state stormwater program and the Chesapeake Bay Preservation Act conflict because the former program is technology based and the latter program's stormwater requirements are performance based. To resolve these conflicts, both agencies and a legislative committee are working on the development of consistent stormwater management criteria which will work for both agency's programs, as well as the Department of Environmental Quality's VPDES program.

Communication from federal agencies on related programs such as NPDES and NPS needs to be improved.

Program Evaluation

Measures of success	ES Control Program - State reviews and rates implementation of local programs to assure compliance with minimum state requirements.
SW Management Program -	Adoption of local programs that meet minimum State requirements, implementation of BMPs.
Research underway	Demonstration projects evaluating effectiveness of newly designed sediment basin, detention structures, infiltration practices. O/M manual being prepared.
Monitoring	No response

Program Evolution into Watershed Approach

The erosion and sediment control program was created in 1973 with adoption of the Erosion and Sediment Control Law. The first edition of the Virginia Erosion and Sediment Control Handbook was published in 1974 with a second edition published in 1980. By 1977, local ES programs had been established in 172 localities. In 1988, law revised to improve compliance and enforcement including establishment of 20 positions at the State level. In 1990, the revised regulations were adopted with the third edition of the Handbook published in 1992. Changes to the law in 1993 created the mandatory certification program and again enhanced enforcement. The ES Regulations were revised in 1994.

The stormwater management program began with passage of the Stormwater Management Act in 1989 with the first regulations adopted in 1990. In 1993 the General Assembly established a subcommittee to study the efficiency and consistency of the program's regulations leading to a revision of the Act in 1994 which exempted certain linear developments.

Retrofitting of developed areas is being pursued as part of watershed planning to correct flooding, water quality degradation, and stream channel erosion.

The Stormwater Management Act encourages watershed planning and the use of regional systems, waterbody targeting, and nonstructural controls.

SEDIMENT CONTROL AND STORMWATER MANAGEMENT PROGRAM SUMMARY

JURISDICTION: **WASHINGTON STATE DEPARTMENT OF ECOLOGY**
P.O. Box 47600
Olympia, Washington 98504-7600

The erosion/sediment control program and the stormwater management program are integrated programs. Additionally, the Department has a separate program for sediment contamination and sediment quality standards issues.

The impetus for the program includes stream channel erosion, water quality, fisheries and shellfish resource protection, and requirements imposed by federal and state legislation.

The program's legal authority is established in:

1. Federal Clean Water Act (NPDES Stormwater Regulations)
2. Chapters 90.70 (Puget Sound Water Quality Authority) and 90.48 (Water Pollution Control)
3. Chapter 173-201A, Washington Administrative Code (Surface Water Quality Standards)
4. Puget Sound Water Quality Management Plan

Stormwater Management Program

Program Goals/Objectives	To protect shellfish beds, fish habitat, and other resources. To prevent the contamination of sediments from urban runoff and combined sewer overflows. To achieve standards for water and sediment quality by reducing and eliminating harm from pollutant discharges free from stormwater and CSOs throughout Puget Sound.
Exemptions and Waivers	Agriculture Forestry operations, except forest conversions Activities disturbing < 1 acre or single family homes only must comply with erosion and sediment controls requirements.
Preferred practices	Infiltration practices are preferred where site conditions allow. Other practices used include pervious and modular pavement, grass swales, vegetated filter strips, extended dry detention, wet detention ponds, constructed

wetlands, and sand filters.

Design criteria are specified in *Stormwater Management Manual for the Puget Sound Basin (1992)*.

Performance Standards and Design Criteria

Water Quality	No specific performance standard	Treatment volume is the runoff from the 6-mo, 24-hr storm which must be treated using BMPs appropriate for site.
Peak Discharge	No specific performance standard. Goal is to minimize streambank erosion.	Post-development rate can not exceed 50% of pre-development for a 2-yr, 24-hr storm nor pre-development for a 10 and 100-yr, 24-hour storm .
Volume	No specific performance standard. Goal is to recharge aquifer, maintain baseflows.	Infiltration of runoff from a 2-yr, 24-hr storm is encouraged when conditions allow its use.

Downstream evaluation is required with downstream channel stability evaluated. Stream channel erosion BMPs must be designed with a correction factor which ranges from 20 to 50% of the design volume depending on the amount of impervious surface.

Available Publications: *Stormwater Management Manual for the Puget Sound Basin (1992)*.

Source Controls Manual includes recommended source controls for specific land uses including nearly 20 types of businesses, transportation and communication activities, wholesale and retail businesses, service businesses, and public lands. Guidance is provided for source control BMPs including fueling stations, vehicle washing, materials handling, storage tanks, and vegetative management.

Erosion and Sediment Control Program

Program goal/objective To prevent erosion and minimize sediment transport by disturbing as little of the site as possible and stabilizing it as quickly as possible.

No specific performance standard.

Exemptions and waivers Same as stormwater program

Preferred Practices Sediment basins and traps which are designed to detain and treat the 10-yr, 24-hr developed condition design storm. Other

practices include seasonal disturbed area limits, staged clearing, silt fence, gravel construction entrance, mulching, sodding, temporary and permanent vegetative cover, slope drains, etc.

Design Criteria Specified in *Stormwater Management Manual for the Puget Sound Basin*.

Program Authority and Implementation

The Washington Department of Ecology implements the NPDES stormwater permitting program within the State. The erosion/sediment control program is implemented by the WDOE using State criteria. The stormwater management program is implemented using State criteria with implementation by WDOE and local governments, some of which have additional local criteria.

Project Permitting At the state level, only Washington NPDES stormwater permits are issued with general permits for construction activities disturbing over 5 acres and for industrial stormwater dischargers.

Review process N/A
A detailed checklist is not used.

Industrial stormwater GP requires applicant to go through procedures required in the State Environmental Policy Act.

Inspections

Erosion/sediment controls NPDES Stormwater GP for construction activities requires inspections at least once every seven days and within 24 hours after any storm of greater than 0.5 inches of rain. Inspections done by site engineer or workers with maintenance performed as needed to assure proper performance.

Stormwater systems No requirements at state level. Local governments may establish.

Program Enforcement and Compliance

Penalty provisions are a program component. They include public rebuke for not complying with the Puget Sound Water Quality Management Plan and civil penalties with fines of \$10,000 per day or up to one year in jail or both.

Other enforcement procedures None

As-built certifications and record drawings are not required by state program.

Final inspection of stormwater systems may be required by local governments.

Maintenance of Stormwater Systems

Maintenance of completed stormwater systems is required.

Legal entities include	Governmental agencies Public utility companies Special districts Private owner for commercial systems Property owners association
Inspection frequency	As needed
Inspected by	Varies with local government, DOT for their system.
Oversight agency	Each local government. WDOE oversees and enforces if water quality standards violated, also has oversight of DOT within the Puget Sound basin.
O/M responsibilities	Specified by design engineer in O/M manual
Funding source	Varies with local government.
Enforcement mechanism	Generally, local governments use enforcement available through local ordinances

Program Resources

<u>Program Funding</u> NPDES SW	<u>Source</u> General appropriations NPDES Permit fees	<u>Amount</u> Highly variable		
<u>Program Staffing</u> NPDES SW	<u>Position</u> Administrative Engineer Scientist Planner Inspector Clerical ?	<u>Full Time</u> 1 4 3 1	<u>Part time</u> 2 2 1 1	<u>Needed</u> ? ? ? ? ? ?
	? Question Marks denote lack of response			

Educational Programs

Educational programs are a required component of the program. Brochures, slide shows/talks, exhibits, newsletters, demonstration projects, and storm sewer stenciling are used to

reach the target audience of contractors, consultants, developers, inspectors, and the general public. The number of workshops varies each year with over 200 persons attending the three given this past year.

Program Coordination

There is close coordination within the integrated erosion/sediment control and stormwater management program.

The program also is coordinated with the Department's wetlands protection and floodplain management programs and with local land use management and building approval programs.

Conflicts arise over funding among the various State programs.

Communication with the EPA on NPDES needs to be improved.

Program Evaluation

Measures of success The Puget Sound Water Quality Management Plan is revisited every two years with details on progress, or lack of progress, in implementing the Plan's tasks and meeting it's schedules.

Research projects The Department's Centennial Clean Water Fund is paying for numerous BMP projects implemented by local governments. The DOE funded a study of wastes picked up by vectors from different types of land uses.

Monitoring None in stormwater program.

Program Evolution into Watershed Approach

The stormwater program at the WDOE began in 1988 with a focus on meeting the goals of the Puget Sound Management program. Requirements imposed by the Federal Clean Water Act led to the establishment of the WDOE NPDES stormwater regulations in 1992. Planning on expanding the state stormwater program throughout the state where it will be advisory except as required under NPDES.

Retrofitting of developed areas is being pursued to reduce water quality degradation, stream channel erosion, and to restore/protect aquatic resources. The Puget Sound Plan requires retrofitting within that basin.

Watershed approaches are just beginning to be used including regional stormwater management systems, water body targeting, and emphasis on nonstructural BMPs.