Prepared for:

City of Clarksville
Street Department
199 10th Street
Clarksville, Tennessee

Stormwater Program Advisory Committee

Program Assessment And Funding Feasibility

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Stormwater Program Advisory Committee
Program Assessment and Funding Feasibility
Executive Summary

The Mayor appointed a wide-ranging group of citizens to investigate the existing stormwater management program and determine appropriate steps to improve the effectiveness of the program. This report summarizes the findings and recommendations of the citizens group, termed the Stormwater Program Advisory Committee (SWPAC).

Committee Creation and Operation

The committee, as appointed, was initially comprised of twelve (12) citizens having diverse backgrounds, interests, and knowledge base. Of the twelve members, seven (7) participated actively in the process and were involved in providing the recommendations contained herein. The seven active committee members are listed in the following along with the stakeholder group they represented.

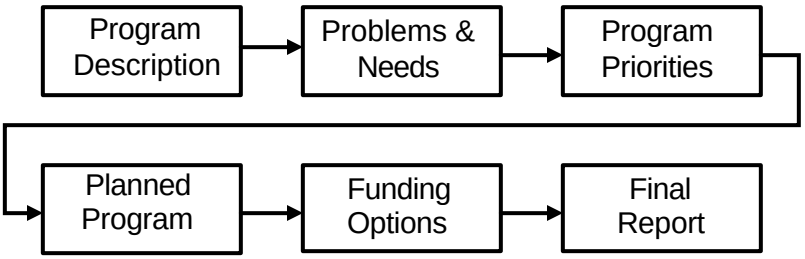
Active Committee Members

Member	Stakeholder Group
Larry Carpenter	Industrial Community
Phil Kemmerly	Academic Community
Bill Ogles, Jr.	Real Estate Community
Staton Shelby	City Council
Thom Spigner	Contracting Community
Bill Summers	Homeowners/Homeowners Associations
Brian Trotter	Engineering Community

The committee first convened in April 2002 at the Clarksville Street Department. The committee held eight (8) meetings over a 9-month period to review the existing stormwater program and develop recommendations for an improved program.

In order to assess the existing stormwater program and recommend improvements to the program, the committee implemented a logical process through which an assessment of the stormwater program, recommendations for an improved program, assessment of funding alternatives, and next steps were developed. The process used by the committee is illustrated in the following figure.

Stormwater Program Advisory Committee
Program Assessment and Funding Feasibility
Executive Summary



Program Assessment Process

The program assessment process was used to seek answers to the following questions:

1. What is Clarksville (and other communities) currently doing in terms of stormwater management?
2. What are the stormwater related problems, issues, needs, and opportunities currently being faced by Clarksville?
3. What stormwater program priorities should guide Clarksville in the improvement of the stormwater program?
4. What specific program improvements should Clarksville make and what will the costs be?
5. What is (are) the best way(s) to pay for these program improvements?
6. How should the importance of stormwater management be presented to the City Council and the general public?

The committee was assisted in its efforts by the Clarksville Street Department and the consultant AMEC Earth and Environmental, Inc. (AMEC). AMEC developed background material, described the subjects and specific issues, gave some alternatives other communities have used, and laid out questions to be answered.

Current Stormwater Program

The responsibility for stormwater management in Clarksville is spread among multiple city departments that implement and enforce local ordinances and administer state and federal programs that affect stormwater management. A brief summary of the existing program responsibilities is presented in the following table.

General Department Responsibilities for Stormwater Management

Department / Agency	Responsibility
Street Department	• Complaint receipt, investigation and response • Drainage system maintenance • Site inspection for streets • Master planning • FEMA no-rise certification reviews • Administration and enforcement of Storm Water Management Ordinance • Coordinates compliance with NPDES program • Reviews development plans • Grading permit issuance
Building and Codes	• Building permit issuance and inspection
Regional Planning Commission	• FEMA program overall responsibility • Zoning and subdivision approval
Golf Courses	• Golf Course fertilizer and pesticide handling and grounds management
Parks and Recreation	• Parks/greenspace fertilizer and pesticide handling and grounds management

Primarily through the Street Department, Clarksville spends approximately $2.5 million annually on the stormwater management program. These expenditures are summarized in the following table by functional area.

Current Program Expenditures

Functional Area	Expenditure
1. Administration & Finance	$513,764
2. Public Involvement & Education	$0
3. Geographic Information Systems (GIS) & Technology Support	$4,261
4. Operations & Maintenance	$1,299,792
5. Capital Construction	$368,539
6. Engineering & Planning	$48,767
7. Regulation & Enforcement	$81,243
8. Stormwater Quality	$212,000
Total Annual Expenditures	**$2,528,366**

The sources of revenue supporting the stormwater management program are the general fund (property taxes) and state shared revenue (gas tax proceeds). Funding for most functional categories are budgeted annually as operating expenses of the Street Department and are reasonably stable. However, funding for Capital Construction ($368,539) and Stormwater Quality ($212,000) is normally budgeted as annual, line-item capital expenditures. Capital funds are not stable and may in some fiscal years be totally non-existent. Therefore, the total annual expenditures may, in some years, be less than $2 million.

Stormwater Problems

The committee discussed the primary, secondary, and root causes for the physical stormwater problems in Clarksville. Findings of the Committee are presented in the following table.

In addition to the physical problems recognized by the committee, several institutional issues were discussed including:

1. Public Awareness and Education;
2. Dedicated Adequate Funding;
3. Piecemeal System and Program Management;
4. Customer Service Policies; and
5. Holistic Program Planning and Cooperation.

Physical Problems and Causes

Physical Problem	Primary Causes	Secondary Causes	Probable Root Causes
Flooding	Urban Development	• No evaluation of offsite or downstream impacts • Not having on-line system models • Lack of compliance with regulations • Regulations not applied consistently to all developments • Not having input in zoning changes	• Lack of pre-development planning • Incomplete or inadequate development regulations • Incomplete plans review and rezoning procedures • Inadequate diligence in enforcing regulations • Enforcement actions not severe enough or frequent enough • Stormwater regulations too dispersed and inconsistent • No control over state or county • Lack of resources for inspections during development • Lack of technical tools
	Poor Home Location	• Past regulatory practices • Lack of sub-surface exploration • Development of poorly situated properties • Homes built too close to sinkholes	• Lack of pre-development planning • Lack of floodplain data on small systems and sinkholes • Lack of procedures to notify home buyer of potential risks
	Clogged or Dysfunctional Systems	• Builders and developers don't assure system function post-construction • Complaint driven maintenance program	• Bonds don't cover stormwater or term is not long enough • Lack of resources for inspections during development • Lack of resources for proactive and preventative maintenance
	Large Rainfall	• Systems inadequate to protect from large storms that exceed design storm • No rainfall collection program or warning system applied to stormwater	• Older systems designed without good guidance on design storm • Lack of fiscal resources to coordinate data collection with State or Federal programs
	Undersized Conveyance Systems	• Poor design • Poor understanding by developers/builders of sinkholes	• Incomplete past design criteria or incomplete plans review • Inadequate assessment tools • Sinkhole flooding
Erosion and Sedimentation	Sediment in Construction Site Runoff	• Lack of source controls • Lack of contractor education • Lack of enforcement	• Past lack of regulations • Past lack of effective enforcement mechanism • Lack of resources for inspections
Water Quality	Poor Surface Water Quality	• Past lack of regulatory programs • Public awareness/education • Polluted urban stormwater runoff • Lack of structural and non-structural source controls • Illicit Connections • Illegal Dumping • Poor agricultural practices • Past development practices	• Lack of regulations • Lack of public education program and associated funding • Lack of inspections • Lack of enforcement actions • Lack of resources

Stormwater Program Goals

The committee established goals for an improved stormwater program and subsequently developed recommended action items and activities to achieve those goals. The following summarizes the goals established by the committee:

1. **Administration and Finance:**
   - Secure stable and adequate funding for the stormwater program.
   - Adequately staff the stormwater program.
2. **Public Involvement and Education**
   - Increase public awareness of stormwater management.
3. **GIS and Technology Support**
   - Build and institute a comprehensive GIS support system for the stormwater management program.
   - Ensure efficient interfacing occurs among the Clarksville-Montgomery GIS Center, the city and county agencies dealing with urban development, private developers, and engineers.
4. **Operations and Maintenance**
   - Develop a more proactive approach to maintenance of the stormwater drainage system including a preventative maintenance program
5. **Capital Construction**
   - Systematically plan, design, and construct capital projects to correct functional and capacity problems of the stormwater drainage system.
6. **Engineering and Planning**
   - Implement comprehensive pre-development planning prior to new construction to minimize post-construction stormwater drainage problems.
7. **Regulations and Enforcement**
   - Consolidate, document and strengthen stormwater regulations.
   - Reduce post-construction stormwater drainage problems through more frequent inspections.

- Increase dissemination of information to developers and engineers on development regulations.

8. Water Quality

- Be proactive in the implementation of the Environmental Protection Agency Non-point Pollutant Discharge Elimination System (NPDES) Phase II stormwater permit requirements.

Recommended Manpower Increases

The advisory committee recommended a number of staff additions to support the program goals and specific recommendations contained herein. The following table summarizes the manpower recommendations. Recommendations include staffing increases over a 3-5 year period.

Summary of Manpower Recommendations

Functional Area	Existing Staffing (No. of Staff)	Proposed Staffing (No. of Staff)
1 Administration & Finance	8	9
2 Public Involvement & Education	0	0
3 GIS and Technology Support	1	2
4 Operations & Maintenance	3 +3 Maint. Crews	4 +6 Maint. Crews
5 Capital Construction	0	0
6 Engineering & Planning	1	2
7 Regulation & Enforcement	4	8
8 Stormwater Quality Management†	0	0
Totals	17 +3 Maint. Crews	25 +6 Maint. Crews

† Staffing necessary for the stormwater quality program are included in the other functional categories as most staff serve dual roles.

Recommended Funding Increases

The advisory committee made recommendations on the funding levels necessary to support the program goals and specific recommendations contained herein. The following table summarizes the recommended program funding.

Summary of Funding Recommendations

Functional Area	Existing Funding (thousands)	Proposed Funding (thousands)	Funding Increase (thousands)
1 Administration & Finance	$514	$544	$30
2 Public Involvement & Education	$0	$35	$35
3 GIS and Technology Support	$4	$54	$50
4 Operations & Maintenance	$1,300	$2,300	$1,000
5 Capital Construction	$369	$500	$131
6 Engineering & Planning	$49	$399	$350
7 Regulation & Enforcement	$81	$281	$200
8 Stormwater Quality Management	$212	$483	$271
Totals	**$2,528**	**$4,596**	**$2,068**

Recommended Funding Mechanisms

The advisory committee stated a need for stable, adequate and equitable funding for the stormwater program. In order to raise the additional revenue recommended by the committee, there are three theoretically potential sources: increased local option sales tax, increased property taxes, and a stormwater user fee (stormwater utility). The committee noted the following advantages and disadvantages of each:

1. **Sales Tax**
   There is about 0.25% in local option sales tax capacity authority remaining under the state cap. This capacity amounts to approximately $1.25 million in revenue.

2. **Property Taxes**

   Property taxes can be used to fund both the operational and capital portions of the program. A property tax increase of approximately $0.21 per $100 of assessed value would likely generate the $2 million in additional revenue necessary to support the committee recommendations for an improved program.

3. **User Fee**

   A storm water user fee, or storm water utility, could be imposed on properties within Clarksville. Based upon a preliminary analysis, it is estimated that a $3.50 to $4.00 charge per month to residences and a proportional charge to non-residential properties would fund the entire stormwater program as proposed ($4.5 million). Similarly, a $2.00 charge per month to residences and a proportional charge to non-residential properties would support the increase in funding as proposed by the committee ($2 million).

   Under a user fee system, properties are billed based on the amount of paved area they have. This is comparable to the amount of demand each property puts on the drainage system. A user fee is flexible and intuitively fair in that those who impact the system most pay the most. Credits could be given for detention ponds, open space, landscaped areas and other practices, thus stimulating sound development and maintenance. Average fees around the country range from $2.00 to $4.00 per household per month with proportional charges for non-residential properties. These 'ballpark' figures were estimated using general guidelines that consider the acreage and population within the City limits and institutional knowledge about growth patterns. User fees were a new funding method in the 1970's, but now there are over 400 stormwater user fee systems in the United States today and several cities in Tennessee are currently pursuing this funding mechanism.

After giving consideration to the funding options discussed above, noting the long-term instability of general funds, the advisory committee made the following recommendation for revenue generation for the stormwater program:

> Establish a stormwater user fee system (utility) to support the entire program at a level of approximately $4.5 million annually. Based on a preliminary analysis, the user fee charge would be approximately $3.50 monthly for a typical residence. Non-residential properties would be charged proportionally.

Implementation and Next Steps

The Stormwater Program Advisory Committee recommends that the City Council and Mayor take steps to:

- review and approve the program concept as presented herein;
- increase public education and awareness efforts for the stormwater program,
- assess and develop funding mechanisms to support the program concept, and
- fully implement the program concept as funding is made available.

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Stormwater Program Advisory Committee
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Section 1 - Background

Committee Creation

The Stormwater Program Advisory Committee was appointed by the Mayor of the City of Clarksville to develop a plan of action to make the Clarksville stormwater management program more effective including determining the appropriate level of funding for the program and the preferred method(s) to fund the program.

The committee, as appointed, was comprised of twelve (12) citizens having diverse backgrounds, interests, and knowledge base. Of the twelve members, seven (7) participated actively in the process and were involved in providing the recommendations contained herein. The seven active committee members are listed in Table 1-1 along with the stakeholder group they represented.

Table 1-1. Active Committee Members

Member	Stakeholder Group
Larry Carpenter	Industrial Community
Phil Kemmerly	Academic Community
Bill Ogles, Jr.	Real Estate Community
Staton Shelby	City Council
Thom Spigner	Contracting Community
Bill Summers	Homeowners/Homeowners Associations
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Committee Operation

The Stormwater Program Advisory Committee (SWPAC) operated as an advisory committee and did not make policy. The goal of the SWPAC was to provide information in the form of this report to guide the Clarksville Street Department and the City Council in developing the kind of stormwater management program that will be most effective in meeting the stormwater management needs of the community.

The SWPAC first convened in April 2002 at the Clarksville Street Department. The SWPAC held 8 meetings over a 9-month period to review the existing stormwater program and develop recommendations for an improved program. A summary of the meetings and primary topics discussed are provided in Table 1-2.

Table 1-2. Committee Meeting Summary

Meeting	Topic	Date
1	Orientation	April 30, 2002
2	Current Stormwater Program	May 21, 2002
3	Problems, needs, issues and goals	June 25, 2002
4	Program Priorities Part 1	July 23, 2002
5	Program Priorities Part 2	August 27, 2002
6	Planned Program Part 1	September 24, 2002
7	Planned Program Part 2	October 29, 2002
8	Funding Options	December 18, 2002

Program Assessment Process

In order to assess the existing stormwater program and recommend improvements to the program, the SWPAC followed a logical process through an assessment of the stormwater program, recommendations for an improved program, assessment of funding alternatives, and next steps. This process has proved to be effective in other communities, allowing the Committee members to develop a stormwater program that meets the needs important to the Committee members and the community as a whole.

The SWPAC followed a "roadmap" as presented in Figure 1-1. Each block of the roadmap corresponded to 1 or 2 individual meetings. In each meeting, the SWPAC developed tentative recommendations to be considered by staff or City Council as they develop the stormwater program plan and funding.

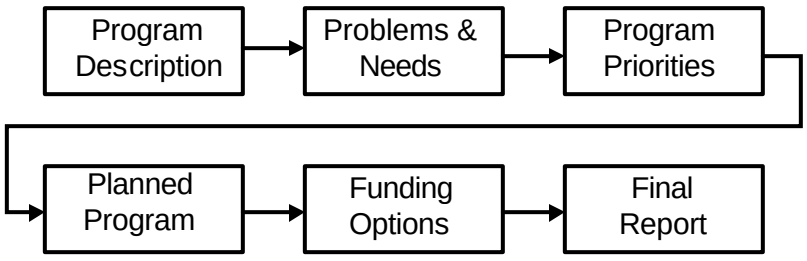

Figure 1-1. Program Assessment Process

The program assessment process presented in Figure 1-1 was used to seek answers to the following questions:

1. What is Clarksville (and other communities) currently doing in terms of stormwater management?
2. What are the stormwater related problems, issues, needs, and opportunities currently being faced by Clarksville?
3. What stormwater program priorities should guide Clarksville in the improvement of the stormwater program?
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The SWPAC was assisted in its efforts by the Clarksville Street Department and the consultant AMEC Earth and Environmental, Inc. (AMEC). AMEC developed background material, described the subjects and specific issues, gave some alternatives other communities have used, and laid out questions to be answered.

Program Assessment Report

The purpose of this report is to present an assessment of the existing stormwater management program and to provide SWPAC recommendations for an improved stormwater management program. In developing findings and recommendations, the SWPAC looked at the current problems and resources and made recommendations to improve the program in terms of the level of service provided to the citizens and financial support for the improved program. This report is organized to walk through the methodical process undertaken by the SWPAC to arrive at its program assessment and recommendations.

Chronology of Significant Program Achievements

The Clarksville Stormwater Management Program has evolved over time and is marked by numerous significant accomplishments, actions, and regulations. In order to understand the current stormwater management program, the following chronology is presented of significant stormwater program achievements:

Pre-1989 City Code and Charter

- Permits required to fill sinkholes.
- Planned Urban Development (PUD) requirements for drainage design in compliance with sub-division regulations.
- Established a Floodway Overlay District.
- Required approval to alter drainage ways.
- Set minimum culvert size at 18 inches.

1989 MTAS Regulations

- Resolution adopted by City Council in March 1989.
- Recommended drainage criteria from MTAS modified for local use.
- Requirements for velocity and erosion control, easements, detention, and pipe sizes.
- Sufficiency requirements for the use of sinkholes to store stormwater.
- Design storm set to 100-year frequency (recurrence interval).

1991 Stormwater Management Action Plan

- Stormwater Management planning document that discusses current stormwater management program and problems, needs, and goals.
- Presents recommendations with conceptual schedule and costs.

1993 Street Specifications

- Adopted by ordinance in April 1993.
- Includes implication to stormwater design and construction as it pertains to streets.
- Includes requirements for construction plans and construction procedures.
- Presents criteria for pipe sizes and materials and stabilization of drainage ways.

1994 Stormwater Ordinance

- Passed by City Council on first reading in May 1994; tabled prior to second reading due a lack of financial support to implement ordinance provisions.
- Comprehensive ordinance addressing land disturbing activities, drainage system alterations, grading plans, plans review and permitting, ownership and maintenance of stormwater facilities, discharge of pollutants, and enforcement of regulations.

1996 Erosion Control Ordinance

- Passed by City Council in August 1996.
- Prohibits sediment deposition on the public right-of-way.

1998 Asset Management (Drainage System Inventory)

- A multi-phase, multi-year inventory of the stormwater drainage system was begun in 1999.
- Aides in infrastructure management, federal NPDES permit compliance, and financial accounting of stormwater assets.

1999 GIS Mapping Initiative

- State of Tennessee GIS mapping pilot study for Montgomery County.
- Joined with Austin Peay University to form a consortium of agencies to maintain the state provided data and to collect and enhance additional base data and prepare specialized data layers to assist the city in making more timely and fiscally efficient decisions on a real time basis.
- Stormwater management program directly benefits from the availability of topographic and planimetric mapping and orthophotographs.

1999 Work Order Management System

- A computerized complaint tracking and work order generation system was implemented to replace paper-based systems used previously.
- Computerized system provides ability to track cost of service for maintenance operations.

2000 Stormwater Management Ordinance

- Comprehensive stormwater management ordinance was passed by City Council in August 2000 with an effective date of November 2000.
- Formally names the Department of Roads, Buildings, and Grounds responsible for stormwater management.
- Addresses multiple aspects of stormwater management including design requirements for new development, plans review processes, system maintenance responsibility, NPDES permit requirements, erosion and sediment control, and enforcement procedures.

2000 Stormwater Management Manual

- Manual was required by the stormwater management ordinance and was released in September 2000.
- Provides technical design criteria and development standards for stormwater management.

2001 Stormwater Management Action Plan (Update)

- Updated the 1991 Stormwater Management Action Plan to incorporate activities undertaken by the City since the original publication and to update stormwater management program responsibilities, budgets, problems, needs, and goals.
- Incorporated anticipated requirements for NPDES permit compliance.
- Presented revised schedules and budgets for stormwater management activities.

2002 Stormwater Technical Advisory Committee

- As recommended in the 2001 Action Plan, an advisory committee was formed to provide public input and guidance to the City in the area of design specifications and design standards for stormwater quality best management practices. The committee efforts resulted in a published report, the *Post-Construction BMP Report*.

2002 Stormwater Program Advisory Committee

- As recommended in the 2001 Action Plan, an advisory committee was formed to provide public input and guidance to the City in the area of general stormwater management program vision and direction, level of funding, and funding policy. The committee efforts resulted in this document; the *Stormwater Program Assessment and Funding Feasibility* report.

General Stormwater Management Functionality

Table 2-1 presents generic operational categories of stormwater management functions. These operational categories are not dependant on a particular organizational structure. The categories are used throughout this report in program assessment, problem discussion, and program recommendations.

Geographic information system (GIS) and database management services generally support the operational categories and are integral to a stormwater management program. Maintenance and capital construction are divided into three categories: routine maintenance, remedial maintenance, and capital construction. Definitions for clarification are as follows:

- Routine maintenance restores the current function of the drainage system through cleaning efforts without reconstructing. Routine maintenance includes ditch cleaning, debris removal, leaf pick up, street sweeping, etc.
- Remedial maintenance involves more minor construction that restores drainage system function without major improvement or upgrading. This includes such things as headwall replacement, culvert replacement, streambank stabilization, and more minor sewer pipe replacement.
- Capital construction involves the more major construction projects that replace larger segments of the drainage system or improve its' capacity.

Table 2-1. Stormwater Management Operational Functions

1. Administration & Finance
General Administration
General Program Development
Interlocal Coordination
Billing Operations
Customer Service
Financial Management
Capital Outlay
Overhead Costs
Cost Control
Support Services

2. Public Involvement & Education
Public Awareness & Education
Public Involvement
Citizen's Group Facilitation
PI&E Support to Other Programs

3. GIS and Technology Support
Geographic Information Systems
Mapping
Database Management
Data Support Services
Graphical Support
Global Positioning System
General Technology Support
Internet and Web Support

4. Operations & Maintenance
General Maintenance Management
General Routine Maintenance
General Remedial Maintenance
Emergency Response Maintenance
Infrastructure Management
Public Assistance

5. Capital Construction
Major Capital Improvements
Minor Capital Improvements
Land, Easement, and Right-of-Way

6. Engineering & Planning
Design Criteria and Standards
Field Data Collection
Quantity Master Planning
Design, Field and Ops Engineering
Hazard Mitigation
Zoning support
Multi-objective Planning Support

7. Regulation & Enforcement
Code Development and Enforcement
General Permit Administration
System Inspection & Regulation
Zoning and Land Use Regulations
Construction Management
Flood Insurance Program
Multi-Obj Floodplain Management
Erosion Control Program

8. Stormwater Quality Management
Quality Master Planning
Retrofitting Program
Monitoring Program
Structural and Non-Structural BMPs
Pest, Herb and Fertilizer
Used Oil & Toxic Materials
Street Maintenance Program
Spill Response and Clean Up
Program for Public Ed & Reporting
Leakage and Cross Connections
Industrial Program
Commercial & Residential Prog.
Illicit Connection & Illegal Dumping
Landfills & Other Waste Facilities
CSO Program
Groundwater Protection
Drinking Water Protection
Watershed TMDL Support
Septic Program
I&I Program

General Stormwater Program Responsibilities

As in most communities, the responsibility for stormwater management in Clarksville is spread among multiple city departments that implement and enforce local ordinances and administer state and federal programs that affect stormwater management. A brief summary of the existing program responsibilities is presented in Table 2-2.

Table 2-2. General Department Responsibilities for Stormwater Management

Department / Agency	Responsibility
Street Department	• Complaint receipt, investigation and response • Drainage system maintenance • Site inspection for streets • Master planning • FEMA no-rise certification reviews • Administration and enforcement of Stormwater Management Ordinance • Coordinates compliance with NPDES program • Reviews development plans • Grading permit issuance
Building and Codes	• Building permit issuance • Building permit inspection
Regional Planning Commission	• FEMA program overall responsibility • Zoning and subdivision approval
Golf Courses	• Golf Course fertilizer and pesticide handling and grounds management
Parks and Recreation	• Parks/greenspace fertilizer and pesticide handling and grounds management

Clarksville Street Department Responsibilities

As depicted in Table 2-2 and specified by local ordinance, the Street Department has the primary responsibility for the Clarksville Stormwater Management Program. Within the Department, responsibilities are divided among the stormwater functional categories as depicted in Table 2-3.

Table 2-3. Stormwater Management Administration within the Street Department

Functional Category	Staff	Function	Percent Time on Stormwater
Administration & Finance	Jim Durrett	Director	30
	Tommy Murphy	Asst. Director	20
	Robert Mills	Safety	30
	Lynn Boggs	Finance	30
	Meriam Hargis	Clerical	30
	Cheryl Harp	Clerical	30
	Angela Sykes	Clerical	30
	Shirley Williams	Clerical	30
Public Involvement & Ed.			
GIS & Technology	Tracy Luton	GIS Support	15
Operations & Maintenance	David Shepard	Ops Manager	80
	Scott Bibb	Lead Foreman	80
	Mike Self	Lead Foreman	50
Capital Construction			
Engineering & Planning	Jack Frazier	Engineering	90
Regulation & Enforcement	James Mickle	Inspections	75
	Randy Peterson	Inspections	75
	George Steward	Inspections	75
	Vacant	Inspections	75
Stormwater Quality			

In addition to these specific staff responsibilities within the Street Department, one employee of the Clarksville-Montgomery County Regional Planning Commission is recognized as having significant stormwater management program responsibility in the coordination of the National Flood Insurance Program (NFIP) administered by the Federal Emergency Management Agency (FEMA). It is estimated that approximately 20 percent of his time is spent coordinating this program.

Summary of Current Stormwater Program Activities

In 1991, the City of Clarksville developed an action plan for stormwater management within the City. The City recognized the need to develop a more mature stormwater management program, addressing the following issues.

- Development pressures had placed the burden of consistent and comprehensive control in the area of stormwater on diverse staff elements which have not always had to consider it a major item of interest.
- Highly erodible soils found in the Clarksville area combined with poor erosion control practices had added greatly to the need for routine stormwater maintenance of sinkholes.

- Drainage infrastructure was of the age where greater attention to both remedial and preventive maintenance was warranted.
- The impacts of urban development on the drainage system were beginning to be felt in a more widespread sense, thus bringing more public and political leadership into the arena.
- The EPA stormwater quality regulations and a growing public awareness of the environment will impose sweeping requirements on stormwater management for municipalities.
- Possible liability issues related to the plan approval process. For example: flooding partially caused by water from public streets or lands and water quality concerns required a more detailed look at impacts of public decisions.
- There was a growing awareness that the drainage infrastructure system is a public utility in the same sense as water supply and sewerage.

The purposes of the 1991 Action Plan were:

- To investigate the current Clarksville stormwater management program and to identify key problems, needs and issues; and
- To layout a stormwater program development strategy/work plan for the City of Clarksville to address the identified problems, needs and issues.

Ordinance and Regulations

Clarksville's stormwater program has been evolving since the 1991 Action Plan, with the majority of its focus being placed upon design standards, enforcement authority, and maintenance of the existing storm drain system, including sinkholes. The current Stormwater Management Ordinance was adopted in August 2000, with the effective date of November 2000. The responsibility for stormwater management is spread throughout various departments, with program management carried out by the Street Department.

The Stormwater Management Ordinance includes requirements for erosion and sediment control, post-development stormwater management, prohibiting illicit discharges and enforcement. This ordinance addresses several of the minimum controls established in the NPDES Phase II requirements and provides the basis for the development of the program. The ordinance mirrors many of the requirements in the Phase II regulations. The *Clarksville Stormwater Management Manual* is referenced in the Stormwater Management Ordinance and includes technical guidance on BMP design and maintenance, the permitting process, and floodplain development restrictions.

Infrastructure Management

Clarksville has completed the stormwater system inventory. During the field review for the inventory, outfalls were identified, and potential illicit discharges were documented for future follow-up. The inventory will also be used to further refine maintenance activities.

System Maintenance

The Street Department performs stormwater system maintenance activities. Prior to large storms, the City mobilizes crews to inspect and clean out the storm drain system to prevent flooding in priority areas. However, the City does not have the resources to proactively maintain their stormwater systems on a regular basis. Therefore, most stormwater system maintenance is complaint-driven. An older section of the City, approximately 3 square miles, has a combined sewer system. The City is investigating the feasibility of separating portions of the system. Also, the City has numerous sinkholes within their jurisdiction. Sinkhole maintenance focuses on sediment and debris removal to increase hydraulic capacity and prevent flooding. Whenever a sinkhole throat is improved in any way, it becomes a Class V injection well and must be permitted under the state's ground water program. Because of the potential to clog, the City requires that the design of new stormwater systems discharging to sinkholes assume a "worst case scenario," where the sinkhole has no hydraulic capacity and only provides storage in the above ground surface area.

Public Education and Outreach

Currently, Clarksville has no formal education and outreach program focusing on stormwater impacts. However, the City provides support for activities that promote stormwater education.

- **The River Walk**. The City Council has funded portions of the River Walk on the Cumberland River. The River Walk includes a small park and trail along the river and raises public awareness of the river.
- **Adopt-A-Street program**. The Adopt-A-Street program is handled by the Street Department and employs volunteers to pick up trash from main thoroughfares.

These activities could be utilized for compliance with NPDES Phase II requirements or minimal effort to improve to a level for compliance.

Public Involvement

Clarksville organized a Stormwater Advisory Committee to help guide the initial program development in 1992 and 1993. Through a series of meetings, the Stormwater Advisory Committee provided input on language for the *Stormwater Management Ordinance* and the technical criteria for the *Stormwater Management Manual*. The committee contained city staff, consultants, developers and other stakeholders. The committee has not actively met since 1993.

Other public involvement efforts were initiated in 2002 through the formation of two advisory committees: one to advise on technical issues and one to advise on programmatic issues. Both committees are currently meeting on a monthly basis with their respective efforts to conclude by the end of 2002.

Illicit Discharge Detection and Elimination

As noted previously, Clarksville adopted a comprehensive Stormwater Management Ordinance in 2000. Included in the ordinance is an illicit discharge section. This section prohibits non-stormwater discharges into the drainage systems and outlines allowable discharges. The allowable discharges are inline with the Phase II regulations. In general, complaints identify illicit discharges and dumping violations. Clarksville has completed their storm sewer system mapping, identifying outfalls and sinkholes as well as other relative stormwater features. During the field investigation for the inventory, outfall information was recorded, and the presence of dry weather flows was documented.

Erosion and Sediment Control

The stormwater ordinance adopted in August 2000 includes provisions for regulation of construction site runoff. Erosion and sediment control regulation in Clarksville is tied to grading and building permits. The following list summarizes the erosion and sediment control requirements.

- Grading permit with erosion and sediment control plan is required prior to land –disturbing activities.
- Developer is responsible to maintain and inspect erosion and sediment control measures.
- Sediment cannot leave property.
- The city has the right to enter sites to inspect.
- All disturbed areas must be permanently stabilized within 30 days of completion of any phase of grading.
- Enforcement tools include a Stop Work Order and civil penalties.

Clarksville's *Stormwater Management Manual* and Ordinance address erosion and sediment control adequately. The manual is based upon the design criteria established by TDEC in their erosion and sediment control manual. Clarksville requirements will change as the state's erosion and sediment control manual is updated.

As installation and maintenance of measures has been a consistent problem, more training for the development community on erosion and sediment control design and maintenance is needed.

Post-Construction Stormwater Management in New Development and Redevelopment

The *Clarksville Stormwater Management Manual* requires that most new development employ stormwater detention and other facilities to limit or mitigate stormwater impacts from new development. A drainage control plan is required for all new development for new construction that would otherwise have an adverse impact on downstream drainage systems. However, the City has not adopted requirements to assess the impacts of new development on downstream systems. The City has the flexibility to waive the detention requirement when detention would exacerbate downstream flooding. The *Clarksville Stormwater Management Manual* outlines design criteria and maintenance options. The primary focus of detention has been to prevent flooding and adverse impacts from increased flow from new development.

The City will accept responsibility for maintenance of detention ponds and other stormwater facilities within new subdivisions. However, property owners or associations are required to maintain their stormwater systems for condominium developments, apartment or townhouse complexes, single family PUDs, commercial, industrial or institutional developments.

The City is currently updating the Stormwater Management Ordinance and *Stormwater Management Manual* to address water quality, as required by their NPDES Phase II Stormwater permit.

Good Housekeeping in Municipal Operations

The Street Department handles all storm drain system maintenance, street sweeping and capital improvements. Maintenance priorities are based upon known flooding problems and complaints. There is one primary maintenance yard and two smaller storage areas. The primary yard houses equipment, soil, salt and other materials. All maintenance materials are covered. Spraying pesticides and herbicides is typically contracted out, so the City stores few chemicals on their properties. The few chemicals stored by the City are kept inside one of the maintenance buildings. The two smaller storage areas are primarily used for short-term sand/salt storage and tailings from storm drain system maintenance and street sweeping. While these areas are uncovered, future maintenance plans include constructing containment structures at each site.

Clarksville owns and operates 2 municipal golf courses. There are two certified sprayers overseeing spraying and fertilizer application on the golf courses. To maintain certification, training must be completed annually. Mr. Fowler Goodowens, Golf Course Superintendent, noted that fertilizers and pesticides are bought in limited quantities and stored inside a storage shed on the golf courses.

Summary of Current Program Expenditures

In 2002, Clarksville spent approximately $2.5 million on the stormwater management program. These expenditures are primarily through the Street Department. A breakdown by functional area is presented in Table 2-4. Each year as program needs shift, this funding scenario can change substantially.

Table 2-4. Current Program Expenditures

Functional Area	Expenditure
Administration & Finance	$513,764
Public Involvement & Education	$0
GIS & Technology Support	$4,261
Operations & Maintenance	$1,299,792
Capital Construction	$368,539
Engineering & Planning	$48,767
Regulation & Enforcement	$81,243
Stormwater Quality	$212,000
Total Annual Expenditures	**$2,528,366**

The sources of revenue supporting the stormwater management program are the general fund (property taxes) and state shared revenue (gas tax proceeds). The revenue allocated to the Street Department from each of these sources is determined annually by the Finance Department. Funding for most functional categories are budgeted annually as operating expenses of the Street Department and are reasonably stable. However, funding for Capital Construction ($368,539) and Stormwater Quality ($212,000) is normally budgeted as annual, line-item capital expenditures. Capital funds are not stable and may in some fiscal years be totally non-existent. Therefore, the total annual expenditures presented in Table 2-4 may, in some years, be less than $2 million.

Given the constraints imposed by the level of current resource allocation to stormwater management outlined previously, Section 3 looks at the relative success of the stormwater program, and barriers to further success. Key problems, needs, issues and

opportunities will be identified and discussed.

Comparison to Other Communities

In evaluating the adequacy of the current stormwater program, the committee compared stormwater expenditures in Clarksville to other regional communities. Clarksville spends about $2.5 million annually on stormwater management, not counting the combined sewer program (which the comparison cities either do not count in the stormwater budget or do not have as a problem).

Table 2-5 presents a comparison of stormwater expenditures of regional cities. These data present expenditures for communities without a dedicated revenue source for the stormwater management program. For comparison sake, data is presented in terms of dollars spent per person per year.

Table 2-5. Expenditure Comparison for Cities Without Dedicated Funding for Stormwater

City	Population	Existing Funding (Thousands)	Dollars per Person per Year
Huntsville, AL	157,000	$4,500	$29
Maryville, TN	23,000	$693	$29
Clarksville, TN	**104,000**	**$2,500**	**$24**
Cleveland, TN	37,000	$675	$18
Murfreesboro, TN	69,000	$1,100	$16
Nashville, TN	546,000	$7,200	$13

Table 2-6 presents a comparison of stormwater expenditures of regional cities that have allocated dedicated funding to the stormwater program. In most cases the dedicated funding source is a stormwater user fee or stormwater utility. Several cities are displayed in both Table 2-5 and 2-6 because they have recently, or are in the process of, implementing an expanded program with dedicated revenue. For comparison sake, data is presented in terms of dollars spent per person per year.

Table 2-6. Expenditure Comparison for Cities With Dedicated Funding for Stormwater

City	Population	Existing Funding (Thousands)	Dollars per Person per Year
Maryville, TN	23,000	$1,300	$57
Charlotte, NC	541,000	$25,000	$46
Franklin, TN	42,000	$1,600	$38
Austin, TX	657,000	$22,000	$34
Chattanooga, TN	156,000	$5,000	$33
Cleveland, TN	37,000	$1,200	$32
Tulsa, OK	393,000	$12,000	$31
Louisville, KY	256,000	$6,600	$26
Nashville, TN	546,000	$13,000	$24

Understanding Stormwater Problems and Issues

Stormwater problems grow over time. They are the result of both decision and indecision, of activity and inactivity. Stormwater is remarkably complex for so simple a concept. To solve stormwater problems it is vitally important to understand the linkage between physical problems and deeper institutional root causes of those problems. Many municipalities have not understood this linkage and, as a result, wrestle continuously with the same problems never arriving at permanent solutions. Figure 3-1 illustrates the dynamics of this technical-institutional relationship using a "five whys" methodology. Six levels of program consideration and problems and issues are shown along with typical stormwater program solutions.

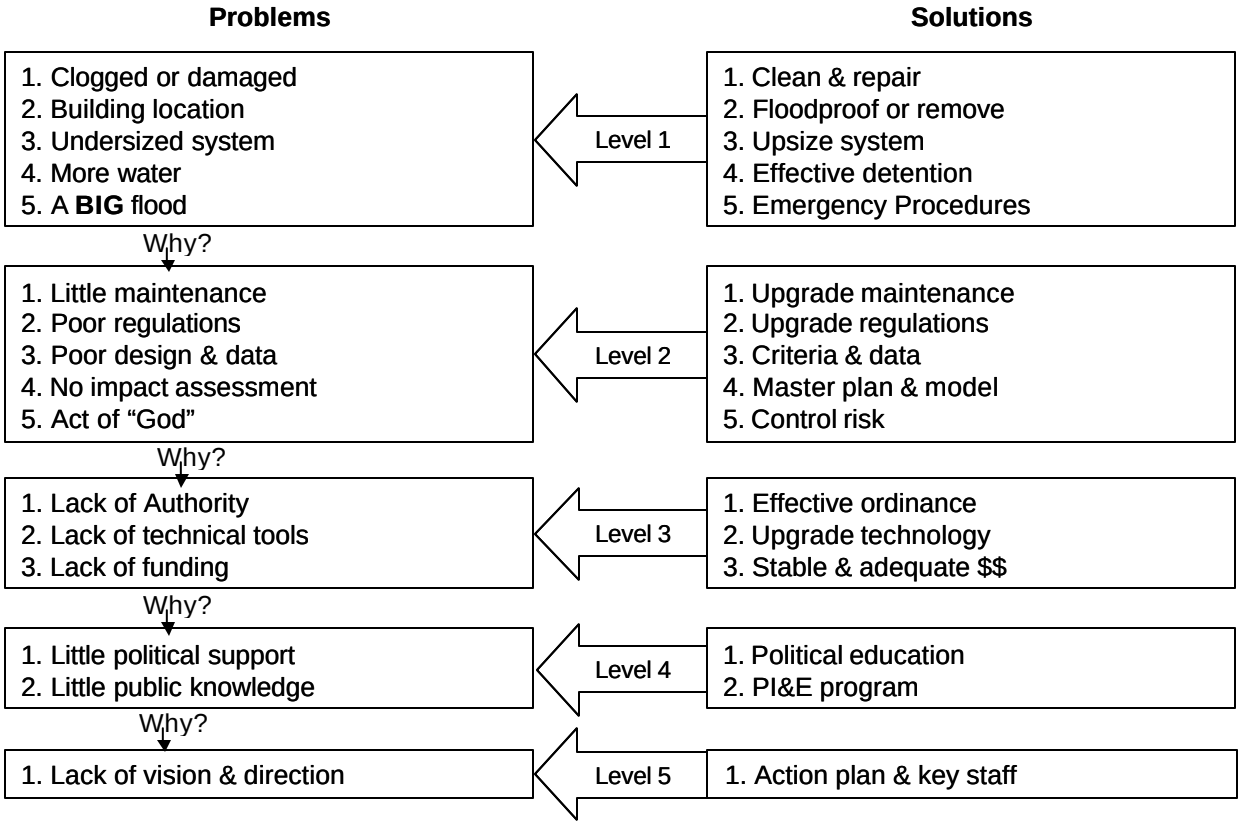

Figure 3-1. Typical Stormwater Problems and Solutions

Level One – The Complaint

Typically, a stormwater administrator, city engineer or political leader gets a drainage complaint call: "I have a flooding problem, and I want you to fix it." This is Level 1: the complaint. The complaint could just as easily have been an erosion or pollution complaint.

Level Two – The Immediate Causes

When the question is asked: "Why is there a flooding problem?" (Level 2), there is usually one of (or a combination of) five reasons:

1. Obstructed or damaged structures;
2. High risk residence location;
3. Undersized structures;
4. Increased flow due to the impacts of urban development; or
5. A flood in excess of design.

The typical solution is to go out and fix the problem or, in some cases, to tell the resident that the problem is not the City's responsibility.

Level Three – Secondary Causes

However, if the Level 3 question is asked: "Why did this flooding problem (and ones like it) occur in the first place?" a matching set of four, more foundational, reasons is uncovered.

1. Structures are obstructed or damaged because they are not inspected and maintained. Some municipalities maintain very little of the drainage system. Most maintenance that is done is in response to complaints and performed within the street right-of-way only. Much of it is done only to protect streets or public property. The fifty to eighty percent of the drainage system closest to private houses and other structures is rarely or never inspected or maintained. This is true despite the fact that much of the water carried in these drainage systems is derived from public streets and is, in some sense, therefore, "public water". Over years of neglect pipes and channels inevitably begin to fill with debris and sediment, structures begin to weather or are damaged, and erosion eats away at culvert headwalls and tail sections. Drainage systems work flawlessly when it is not raining. Finally the system is tested and overwhelmed by a storm whose intensity is often less than the system was designed to carry. Homes are flooded, roads are overtopped, damage is incurred, and complaints flood in.

2. The public perceives that homes are located too close to streams or sinkholes because no one properly regulates the location. Because of the demands of the Federal Flood Insurance Program, most municipalities control the location and elevation of new construction within regulated floodplains. However, the vast

majority of complaints are received from residents outside of regulated floodplains in locations where there is no such control. Clarksville does not allow development within the 100-year floodplain below the mandatory flood protection elevation or in the 100-year flood elevation of sinkholes. However, the City routinely approves plans for developments where a number of homes, unwittingly located within "unregulated" floodplains, would be inundated by smaller more localized 100-year floods. No one (not the property owner, realtor, developer, or political leadership) besides the flooded homeowner and the city staff answering the complaint has a realized strong vested interest in keeping development out of flood prone areas.

3. Historically, structures have been undersized because of poor or inappropriate methodology and incomplete data. In the past, most municipalities allowed drainage structures to be sized using the Rational Method. While this is not wrong, per se, the limits of this method are rarely understood by designers and plans reviewers. In cases where backwater effects predominate or under other special circumstances such methods may give non-conservative results. Additionally, many municipalities have little data on actual local rainfall values, inlet capacities, or actual expected future maintenance-related condition of structures. Without this information designers may produce inferior designs unknowingly.

4. Upstream development floods downstream development because it is not accounted for in the design of the downstream structures and/or it is not accounted for far enough downstream in the drainage system. Few municipalities require designers to account for either their own flow related impacts or for the flow increases from expected development located upstream from themselves. Higher and faster peaks, greater flow volumes, increased velocities, warmer and dirtier water and lower base flow are all the result of urban development. Those municipalities that do account for impacts with a detention ordinance or policy rarely assess the impacts beyond the site boundaries. Therefore the mitigative effect of the detention basin is not analyzed very far downstream; and the accumulative consequences of development, even with detention, result in growing systemic flooding problems.

5. The matter of "a big flood" is obviously caused by a big rain. The issue here is not that big rains come along, but how the local government plans for, measures, and reacts to a big rain.

In urban hydrology, the rainfall depths contained in a typical intensity-duration-frequency (IDF) curve or table are point values. We would anticipate a typical ten-year design pipe or culvert to be overwhelmed by a storm event in excess of design once every ten years, on average. In most of the country, this is a thunderstorm whose radius of intense rainfall may be less than a city block. For a local government area of many acres, we would expect several storms in excess of the ten-year storm every year so that every culvert in the area would face the same statistical chance of flooding. Thus,

the “big flood” will happen several times each year to different parts of the area so that the whole area experiences flooding according to the statistics reflected in the IDF curve.
How should a local government plan for and react to this natural situation? First of all, the city should realize that every design contains an element of risk. When the inevitable big storm hits, is the result nuisance flooding or homes and arterials under water? How does a city handle flows that overtop the system? What level of risk should the city tolerate in its design criteria? Should it be the same for all segments of the system?

Secondly, does the city have a plan for flood warning and evacuation? It is one thing for water to flow into a home or business. But it is another for a street to be flooded with dangerous flows and the city not be in a position to know which roads are impassable and to have taken steps to prevent motorists from inadvertently driving into the floodwaters.

And finally, how can the city prove that the rainfall was in excess of design? Many of the flooding complaints received by local governments are the result of excess flows and not poor design, lack of maintenance or inadequate planning. Pressure is then put on the leadership to fix a system that is not in need of fixing. With an adequate set of rain gages a city may be able to predict flooding and to plot rainfall hyetographs in near real time. With this information it can be shown that some flooding has nothing to do with a system problem but with the fact that, for example, a 50-year storm was experienced by a ten-year system.

Level Four – Three Factors

If again the "why" question (Level 4) is asked, three basic causative factors emerge.

1. Cities do not require appropriate levels of technical analysis because they are not sure what to require and how to implement these requirements. In spite of the wealth of computer software for drainage system analysis and the ability to remotely collect rainfall and runoff information, most municipalities have not had the time or the knowledge to investigate and invest in such solutions. Programs are often staffed on a day-to-day basis by junior or mid-level engineers without the authority or experience to make such changes. Their superiors have multiple other pressing duties and responsibilities and, without prompting and education, do not see stormwater as having the same importance or the same clear solutions as roads or solid waste. Thus, overall master planning for stormwater management is seldom done.

2. Municipalities do not impose certain flood mitigation measures, development controls or maintain off the public right-of-way because there is no legal authority to do so, and there is little impetus to establish such authority. To extend control of development beyond Federal mandates or to extend maintenance beyond the bare minimums requires gaining the support of political leaders, key staff

members and "stakeholders". It is often difficult to stimulate such desires when so few of these individuals have anything clear to gain by doing so. Environmental Protection Agency (EPA) mandates, local citizen groups and/or a big flood event are often the necessary catalysts to action.

3. Even if these last two factors were solved, the bottom line is that there is no stable, adequate and equitable funding source for stormwater management. Stormwater usually cannot compete effectively with such things as solid waste and street repair for general tax based funds. Therefore, a shift toward dedicated stormwater funding is occurring throughout the country. This can take the form of such things as sales taxes, earmarked tax revenues and user fee systems (stormwater utilities).

Level Five – People and Politicians

The more basic factors emerge with the next "why" question (Level 5). Even when key stormwater staff understand the problems they must ask: who else is aware that flooding, erosion or pollution problems exist? Who supports a growth in stormwater management? Who must support it for a successful program to be established?

The public is usually unaware of flooding problems and municipal staff have little long-term political support to solve such problems unless problems are serious and chronic. Usually, if actions are not taken and decisions made within a month or two after a flood event support quickly dries up and memories fade. Other pressing demands thrust aside flooding, erosion and surface water pollution problems. However the problem remains, largely invisible, until the next time a large storm moves through the area. Building and maintaining consensus and support for the stormwater program is necessary for its establishment and survival.

Level Six – Making a Compelling Case

The basic reason for lack of success in stormwater management is the same as for lack of success in anything else: lack of vision or direction (Level 6). In almost every case where a successful program has been developed, one or several individuals had or developed a vision for what their streams and creeks should and could be. It is important that a compelling case be made for fixing stormwater problems – compelling to decision makers, to stakeholders, and to the general public

Had the original complaint been an erosion or sedimentation problem an analogous set of four factors causing erosion and sedimentation can be given: the banks and/or bed have been attacked by the flow so as to reduce their ability to resist erosive forces or are not maintained; more sediment from upstream reaches overwhelms the stream's ability to carry it away and sediment deposition occurs; or less sediment is present in the inflowing stream, than the natural situation, which may cause the water to attempt to pick up additional sediment (up to its carrying capacity) from the bed and banks; the basic slope or channel configuration has been constructed or modified in such a way as

to place the channel in an unnatural configuration and without appropriate bank protection (termed "out of regime") natural forces tend to bring the channel back in regime; or more water creates more and longer shear stresses on the sides and bed of the channel causing more erosion.

Had the original complaint been pollution, a set of four other factors can be derived: pollution control devices are no longer operating properly; illegal dumping or illicit connections are present; pollution control devices were not placed or designed properly; or more uncontrolled development-related pollution is entering the system.

In each of these other two cases the five whys could be asked. In each case the questioning will merge at Level 3 in a manner similar to the flooding complaint.

Physical Problems – Institutional Roots

Notice that the first levels of assessment contain primarily physical and technical problems for which structural technical solutions are appropriate. Water is impacted by some physical means. However, when the later levels are considered, the solutions are institutional, programmatic and non-structural in nature. People are impacted by administrative means. These foundational problems allow or generate the more visible physical problems. If the root institutional problems are not eventually solved there will be a continual need to respond to an overwhelming number of flooding, erosion and pollution complaints. Successful municipal stormwater management programs account for and deal with both the technical and institutional aspects in a comprehensive and coordinated manner.

Clarksville faces, to some extent, almost every problem at every level. Crafting a stormwater program that only addresses the physical situation is relatively easy, but will eventually fail the test of long-term program success.

Stormwater Paradigms Impacting Clarksville

A paradigm is our “grid” or understanding of a certain subject. It is what we believe to be true about a subject. Clarksville has gone through several stormwater management paradigms and is facing rapid change in how stormwater management will need to be conducted in the near future. Understanding the basics of these paradigm changes will aid development and direction of the Clarksville stormwater program. Tables 3-1 and 3-2 summarize the different stormwater management paradigms, past and future.

Clarksville, like many older cities from a stormwater design standpoint, looks like a circular target. Clarksville’s central core (approximately 3 square miles) was built with combined sewers, fine at the time but costly now. The next concentric circle was build with efficient street drainage, curb and gutter or ditches, draining to the nearest stream or sinkhole. Later, detention was required and developments since the 1980’s incorporate this feature.

Table 3-1. Previous Stormwater Paradigms in Clarksville

Paradigm	Characteristics	Problems
Combined Sewers	Until the 1960's, sewage and stormwater were run through the same pipes. Treatment during dry periods was accomplished, but overflows occurred during wet weather.	Advanced levels of required wastewater treatment made treating "clean" stormwater too costly. In large storm events, overflows occurred, causing public concern over perceived damage to receiving streams.
Municipal Separate Storm Sewer Systems	From the 1960's until the late 1980's. Develop efficient drainage systems from paved surfaces and developments to the nearest stream or sinkhole primarily through curb and gutter neighborhoods.	Solved the problem of treating stormwater, but created the problem of flooding as more water was drained into inadequate sinkholes and undersized downstream systems, or systems not designed with upstream development in mind.
Detention of Runoff	From the late 1980's until present. Required that most developments detain stormwater in ponds or sinkholes attempting to reduce downstream flooding.	Sometimes solved the downstream flooding problem of the previous paradigm. But more often did not fully handle flooding problems effectively or efficiently.
Stormwater Master Planning	During the 1990's, two studies were conducted to develop solutions for flooding problems on a basin or neighborhood scale. Planning led to capital construction of recommendations.	Solved flooding problems through a "study to design to construction" process but only a limited number of studies/projects could be funded. Planning didn't address water quality concerns.

Table 3-2. Future Stormwater Paradigms in Clarksville

Paradigm	Characteristics	Problems
Stormwater <u>Quality</u> Control	Beginning in 2003, EPA's NPDES permit program will require a set of programs and standards to attempt to control pollution from runoff and prohibit non-stormwater from entering the stormwater system – and waters of the state. Five-year permit to be issued soon thereafter.	Permit will require new programs to be developed and implemented requiring additional staff and increased focus on erosion and sediment control and new focus on quality of stormwater runoff. Permit compliance will require new ordinances and regulations that may be perceived as a burden to developers.
Holistic Watershed Management (*Future*)	Consideration of a watershed or basin as one ecological and planning unit, with many stakeholders and layers of government seeking, through various means, to influence or control activities and programs within the watershed that impact stream health and aesthetics. Strong environmental flavor.	Often seen as "top down" and ineffective in dealing with day-to-day problems related to development, retrofitting, and environmental compliance. Has little practical enforcement capability except through regulatory programs (e.g. TMDL, NPDES, endangered species, etc.) and lawsuits filed by environmental watch dog groups. Often planned much but accomplished little.
Green Infrastructure **(aka: Sustainable Development, Low Impact Development, Better Site Design, Environmental Design, Conservation Development, Smart Site Design) (*Future*)**	Characterized by a network of inter-connected linear and patch areas that seek to sustain life and enrich the quality of life by: - mimicking "acceptable" hydrology - enhancing natural diversity and beauty -balancing ecological preservation or conservation with economic growth & development - building systems that are sustainable & maintainable - working at a small, integrated scale with accumulated results	Will require, over time, a radical change in the way stormwater management is done as stormwater designs and methods become more integrated into site developments and distributed throughout developments at a more micro-scale. Larger dependence on site design concepts that limit pollution and through non-structural and programmatic efforts that change human behavior. Large amount of momentum driving stormwater in this direction, though many of the methods do not have a long history of use.

Each paradigm shift increases the level of complexity, level of technology, and cost of stormwater management. Clarksville is facing a period of rapid transition in its programs due to the unmet demands of past paradigms (major and minor system flooding, floodplain issues, deteriorating drainage infrastructure, etc.) and the future paradigms (NPDES and water quality, comprehensive pre-development planning, land use and programmatic changes). Planning and organizing for these changes will be important; funding these changes will be critical.

Summary of Problems

The need to change and improve the Clarksville stormwater program is predicated on solving serious physical and institutional problems. While there were many issues and problems, it is only the major issues that are driving consideration of major transformation and increase in funding for the stormwater program. For consistency, the same eight-function organization of stormwater management activities will be used.

It is understood that each major physical issue is the result of both the physical situation in Clarksville (system age, climate, etc.) and of long-term institutional decisions (or indecision) and their ramifications, as discussed previously. These long-term institutional issues must also be addressed for the program to be successful. In fact, if these foundational institutional issues are not addressed experience has shown in many other municipalities that the stormwater program can never be more than marginally successful.

Summary of Physical Problems

Table 3-3 gives direct primary, secondary, and more root causes for the physical problems recognized by the committee. There are many indirect causes or contributors to the issues. For example, the lack of adequate pre-development planning hampers the ability to manage stormwater on a watershed or basin scale.

Table 3-3. Physical Problems and Causes

Physical Problem	Primary Causes	Secondary Causes	Probable Root Causes
Flooding	Urban Development	• No evaluation of offsite or downstream impacts • Not having on-line system models • Lack of compliance with regulations • Regulations not applied consistently to all developments • Not having input in zoning changes	• Lack of pre-development planning • Incomplete or inadequate development regulations • Incomplete plans review and rezoning procedures • Inadequate diligence in enforcing regulations • Enforcement actions not severe enough or frequent enough • Stormwater regulations too dispersed and inconsistent • No control over state or county • Lack of resources for inspections during development • Lack of technical tools
	Poor Home Location	• Past regulatory practices • Lack of sub-surface exploration • Development of poorly situated properties • Homes built too close to sinkholes	• Lack of pre-development planning • Lack of floodplain data on small systems and sinkholes • Lack of procedures to notify home buyer of potential risks
	Clogged or Dysfunctional Systems	• Builders and developers don't assure system function post-construction • Complaint driven maintenance program	• Bonds don't cover stormwater or term is not long enough • Lack of resources for inspections during development • Lack of resources for proactive and preventative maintenance
	Large Rainfall	• Systems inadequate to protect from large storms that exceed design storm • No rainfall collection program or warning system applied to stormwater	• Older systems designed without good guidance on design storm • Lack of fiscal resources to coordinate data collection with State or Federal programs
	Undersized Conveyance Systems	• Poor design	• Incomplete past design criteria or incomplete plans review • Inadequate assessment tools
Erosion and Sedimentation	Sediment in Construction Site Runoff	• Lack of source controls • Lack of contractor education • Lack of enforcement	• Past lack of regulations • Past lack of effective enforcement mechanism • Lack of resources for inspections
Water Quality	Poor Surface Water Quality	• Past lack of regulatory programs • Public awareness/education • Polluted urban stormwater runoff • Lack of structural and non-structural source controls • Illicit Connections • Illegal Dumping • Poor agricultural practices • Past development practices	• Lack of regulations • Lack of public education program and associated funding • Lack of inspections • Lack of enforcement actions • Lack of resources

Institutional Drivers and Issues

It is the foundational policies and paradigms in stormwater management that create an environment in which the physical issues, summarized in Table 3-3, exist. If just the physical issues are addressed without changing the underlying institutional problems, the physical issues will continue to occur regardless of the budget increases assigned to address them, and the program will fail to meet the needs and expectations of political leaders and citizens. Below is a list of key institutional issues that should be addressed as changes in policy, organization, or program management for the program to be most effective.

1. Public Awareness and Education

The committee stated a belief that the citizens of Clarksville have a general lack of awareness of stormwater issues, needs, and general importance. Stormwater is very much a city service that is out-of-sight and out-of-mind except when it rains and citizens are negatively impacted by the dysfunction of the stormwater system. Public awareness and education transcends specific physical problems and is recognized as a global institutional issue to be addressed in order to have a strong, effective, and well funded stormwater program.

The U.S. Environmental Protection Agency (EPA) placed great emphasis on public awareness and education in the promulgation of the Phase II Non-point Discharge Elimination System (NPDES) regulations. The NPDES regulations mandate that Clarksville develop programs to address six minimum control measures defined in the regulations as follows:

1. Public Education and Outreach;
2. Public Involvement and Participation;
3. Illicit Discharge Detection and Elimination;
4. Construction Site Stormwater Runoff Control;
5. Post-Construction Stormwater Management in New Development and Redevelopment; and
6. Pollution Prevention/Good Housekeeping for Municipal Operations.

Note that EPA mandates public awareness and education activities and places so much emphasis on these activities that two of the six minimum control measures pertain to the education and involvement on the public. EPA believes that as the public gains a greater understanding of the municipally developed stormwater program, the municipality is likely to gain more support for the program (including funding initiatives). In addition, compliance with the NPDES Phase II program would probably be greater if the public is well educated on stormwater pollution prevention. Well-informed citizens might even act as formal or informal educators to further disseminate information and gather support for the program, thus easing the burden on the municipalities to perform all educational activities.

In summary, the committee recognized a need to increase global public awareness of stormwater management. This increased awareness may be accomplished by the distribution of educational materials, publication of news articles, or implementation of public outreach program(s) working with other regulated communities or organizations (e.g., environmental and nonprofit groups and industry).

2. Dedicated Adequate Funding

Stormwater cannot compete against other services for general funds. It is not as urgent as police and fire, but it is important. Therefore it becomes chronically under-funded. Capital funds are not assured from year to year making it impossible to plan and execute a capital improvement program. Operational funds are borrowed from roadway funds, and are inadequate to fund a routine and remedial maintenance operation. Citizen needs go unmet and frustration levels grow citywide.

Funding based on property tax or water usage used to support stormwater programs can be seen as mismatching the source of the demands on the system and the source of the revenue paying the imposed cost of those demands – and may not fulfill a rational nexus test.

Managers of successful stormwater programs in sister cities routinely state that, in the long term, having a dedicated, stable, adequate, and equitable source of funding independent of competing needs was the major reason for the stormwater program's success.

The universal concern of staff with respect to the program was that if the program did not come with stable, adequate, and equitable funding the program could not be expected to succeed in the long run.

3. Piecemeal System and Program Management

The stormwater system looks and behaves like a sewer system. It is an interconnected dendritic system of hundreds of miles of pipes, ditches, ponds, and creeks. Stormwater systems, unlike sewer systems, are stressed to capacity only episodically – maybe not for a few years. They appear to work flawlessly when it is not raining. Therefore they are prone to neglect.

The stormwater system is just that: a "system." It is not possible to effectively manage that system in a professional manner without: adequate models of the system, an effective inventory of the whole system, a work order management software system, on-line and available GIS information and software with trained technicians, adequate inspection staff, complete ordinances and design criteria, an ability to influence zoning decisions, a city-wide professionally driven capital

improvement prioritization program, full coordination between all entities that operate in the field and impact the stormwater system, and staff whose success is measured based on professional system management.

4. Customer Service Paradigm

Stormwater programs that are perceived to be successful stress customer service and maintain that orientation in response to complaints, in capital construction scheduling and in execution of programs and public education.

When other resources are adequate it is important that Clarksville begin to operate the system with a strong customer service mentality in which staff are seen as responsive, informative, accessible, and organized. Council staff should feel well served by the answers they obtain on drainage complaints and inquiries. A modern complaints tracking and response capability with trained customer service representatives should be instituted.

5. Holistic Program Planning and Cooperation

There are significant cooperation and coordination issues involving the stormwater management program among the various departments and agencies. It is clear that potential synergies between the greenways and parks and floodplain programs and between Clarksville and State and Federal agencies and potential alternative funding sources have not been fully exploited. Much of this is due to the lack of funding and staff resources to explore the planning and coordination efforts. Some may be due to the underlying organizational and operational structures.

Another part of this institutional issue is the potential consideration of watersheds in Clarksville as the rational unit of planning; as they intersect neighborhoods and jurisdictional boundaries. Overarching regulatory drivers will force, to some extent, the consideration of watershed and stream segment quality in planning. Even though there is a preponderance of sinkholes in Clarksville, the presence of large streams and creeks mandates that a system-wide approach on the watershed scale take place in developing master plans for stormwater drainage and coordinating capital improvements. Several departments within local government have a stake in such consideration. Matching flood control, water quality, and aesthetic and recreational needs within a watershed and within a riparian corridor makes sense and allows a synergy to occur that uncoordinated efforts can never achieve.

Leveraging Funding

Another issue that grows out of the lack of resources, staffing and funding is the inability or historical inactivity in seeking and leveraging Federal and State funding. There are significant programs available to provide various kinds of financial assistance, grants, cost sharing, and professional services.

Basic sources include: the Corps of Engineers, Federal Emergency Management Agency, USGS, NRCS, Federal Highway Administration, EPA, and the State of Tennessee.

There is also an ability to take advantage of non-profit non-governmental agencies for partnering, especially in environmental issues. Non-profit environmental groups have successfully partnered with other cities and towns providing manpower, credibility, and over 500 grant resources not available to local governments.

Based on discussions with both staff and various agency personnel, Clarksville has not been proactive in seeking funding sources nor in partnering with non-profits. With little or no matching funding, many of the sources were probably seen as beyond the reach of the City in any case. Appendix A provides a listing of applicable funding sources that should be investigated by the City of Clarksville to defray some of the cost of an improved stormwater management program.

Stormwater Program Advisory Committee
Program Assessment and Funding Feasibility
Section 4 – Program Recommendations

This section describes the direction for the future stormwater management program for Clarksville as recommended by the Stormwater Program Advisory Committee. The recommendations do not address all of the minor details necessary to develop an improved stormwater management program but outline the major thrusts of the program, key support programs, and key one-time costs. The recommendations contained herein were developed with the assumption that the program will continue to function as a division of the Clarksville Street Department. The committee did not discuss changes in organizational structure. However, they did make recommendations for additional staffing, based upon their identified program goals.

Recommendations below are presented along the functional lines or categories discussed in Section 2. These recommendations are for general and specific program activities and do not include program funding. Recommended program funding levels and revenue source recommendations are discussed in Section 5.

Administration and Finance

Goals:

1. Secure stable and adequate funding for the stormwater program.

2. Adequately staff the stormwater program.

Specific Recommendations:

1. Implement a user fee system (stormwater utility) to supplement the tax based system that currently funds stormwater program.

2. Add one administrative staff position to support the stormwater program.

3. Increase annual funding for administration and finance by $30,000 to support the staffing recommendation.

Public Involvement and Education

Goals:

1. Increase public awareness of stormwater management.

Specific Recommendations:

1. Develop a public awareness program to educate the public on the importance of

good stormwater management. Expand the public awareness compliance activities in the water quality (NPDES) program to include general and broad public education pertaining to flooding and erosion and sediment control. (These activities are currently under development as compliance activities for the City's NPDES Phase II permit. The committee fully supports a comprehensive public awareness program addressing stormwater management.)

2. Develop educational literature and distribute to the public on the stormwater management problems that result from urban trash and debris.

3. Develop and implement a training program for builders, developers, and engineers on stormwater management regulations and, specifically, proper erosion and sediment control techniques.

4. Increase annual funding for public involvement and education by $35,000 for development of educational tools and conduct of training seminars.

GIS and Technology Support

Goals:

1. Build and institute a comprehensive GIS support system for the stormwater management program.

Specific Recommendations:

1. Coordinate mapping needs of the stormwater program with other mapping interests with the specific intent of developing cost-sharing opportunities while advancing the datasets available for use by the program.

2. Develop and implement processes to maintain the stormwater infrastructure inventory dataset compiled by the Street Department including processes for updating the dataset based on new development, city maintenance activities, and capital improvement projects that change the condition or composition of the drainage system.

3. Add one GIS staff person dedicated full-time to the stormwater program.

4. Increase annual funding for GIS and technology support by $50,000 to support the staffing recommendation.

Operations and Maintenance

Currently, the City maintains their stormwater system in response to complaints. The City has developed a maintenance policy, which identified priorities based upon the potential for the drainage system to cause harm downstream. However, the City does not routinely perform maintenance on any systems outside of the right-of-way or on systems not receiving public water. Sinkholes are managed in much the same way, with a high priority placed on sinkholes receiving public water and resulting in damage if the sinkhole were fully blocked. Such approaches lead to a reactive management system. The City's current complaint tracking system and work order generation system is not set up to track stormwater complaint response time. However, the perception of the Committee is that maintenance response time is too long and that maintenance is performed only in response to complaints.

The Committee also discussed the NPDES Phase II program demands at length. The City's Phase II permit requirements will increase maintenance program needs significantly. The City, under the requirements for the post-construction runoff control program, must ensure the longevity of every structural BMP installed in the City in response to Phase II. The City will be required to adopt inspection and maintenance programs addressing these requirements.

Goals:

1. Develop a proactive approach to maintenance of the stormwater drainage system including a preventative maintenance program.

Specific Recommendations:

1. Be more proactive in maintenance activities of drainage facilities during and following development.

2. Develop a routine maintenance program and associated plan and schedule.

3. Increase preventative maintenance activities including more inspections during construction to insure that drainage systems are fully functional when the City assumes responsibility for maintenance. Recommendations for increased inspections and related staff are discussed later under the heading Regulation and Enforcement.

4. Raise the fee for maintenance bonds for new development to adjust for inflation from the date of inception of the bonds to current (2003). Based on inflation, adjust the fee for maintenance bonds every 5-years.

5. Investigate the applicability and feasibility of dedicated and self-supporting fund to support City maintenance activities resulting from non-compliance with stormwater regulations and/or financial default by the developer.

6. Add one maintenance supervisor and three maintenance crews to support the recommended increase in proactive and preventative maintenance.

7. Increase annual funding for operations and maintenance activities by $1,000,000 to support the staffing recommendations and associated equipment and materials.

Capital Construction

Goals:

1. Systematically plan, design, and construct capital projects to correct functional and capacity problems of the stormwater drainage system.

Specific Recommendations:

1. Develop a stable and adequate funding source for the planning, design, and construction of stormwater capital improvement projects.

2. Develop and implement a prioritization system for capital projects and construct capital improvement projects through prioritized, long-term planning.

3. Increase annual funding for capital construction to a consistent level of $500,000.

Engineering & Planning

Goals:

1. Implement comprehensive pre-development planning prior to new construction to minimize post-construction stormwater drainage problems.

Specific Recommendations:

1. Develop stormwater master plans for drainage areas currently undeveloped but likely to be developed.

2. Establish “zones” for stormwater and develop specific standards for development in these zones. Establish zones in which construction of new habitable structures is prohibited.

3. Develop a geographic overlay of sinkholes and known sub-surface conduits. Implement a program to map subsurface conduits to develop sub-surface stormwater connectivity maps.

4. Develop regulations and associated technical requirements for sub-surface explorations for all new development. Include requirements for building around sinkholes based on a determination of structural stability.

5. Develop requirements for developers to assess the off-site impacts of new development prior to approval of construction plans.

6. Promote and encourage low-impact development techniques to minimize the volume and rate of runoff from new development and maximize the quality of runoff from new development.

7. Add one engineering staff member to support and coordinate the recommended pre-development planning efforts and the new water quality programs mandated by the NPDES regulations.

8. Increase annual funding for engineering and planning by $350,000 to support the staffing recommendation and the recommended pre-development planning.

Regulations and Enforcement

Goals:

1. Consolidate, document and strengthen stormwater regulations.

2. Reduce post-construction stormwater drainage problems through more frequent inspections.

3. Increase dissemination of information to developers and engineers on development regulations.

Specific Recommendations:

1. Apply stormwater regulations and requirements consistently for all developments.

2. Coordinate with other departments and regulatory bodies and make stormwater regulations consistent across Departments and Agencies and consolidate the regulations affecting stormwater management.

3. Increase the number and frequency of stormwater inspections to at least once per week during new construction.

4. Inspect construction sites adjacent to streams or sinkholes daily.

5. Revisit and revise requirements for submission of plans for review. Be stringent and consistent in applying the plan submission requirements.

6. Require that development plans be submitted in digital form to facilitate data storage, access, and the merging of development data with existing GIS resources.

7. Encourage county coordination and participation in the stormwater management program with the expectation of developing consistent standards for new development countywide.

8. Seek mechanisms by which the City can apply stormwater regulations and associated enforcement to County, State, and Federal properties.

9. Develop and maintain a stormwater management web page and post stormwater management regulations, requirements, checklists, reports, contacts, etc.

10. Add 4 construction site inspectors to support the recommendations for increased oversight of new construction.

11. Increase annual funding for regulation and enforcement by $200,000 to support the staffing recommendations and the recommended website development.

Water Quality

Goals:

1. Be proactive in the implementation of the Environmental Protection Agency NPDES Phase II stormwater permit requirements.

Specific Recommendations:

1. Develop programs and activities necessary to fully comply with the NPDES Phase II and other water quality regulations, including:

    a. Develop a public education program;
    b. Develop a stream monitoring program to prepare for future TMDLs;
    c. Develop an illicit discharge inspection program;
    d. Develop Stormwater Pollution Prevention Plans and associated good housekeeping practices for city facilities including training for city staff;
    e. Develop water quality Best Management Practice (BMP) requirements and associated design guidance for developers;

f. Develop an inspection and maintenance program for stormwater BMPs; and

g. Train city staff and the development community on new water quality requirements and associated programs.

2. Utilize staff additions outlined for other functional areas to support the requirements of the NPDES permit.

3. Increase annual funding for water quality permit compliance by $271,000 to support the programmatic requirements of the NPDES Phase II permit.

Summary of Manpower Recommendations

The Stormwater Program Advisory Committee recommended a number of staff additions to support the recommendations contained herein. The recommended staff additions are summarized in Table 4-1. Maintenance crew staff increases should be added systematically over a three to five year period based upon the increased level of maintenance required by the NPDES permit and as recommended by the Stormwater Program Advisory Committee..

Table 4-1. Summary of Manpower Recommendations

Functional Area	Existing Staffing (No. of Staff)	Proposed Staffing (No. of Staff)
1 Administration & Finance	8	9
2 Public Involvement & Education	0	0
3 GIS and Technology Support	1	2
4 Operations & Maintenance	3 +3 Maint. Crews	4 +6 Maint. Crews
5 Capital Construction	0	0
6 Engineering & Planning	1	2
7 Regulation & Enforcement	4	8
8 Stormwater Quality Management†	0	0
Totals	17 +3 Maint. Crews	25 +6 Maint. Crews

† Staffing necessary for the stormwater quality program are included in the other functional categories as most staff serve dual roles.

Summary of Funding Recommendations

The Stormwater Program Advisory Committee made recommendations on the funding levels for each of the functional categories discussed herein. The recommended funding levels are summarized in Table 4-2. The Proposed Funding of $4,596,000 assumes full implementation of the committee recommendations for staffing.

Table 4-2. Summary of Funding Recommendations

Functional Area	Existing Funding (thousands)	Proposed Funding (thousands)	Funding Increase (thousands)
1 Administration & Finance	$514	$544	$30
2 Public Involvement & Education	$0	$35	$35
3 GIS and Technology Support	$4	$54	$50
4 Operations & Maintenance	$1,300	$2,300	$1,000
5 Capital Construction	$369	$500	$131
6 Engineering & Planning	$49	$399	$350
7 Regulation & Enforcement	$81	$281	$200
8 Stormwater Quality Management	$212	$483	$271
Totals	**$2,528**	**$4,596**	**$2,068**

Figure 4-1 presents a generalized comparison of the existing and proposed per-capita expenditure. As discussed in Section 2, Clarksville currently spends approximately $24 annually per resident. At this level of funding, Clarksville spends a “minimum to moderate” amount on stormwater management compared to the perceived needs for programs around the country. If the budget is increased by $2 million this would increase the annual per-capita spending to about $44, placing the Clarksville program in the moderate to advanced category. This category is by no means “cutting edge” but is simply termed “moderate to advanced” by way of comparison with other cities and counties.

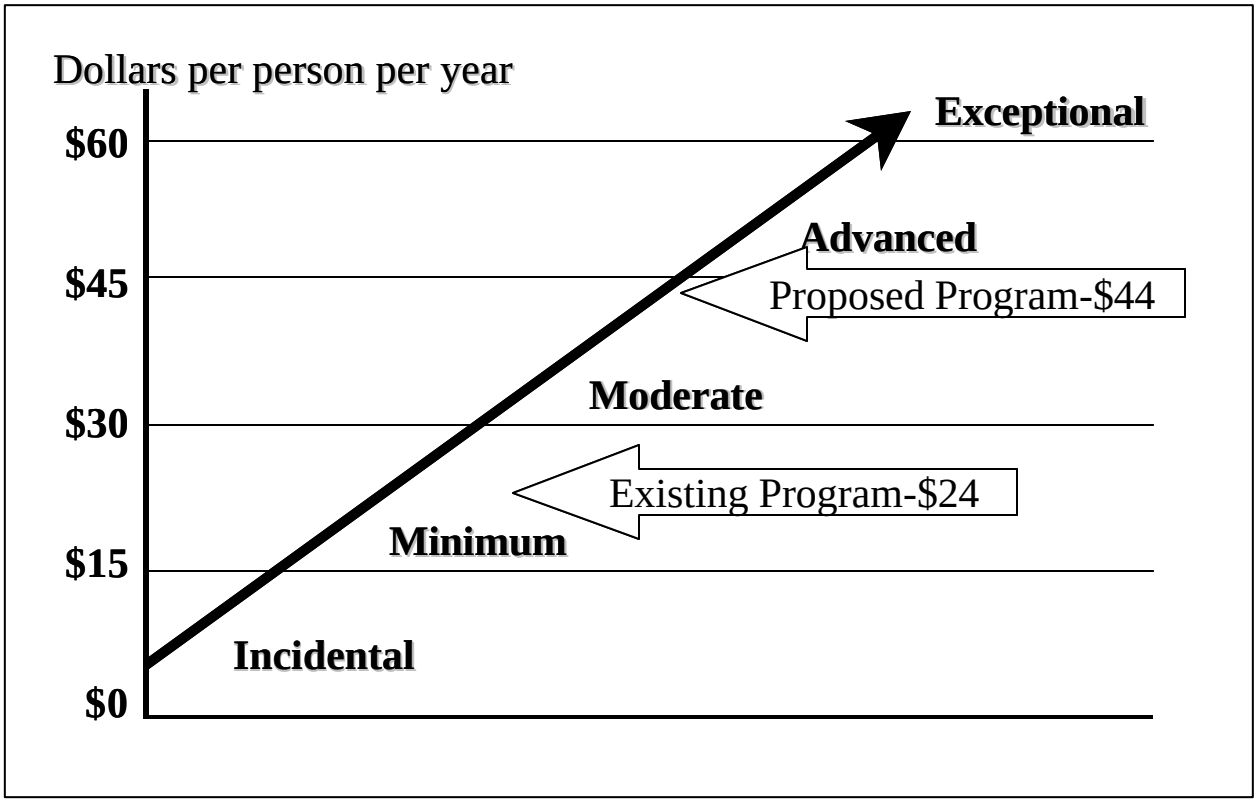

Figure 4-1. Program Expenditure Comparison

Existing and Proposed Funding Needs

Clarksville currently funds the stormwater program out of the general fund as discussed in Section 2. The Stormwater Advisory Committee made recommendations on a proposed stormwater program, based upon input from other committees, City staff, and regulatory programs, such as NPDES Phase II. The proposed program is outlined in Section 4 of this report. Funding associated with the existing and proposed programs is presented in Table 5-1.

Table 5-1. Existing and Proposed Program Funding

Functional Area	Existing Funding (thousands)	Proposed Funding (thousands)
1 Administration & Finance	$514	$544
2 Public Involvement & Education	$0	$35
3 GIS and Technology Support	$4	$54
4 Operations & Maintenance	$1,300	$2,300
5 Capital Construction	$369	$500
6 Engineering & Planning	$49	$399
7 Regulation & Enforcement	$81	$281
8 Stormwater Quality Management	$212	$483
Totals	**$2,528**	**$4,596**

Funding Sources

The advisory committee recognized the need for stable and adequate funding for the stormwater program and discussed different potential funding methods including sales tax increases, property tax increases, and a user fee or utility. Below is a summary of the discussions for each funding mechanism.

Sales Tax

Sales taxes can, in some cases, generate a substantial amount of revenue to support a stormwater program. Clarksville has a local option sales tax of 2.5% with about 0.25% remaining in capacity under the state cap for sales tax. This remaining capacity translates to a revenue potential of approximately $1.25 million.

A sales tax increase method has the advantage of raising revenue from visitors to Clarksville. However, sales tax funding for stormwater is not seen as equitable and is in no particular way related to stormwater runoff quantity or quality. Additionally, the remaining capacity in the sales tax rate would not generate sufficient revenue to support the committee's recommendations for the proposed program. The committee believed that a sales tax increase to fund the stormwater program would not be well received by the community and would drive shoppers across the state line, undermining the revenue potential.

Property Tax

The current property tax rate is $1.81 per $100 of assessed value. According to the Finance Department, $0.01 increase in the property tax rate will generate approximately $100,000 in revenue. Therefore, a property tax rate increase of $0.21 would be needed to fully fund the committee's recommendations for a $2.1 million increase in spending for the stormwater program. A property tax increase would be functionally simple to implement. However, it is viewed to be politically unpopular and does not generate funding from tax-exempt properties and is, therefore, not viewed as equitable. The committee believed that a property tax increase would not be well received by the community.

User Fee

A stormwater user fee, or stormwater utility, could be implemented for properties within Clarksville. Based upon a preliminary analysis using general guidelines, it is estimated that a $1 per month charge to residences and a proportional charge to non-residential properties will generate approximately $1.2 million annually. Therefore, an average monthly residential charge of $3.50 to 4.00 per month charge would generate approximately $4.8 million annually, which would fund the entire stormwater program as proposed by the committee. Charges could be included on other monthly billing systems already in place, such as the water bill. Advantages to a user fee system include

- **Equitable**. Parcels are charged based upon the demand placed on the system. Credits can be created to give fee credits based upon improvements.

- **Dedicated, stable funding**. Revenue streams from a utility are consistent and must be spent on stormwater program activities only.

Recommendations on Funding Mechanism

The Committee spent much time determining and discussing alternatives for funding Clarksville's stormwater program at a level acceptable to the public. Two alternatives were investigated. These alternatives and their corresponding arguments are outlined below.

1. Continue using the general fund (property taxes, gas tax, etc.) to support the proposed stormwater program at the existing level of approximately $2.5 million and establish a stormwater user fee system to support the proposed stormwater program at a level of approximately $2.0 million annually. This option will keep the utility rate low (estimated at $2.00 per month for a typical residential bill). However, given the instability with the general fund appropriations, the existing stormwater program budget could potentially be reduced and the stormwater program forced to rely solely on the funding from the user fee. And, having based the idea of a user fee upon a higher level of service, public perception of the stormwater program would likely be negative.

2. Fund the entire stormwater program (as proposed) through a stormwater user fee system at a level of approximately $4.5 million annually. The estimated user fee would be approximately $3.50 per month for a typical residential bill. While this option would require a significant public education and awareness campaign, funding would be much more stable than relying solely or partly on the general fund.

After giving consideration to the funding options, the advisory committee made the following recommendation for revenue generation for the stormwater program:

> Establish a stormwater user fee system (utility) to support the entire stormwater program at a level of approximately $4.5 million annually. Based on a preliminary analysis, the user fee charge would be approximately $3.50 monthly for a typical residence. Non-residential properties would be billed at rates proportional to equivalent residential units.

Through discussions on the recommendation to implement a stormwater utility, several needed policy decisions were recognized by the committee. Table 5-2 presents a comprehensive listing of policy decisions that need to be developed prior to implementation of a stormwater utility. While the committee did not address most of these policy decisions at this time, two were discussed in some detail. A summary of the discussions follows:

What Residential Rate Structure Should the City Use?

The Committee discussed several rate options for the single-family residential fee itself:

1. A flat rate for all residential properties,
2. Two separate rate tiers, or
3. Separate rates for each residential property, individually figured on the basis of lot-specific imperviousness.

The Committee noted that a flat rate would not distinguish between lots with high imperviousness, and therefore a higher stormwater system demand, and lots with lower imperviousness that place a low demand on the stormwater system. However, administration of a flat rate system would be easy, and development of the system would be cheaper.

Two separate tiers could be established to account for those that may not be able to afford the fee and to establish a more equitable fee system. This rate system would prove more costly to develop and more complex to administer.

Another option for a stormwater utility rate is to develop individual fees for each residential property, based upon that property's demand placed on the City's system. This option would require an assessment of each lot for impervious area. Advantages to this option include fairness of application based upon each property's demand placed on the system. However, this option would be cost-prohibitive and complex to administer.

Committee Recommendation. The committee recommended a rate structure with two tiers believing a two-tier system to be the most cost-effective and equitable.

Table 5-2. Policy Decisions for Stormwater Utility Development

Program Related policy issues

- Program Mission
- Program Service Description
- Extent of Service
- Stormwater Quality Strategy
- Privatization
- Relationship with Other Programs
- Public Input or Advisory Groups
- Major Program Priorities
- Service Area
- Levels of Service
- Organization and Staffing
- Inter-Local Agreements and Responsibilities
- Public Relations

Funding Related Policy Issues

- Types of Stormwater Services Funded
- Prior Investment
- Accounting Method
- Basic Funding Methodology
- Secondary Funding Methods
- Credits
- Public Streets and Properties
- Basis for Cost Distribution
- Future Use of Stormwater Systems
- Rate Methodology
- Modification Factors
- Overall Funding Strategy
- Equivalent Residential Units (ERUs)
- State and Federal Properties

Billing Related Policy Issues

- Billing and Collection Methods
- Independent Database Tie In
- Appeals and Adjustments
- Collections and Delinquencies
- Property Liens
- Management Reporting Process Acc.
- Use of Other Databases
- Number and Type of Data Fields Required
- Rounding and Ranges
- Billing Cost Allocations
- Billing Owners or Tenants
- Multiple Owners
- Multi-story Condominiums
- Consolidated Billing
- Information to Put on the Bill
- Impervious or Total Area Measurement Accuracy
- Master Account File Database Maintenance and Updating Process
- New Stand Alone System
- Modification of Existing Billing System
- Billing Period
- Water Bill Tie-In
- Enforcement Procedural Issues
- Master Account File Development
- Resolution Procedures for Discrepancies
- Impervious Area Methodology
- Street Centerline Data
- Customer Service Procedures
- Case Exceptions Included
- Undivided Interest, Common Areas
- Stormwater Only Accounts
- Use of GIS, Mapping or CADD

Should the City bill undeveloped land or only developed properties?

The Committee discussed how to handle billing for undeveloped land. All properties benefit from flood control and the stormwater system, regardless of the state of development or land use. Undeveloped property may not mean pristine with no hardened surfaces. However, billing a property owner for property that is not yet placing a demand on the system may be seen as inequitable. If the stormwater utility fee is billed on an existing utility bill, undeveloped properties may not be billed.

***Committee Recommendation*.** The committee felt that undeveloped properties should be billed some amount but were unsure if the properties should be billed at a reduced rate or the full fee.

Stormwater Utility Overview

The committee was given an overview of the basic fundamentals of a user fee, or stormwater utility. This section summarizes the information provided to the committee.

Rate Methodology

The basis for a user fee is the demand placed upon the City's stormwater system. The higher the imperviousness of a property, the higher the demand placed upon the system. "Imperviousness" is defined as hardened surfaces such as rooftops, driveways, parking lots, roads, etc., that hinder the infiltration of rain. In Figure 5-1, the house represents a typical house in Clarksville. It may have an imperviousness of 2000 – 2700 square feet. For this example, let's use 2500 square feet as our basic estimate. Then 2500 square feet is equal to one equivalent residential unit, or one ERU.

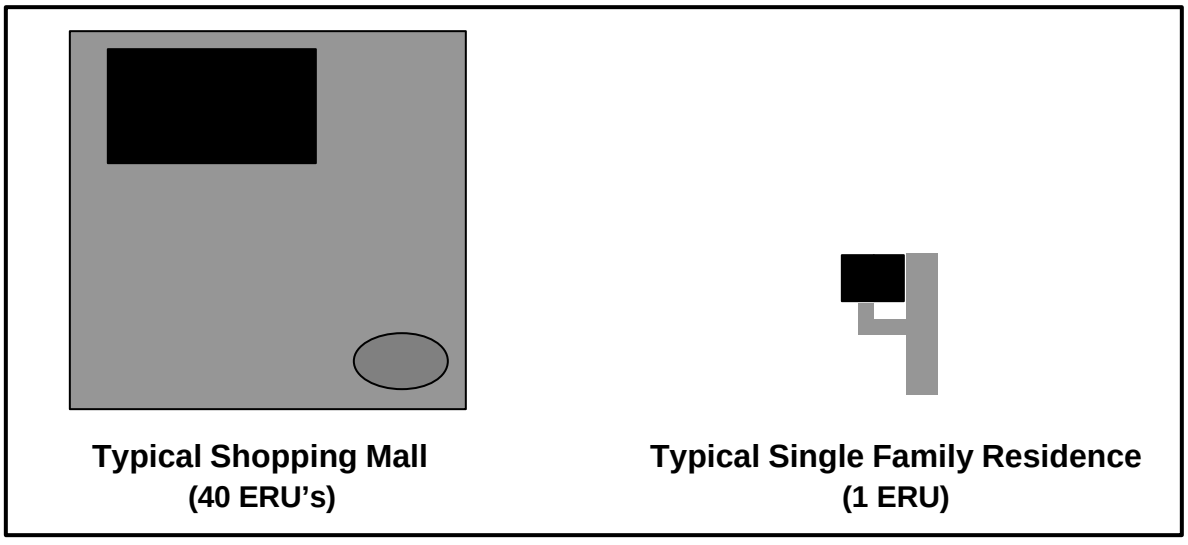

Figure 5-1. Example of Equivalent Residential Unit

For the sake of simplicity all houses are charged the same flat rate, or there may be two tiers of charges, a higher rate for larger houses and a lower rate for smaller ones. For our example, let's assume all homes are charges the same rate. Then, each home is equal to one ERU.

The shopping mall shown above has 40 times the imperviousness of a single home (40 x 2500 = 100,000 square feet). Thus, it would pay 40 times the rate of a single-family home. So, for example, of the monthly charge per ERU (and per home) is $2.00, then the mall would pay $2.00 x 40, or $80.00 per month. The mall could also get a reduction in the monthly fee if the City developed a crediting system to account for stormwater improvements, such as the detention pond (noted in the lower right hand side of the mall).

All non-residential land uses would be billed a proportional amount, based upon their imperviousness and ERU. Crediting mechanisms can be developed to allow property owners to reduce their utility bill based upon stormwater improvements.

Development of a Utility

A stormwater utility provides a vehicle for:

- Developing funding that is stable, adequate, flexible and equitable and dedicated solely to the stormwater program; and
- Developing programs that are comprehensive, cohesive and consistent year to year.

A stormwater utility is equitable because the cost is borne by the user based upon the demand placed on the drainage system. It is consistent because it is not dependant on the vagaries of the annual budgeting process. And it is adequate because the typical stormwater program can be financed on a cost below the normal customer's willingness to pay.

No two stormwater utilities are identical, just as no two cities are identical. Therefore, it is not prudent to take a "one size fits all" approach, but seek to understand the community make up, problems and goals. A clear understanding of the community's stormwater system, capabilities and issues must be gained. A "cloned" program from another city will likely not work when applied to a different community. Such programs cannot withstand the scrutiny of staff, council members or environmental groups and therefore, fail politically. However, the real danger of using a "cloned" program is that it fails to effectively and efficiently address the community's stormwater problems. The local problems, needs and circumstances must drive the form, priorities and pace of the program transition.

While each utility is unique, the approach to developing a utility is often similar. Most utilities should proceed along three inter-connected tracks: program, finance and

database development. Surrounding these tracks and flowing through them is a public education and public awareness campaign.

- The program track builds on basic problems, needs and goals through a setting of program priorities, laying out a program for a three to five year period, a costing of that program, and finally setting up implementation steps. The program must drive the rate and rate structure, though due regard must be given to the customer's willingness to pay for stormwater given the other demands placed on citizens' resources.
- The financing track sets some basic financing policies first. Then, based on program input, it goes from development of a rate structure to meet program needs, to a rate study and cash flow analysis, and finally to a rate ordinance.
- The database track has two main purposes: to develop the master account file and to develop a mechanism to deliver a bill to a customer. Inherent to these two purposes are numerous decisions on whom to bill, how to handle certain properties, etc.

Sources Other than the Corps of Engineers Include:

Disaster Prevention and Relief

Federal Emergency Management Agency, administered through state emergency management agencies
Flood Mitigation Assistance Program
Hazard Mitigation Grant Program
Project Impact Grant Program

U.S. Army Corps of Engineers
Flood Hazard Mitigation and Riverine Ecosystem Restoration Program (Challenge 21) (USACE)

U.S. Department of Agriculture
Emergency Conservation Program (FSA)

U.S. Environmental Protection Agency
Superfund Technical Assistance Grants for Citizen Groups at Priority Site (OERR)

Pollution Prevention and Control

Small Business Administration
Pollution Control Loans

U.S. Department of the Interior
Clean Vessel Act Grant Program (FWS)

U.S. Environmental Protection Agency
Chemical Emergency Preparedness and Prevention Technical Assistance Grants (CEPPO)
Pesticide Environmental Stewardship Grants (OPPTS)
Pollution Prevention Incentives for States (OPPTS)

Watershed and Drinking Water Source Protection

U.S. Department of Agriculture
Watershed Protection and Flood Prevention Program (NRCS)

U.S. Department of Transportation

Transportation Equity Act for the 21st Century Funding Programs (FHWA)

U.S. Department of the Interior
Land and Water Conservation Fund Grants to States (NPS)

U.S. Environmental Protection Agency
Capitalization Grants for Clean Water State Revolving Fund (OWM)
Capitalization Grants for Drinking Water State Revolving Fund (OGWDW)
Nonpoint Source Implementation Grants (319 Program) (OWOW), administered through state nonpoint source programs
Water Quality Cooperative Agreements (OWM)
Watershed Assistance Grants (OWOW)

Wetlands

U.S. Department of Agriculture
Wetlands Reserve Program (NRCS)

U.S. Department of the Interior
National Coastal Wetlands Conservation Grant Program (FWS)
North American Wetlands Conservation Act Grants Program (FWS)

U.S. Environmental Protection Agency
Five-Star Restoration Program (OWOW)
Wetlands Program Development Grants (OWOW)

Corps of Engineers

The U.S. Army Corps of Engineers (Corps) has a number of authorities for assisting States, local governments, and Native American Indian tribes in the reduction of flood damages. Most of these programs provide cost-shared support, not grants. These programs were authorized under the various Flood Control Acts (FCA) and Water Resources Development Acts (WRDA).

- Flood Control Authorization: Section 205 of FCA 1948, as amended.

  Program Goals: To study, adopt and construct small flood control projects using structural or non-structural measures. The scale of projects under this authority is such that the Federal share on individual projects not exceed $7,000,000.

  Cost Sharing: After the first $100,000 of full Federal funding, the non-Federal partner must cost share 50 percent of the feasibility study and 35 percent of design and construction. The local partner is responsible for lands, easement, rights-of-way, relocations and disposal (LERRD).

Budgetary: Annual funding not to exceed $40,000,000 Corps-wide. The FY 2000 appropriation for this program was $35,800,000.

- Planning Assistance to States Authorization: Section 22 of WRDA 1974, as amended.

  Program Goals: Support States and tribes in their comprehensive planning for the development, utilization, and conservation of water and related land resources. Section 22 can also be used in watershed and ecosystem planning.

  Cost Sharing: 50% Federal, 50% State or tribe.

  Budgetary: Annual funding not to exceed $10,000,000 Corps-wide. The FY 2000 appropriation for this program was $5,800,000.

- Flood Mitigation and Riverine Restoration Program Authorization: Section 212 of WRDA 1999.

  Program Goals: To conduct flood damage reduction projects that conserve, restore, and manage hydrologic and hydraulic regimes and restore the natural functions and values of floodplains.

  Application: This is a new authority that emphasizes, to the maximum extent practicable and appropriate, nonstructural approaches to preventing or reducing flood damages. The maximum Federal share on individual projects cannot exceed $30,000,000.

  Cost Sharing: After the first $100,000 of full Federal funding, the non-Federal partner must cost share 50 percent of the feasibility study and 35 percent of design and construction. The local partner is responsible for lands, easement, rights-of-way, relocations and disposal (LERRD).

  Budgetary: Annual funding not to exceed $20,000,000 Corps-wide.

- Clearing & Snagging Authorization: Section 208 of FCA 1954, as amended.

  Program Goals: Undertake emergency clearing and snagging for flood control. The scale of projects under this authority is intended that the Federal share on individual projects not exceed $500,000.

  Application: This authority has been used for the removal of debris from rivers and streams, which accumulates at bridges, restricts flows and aggravates flooding.

  Cost Sharing: After the first $40,000 of full Federal cost, the non-Federal partner must cost-share 35 percent of planning, design and construction. The local

partner must also provide all necessary lands, easement, rights-of-way, relocations and disposal (LERRD).

Budgetary: Annual funding not to exceed $7,500,000 Corps-wide. The FY 2000 appropriation for this program was $100,000.

- Flood Plain Management Services Authorization: Section 206 of FCA 1960, as amended.

  Program Goals: Provide technical assistance to states, tribes, counties and cities in planning the prudent use of land subject to flooding from streams and lakes.

  Application: Upon request, the Flood Plain Management Services program provides a full range of technical services and planning guidance on floods and flood plain issues within the broad umbrella of flood plain management.

  Cost Sharing: This service is available to state and local governments without charge, within the limits of available appropriations. This support is available to other Federal agencies and private individuals on a fully reimbursable basis.

  Budgetary: The FY 2000 Appropriations for this program (nationwide) was $8.5 million.

- Reconnaissance Study Under the authority of Section 905(b) of WRDA 1986, the Corps can conduct a Reconnaissance Study of a wide range of potential water resources projects at full-Federal cost, not to exceed $100,000. This study can be used to determine if flooding problems might be addressed using existing authorities or if a specifically authorized project should be pursued.

- Reimbursable Support Aside from the cost-shared authorities described above, the Corps can provide technical support to State, municipal and tribal agencies on a reimbursable basis.

The table below gives a summary of key aspects of Corps of Engineers Funding Sources.

Grant Program	Purpose	Matching Share
Remedial Action Plans (Section 401)	General assistance for RAP development and implementation	50%, but may include in-kind services
Expedited Recon Study (Section 905(b))	Conduct a reconnaissance study of local water-related problems to determine applicability of Corps programs	none required
Beneficial Use of Dredged Material (Section 204)	Protect, restore and enhance aquatic habitat using dredged material from Federal navigation projects	25% (with credit for lands, easements, rights-of-way and relocations)
Aquatic Ecosystem Restoration (Section 206)	Plan, design and construct aquatic ecosystem restoration and protection projects	35% (with credit for lands, easements, rights-of-way and relocations)
Restoration of Environmental Quality (Section 1135)	Modify Corps structures or their operations to restore environmental quality. Restoration may be away from Corps project	25% (with credit for lands, easements, rights-of-way and relocations
Flood Mitigation & Riverine Restoration (Section 212)	Develop flood protection projects that restore natural functions of floodplain and enhance habitat	35% (with credit for lands, easements, rights-of-way and relocations)
Environmental Dredging (Section 312)	Provide for the removal of contaminated bottom sediments in waterways outside Federal navigation channels	35% (with credit for lands, easements, rights-of-way and relocations)
Environmental Infrastructure (Various authorities)	Support development or restoration of environmental infrastructure, including water supply, wastewater, combined sewer overflows	Variable
River Basin Studies (Section 729)	Study water resources needs of river basins and regions	None Required

Other Key Funding Sources

319(h) Non-point Source Implementation Grants

These are formulated grants provided to the states to implement nonpoint-source mitigation projects and programs in accordance with Section 319 of the Clean Water Act. Examples of projects that 319(h) grants cover are implementation of best management practices (BMPs) in agricultural settings; implementation of BMP systems for lake, estuary, or stream watersheds; and basin-wide education programs. These grants are funded federally for 60% of the cost of the project, with a local match of 40%.

Hazardous Mitigation Grant Program

The purpose of this funding source is to provide financial assistance to state and local governments for projects that reduce or eliminate the long-term risk to human life and property from the effects of natural hazards. The grant program has 75% federal and 25% bcal contribution. The nonfederal share may be met with local cash contributions, in-kind services, or certain other grants such as Community Development Block Grants. The Federal Emergency Management Agency makes the final decisions on project eligibility, but the state agencies administer the program. Eligible projects include acquisition of property, retrofitting of buildings, development of standards with implementation as an essential component, and structural hazard control or protection measures such as dams and sea walls.

Clean Water State Revolving Loan Fund

Initially funded with federal and state money and continued by repayment of earlier loans, State Revolving Funds (SRFs) provide low-interest loans for stormwater programs, usually a small fixed interest rate of 3-4% and the closing cost. Non-point source funds may be utilized for major capital equipment, capital projects, and associated engineering costs related to the projects. The Clean Water Act of 1987, Section 606, requires each state to prepare annually an Intended Land Use Plan identifying the use of funds in the Clean Water SRF.

Stream Restoration Mitigation Bank

This relatively new financial tool will gain wider acceptance as watershed management and development continue to occur. It can be a public or public/private relationship tool. Communities assess their streams for restoration, preservation, and enhancement, and then submit a plan to the Army Corps of engineers for approval and the establishment of the bank. If local governments develop the bank on their own, they can sell the credits for the restoration of the stream segments. If a partnership is established, a bank is created and credits sold for development of the streambank program. There are also other sundry ways to develop this type of program funding tool.

Surface Transportation Program

This federally funded program, known as TEA-21, can be used by local governments for any roads not functionally classified as local or rural minor collectors. Each state sets aside funds for transportation enhancements, which can include but are not limited to such activities as wetland mitigation and implementation of control technologies to prevent polluted highway runoff from reaching surface water bodies. This program also funds other enhancements not linked to watershed-related projects. Local governments, profit and nonprofit entities, and colleges and universities may be eligible for this funding, which is usually 80% federal funding and 20% local match.