An Annotated Bibliography of Stormwater Finance Resources

April 29, 2002

Compiled by

Dana Busco and Dr. Greg Lindsey

Center for Urban Policy and the Environment
School of Public and Environmental Affairs
Indiana University- Purdue University Indianapolis

Introduction:

Stormwater utilities have become one of the most popular options for funding stormwater programs during the past thirty years. Hundreds of articles, presentations, books, how-to manuals, and surveys have been published about them. Thousands of communities have researched the utility concept in order to provide a stable, dedicated funding source for the stormwater management programs that are vital to their efforts to minimize flood damage, maintain stormwater systems, and improve surface water quality. Renewed focus on total maximum daily loads, reducing nonpoint source pollution, and EPA's National Pollutant Discharge Elimination System (NPDES) stormwater permitting requirements have put additional pressure on local governments to increase funding for stormwater management programs.

Most local governments have historically been unable to allocate enough money from the general fund to provide adequate stormwater management services. Consequently, they are turning to dedicated funding sources like stormwater utilities in hopes that their stormwater programs can become self-sufficient. The purpose of this bibliography is to collect into one place all currently available literature on stormwater utilities and other potential funding sources. Community stormwater managers and planners can use this bibliography as a reference or research tool by proceeding through the bibliography as their projects develop, utilizing the general resources first and then referring to the other resources as they become relevant. This bibliography is separated into nine sections:

- stormwater and urban runoff manuals
- government finance manuals
- general articles about stormwater utilities
- surveys of stormwater utilities
- stormwater utility manuals
- other topics concerning stormwater utilities
- impact fees
- permit and inspection fees
- case studies.

Each of the sections contains references that serve different purposes.

Stormwater and urban runoff manuals are usually technical manuals about the setup, operation, and maintenance of stormwater management systems that only contain brief discussions of stormwater financing methods. Government finance manuals usually review several different options that communities can use to finance capital projects without any discussion of stormwater management specifically.

The section with general stormwater utility articles contains papers and presentations that provide the reader with an overview of the stormwater utility concept. The stormwater utility surveys provide raw data and statistical information concerning existing utilities around the country while the stormwater utility manuals guide the reader through a series of suggested steps toward the implementation of a utility. The components of the stormwater utility surveys and manuals are summarized in two tables within the body of the bibliography in order to provide planners with an overview of each reference.

Resources in the "other topics" category discuss sub-topics of the utility creation process, such as how to structure the billing system or determine the base unit charge in detail. Materials in the impact fees section discuss the types of impact fees that can be used to fund stormwater programs, the legal issues surrounding impact fees, and how to determine the appropriate impact fee amount. Permit and inspection fees papers discuss how to assess each type of fee, how much to charge, and what types of fees are the most common. Finally, the case studies discuss the specifics of individual communities' stormwater management programs.

The nine different reference sections will allow readers to quickly and easily find the type of resources that they need and eliminate those resources that do not relate to the topic that they are researching. Some of the resources fit more than one of the nine categories so they have been placed in the most appropriate category and referenced so that they can be found easily in all of the relevant categories.

General Manuals About Stormwater and Urban Runoff

The manuals in this section are not specific to stormwater program funding. However, they usually include useful basic information about the creation of a stormwater utility and other funding options. These references are usually technical manuals about stormwater and urban runoff that focus more on control methods than financing issues.

American Public Works Association. (1981). Urban Stormwater Management Special Report No. 49. Chicago, Illinois: Author.

This special report by the American Public Works Association Research Foundation was one of the first manuals published that discussed stormwater utilities. The manual covers several other important topics concerning stormwater management including the planning process, urban hydrology, stormwater collection systems, stormwater detention systems, and stormwater ordinances. Chapter 15 discusses stormwater financing options and uses examples from several of the oldest stormwater utility systems in the United States (Boulder, Colorado; Bellevue, Washington; Tacoma, Washington; Aurora, Washington; and Corvallis, Oregon).

Center for Watershed Protection. (2001). The Stormwater Manager's Resource Center. [Online]. Available: http://www.stormwatercenter.net.

This Web site is designed to provide technical information to stormwater professionals and communities searching for information about stormwater management. The site includes a library of over 600 references and several slide shows that explain stormwater management issues. One page helps communities design their own stormwater manuals. The site also includes examples of local ordinances, simple techniques that can be used to assess a community's stormwater needs, and pollution prevention and resource protection techniques.

Government Finance Research Center. (1980). Planning for Urban Stormwater Management: Financial Issues and Options- Draft. Washington, D.C.: Municipal Finance Officers Association.

This draft guide discusses planning urban stormwater management programs, emphasizing finance options. The guide focuses on answering questions about who pays, how much they pay, and when they pay. Project costs estimations are discussed along with a list of issues that should be considered in the design of a stormwater management program. Several worksheets are provided to help planners estimate revenue requirements, determine costs, and compare alternative financing methods.

Lehner et. al. (1999). Stormwater Strategies: Community Responses to Runoff Pollution. Washington, D.C., Natural Resources Defense Council. [Online]. Available: http://www.nrdc.org/water/pollution/storm/stoinx.asp.

This report discusses strategies used by communities around the country to control urban stormwater runoff. The report explains the causes and consequences of urban runoff and outlines strategies that have been used by communities in six regions of the United States. Finally, the report draws on the experiences of the case study communities and makes nine recommendations on how to design and implement a successful stormwater management program. The report includes a chapter on funding and getting public support for stormwater programs that recommends the use of a dedicated funding source like a stormwater utility. The finance chapter includes examples of stormwater utility fee structures from around the country and a list of communities around the country with stormwater utility programs.

Phillips, N. (1992). Decisionmaker's Stormwater Handbook: A Primer. Washington, D.C.: Terrene Institute.

Nancy Phillips of the EPA prepared this handbook for distribution by the Terrene Institute to familiarize decision makers with urban stormwater runoff issues. The book discusses what stormwater runoff is, how development impacts water quality, and what best management practices are available to manage stormwater. The handbook contains sample site plans and a brief discussion of funding mechanisms. A list of other resources concerning stormwater management is included as an appendix.

Texas Statewide Storm Water Quality Task Force. (1998). Texas Non- Point Source Book. [Online] Available: http://www.txnpsbook.org

The Texas Non- Point Source Book is a Web site designed to disseminate information about storm water management to interested professionals. It contains information about how to set up a storm water management program, how to assess urban waterways, and BMPs for controlling storm water. The funding mechanisms section of the Urban Runoff Management Programs chapter contains a detailed explanation of how to set up a drainage utility in Texas.

Watershed Management Institute. (1997). Institutional Aspects of Urban Runoff Management: A Guide for Program Development and Implementation. Ingleside, Maryland: Author.

The Watershed Management Institute prepared this manual for the EPA in order to provide recommendations to individuals who are responsible for designing and managing urban runoff control programs. The institute surveyed thirty-two local, regional, and state government programs and based their recommendations on the experiences of those who were surveyed. This manual provides valuable contact information in the individual program summaries in Appendix B. This information would be very useful to communities that wanted to examine several different types of stormwater management programs and financing methods before determining what type of system would be best for their area of concern.

Watershed Management Institute. (1997). Operation, Maintenance, and Management of Stormwater Management. Ingleside, Maryland: Author.

This is a technical manual that focuses on the design, construction, inspection, and maintenance of stormwater Best Management Practices (BMPs). The chapter on costs and financing of stormwater systems touches on the benefits of stormwater utilities and discusses some of the requirements for the creation of a successful utility.

Government Finance Manuals

Amatetti, E.J. (1993). Meeting Future Financing Needs of Water Utilities, Denver, CO: American Water Works Association Research Foundation.

This report provides an overview of the key elements in a comprehensive, well-conceived strategy for meeting the funding needs of water utilities. Some of the issues discussed include changes in the finance of water utility operations, strategic financial planning and risk management, determining the creditworthiness of a water utility, identifying and evaluating financing alternatives, marketing securities, and the implications of tax laws for financing alternatives.

Bland, R.L. (1989). A Revenue Guide for Local Government. Washington, D.C.: International City/County Management Association.

This book covers six of the most common local government revenue sources: property taxes, general sales taxes, excise taxes, income taxes, user charges, and impact fees. Bland discusses the advantages and disadvantages of each revenue source, identifies recent trends in local government finance, and provides his recommendations on how to promote revenue stability.

Golgowski, G. & Dowling, A. (1985). Review of Approaches and Techniques Used to Assist in Financing the Retrofitting of Existing Urban Storm Drain Systems. Stormwater Management: "An Update". Orlando, Florida: University of Central Florida.

This paper explores alternative funding options for stormwater system improvement projects including utilities, drainage districts, municipal bonds, state and federal grants-in-aid, and special assessments. The authors focus on options available to Florida communities and provide a case study of Orlando and Orange County, Florida to show other communities how to fund stormwater programs through a variety of different funding sources.

Lucero, A. (1997). The Price of Progress: Infrastructure Payments You Can Live With. American City and County. 112(5), 42-49.

This article reviews several of the infrastructure financing options that are available to communities including impact fees, special assessment and community facilities districts, and tax increment financing. The article also discusses breaking down projects into components in order to finance smaller, more affordable projects and addresses how to gain public support for the new financing strategies.

Matzer, J. Jr. (Ed.). (1989). Capital Projects: New Strategies for Planning, Management, and Finance. Washington D.C.: International City/County Management Association (ICMA).

The International City Management Association published this book to provide local government officials with a resource guide covering infrastructure planning, management, and funding options. The book is divided into five sections covering different aspects of infrastructure management and finance. The first section discusses declining federal funding and other constraints that have caused local governments to fall behind in the construction and maintenance of new and existing public works projects. The second section of the book provides case studies of innovative planning methods and the third section discusses infrastructure management tools and techniques. The fourth section discusses several financing alternatives including municipal bonds, revolving loan funds, special districts, impact fees, and utilities. The final section of the book discusses infrastructure maintenance programs.

Raftelis, G.A. (1989). The Arthur Young Guide to Water and Wastewater Finance and Pricing. Chelsea, Michigan: Lewis Publishers.

This book discusses water and wastewater financial planning and pricing. The book describes the major capital items required for water and wastewater utilities, the capital and financial planning process, and the different short-, and long-term financing methods that are available to utility planners. The book also discusses capital recovery charges, and the pricing process for water and wastewater utilities. This book does not address stormwater utilities but many of the concepts used in financial planning and pricing for water and wastewater utilities can be adapted for use with a stormwater utility.

Strachota, D. & Engelbrekt, B. (1992). Catalog of Public Fees and Charges. Chicago, Illinois: Government Finance Officers Association.

This catalog lists nearly 1500 different types of public fees and charges that communities have created in order to subsidize services provided by the local government. This would be a good brainstorming resource for communities searching for additional revenue sources.

United States Environmental Protection Agency, Administration and Resources Management. (1990). Paying for Progress: Perspectives on Financing Environmental Protection. Washington, D.C.: Author.

This publication includes essays on the topic of financing environmental protection projects that were written by government officials, conservation groups, financial experts, industry professionals, and academics. The essays examine the changing roles of federal, state, and local governments, creative approaches to environmental financing, and overcoming barriers and introducing incentives.

United States Environmental Protection Agency. Environmental Financial Advisory Board. (1999). Recommendations and Final Report on Financing Opportunities for the Clean Water Action Plan. [Online]. Available: http://www.epa.gov/efinpage/cwapfin5.htm

This report covers environmental financing trends and issues and outlines several finance options that could be useful. The Board emphasizes the need for a long-term financing strategy and recommends the development of a financing guide for implementation of the Clean Water Action Plan.

United States Environmental Protection Agency. Environmental Financial Advisory Board, Environmental Finance Center Network. (1999). A Guidebook of Financial Tools: Paying for Sustainable Environmental Systems. [Online]. Available: http://www.epa.gov/efinpage/guidbk98/index.htm

This web-based guidebook was produced by the Environmental Financial Advisory Board and the Environmental Finance Center Network as a guide to tools that can be used to pay for environmental management. The guidebook discusses available tools for raising revenue, acquiring capital, and building public private partnerships. The guidebook lists methods for lowering the costs of environmental management, encouraging pollution prevention and recycling, starting community-based environmental protection programs, and financing the redevelopment of brownfields. The discussion on tools for raising revenue would be especially helpful to communities that are considering several funding options as it describes each tool and lists advantages and disadvantages of each in a comparison matrix that would help communities determine what funding tool is most appropriate for their situation.

United States Environmental Protection Agency, Office of Water. (1988). Financing Marine and Estuarine Programs: A Guide to Resources, Washington, D.C.: Author.

The U.S. EPA Office of Water developed this financial resource guide for marine and estuarine program managers so that they would be better prepared to finance the protection plans of the National Estuary Program. The guide is divided into three sections: an introduction and overview of finance concepts, an examination of several financial management mechanisms, and ten case studies of financial mechanisms that can be used to fund marine and estuarine programs. This guide is designed to help managers of marine and estuarine programs but the discussion of basic financial terms and possible financing mechanisms would be helpful to stormwater program managers as well.

United States Environmental Protection Agency, Office of Water. (1990). Funding of Expanded Uses Activities by State Revolving Fund Programs: Examples and Program Recommendations, Washington, D.C. Author.

This guide includes a description of the state revolving loan fund program and discusses the availability of those funds for expanded uses activities. The guide includes eight examples of projects that could potentially receive revolving loan fund money. Three of the examples are stormwater management projects, three are agricultural activities, and two are groundwater protection activities.

United States Environmental Protection Agency, Office of Water. (1994). A State and Local Government Guide to Environmental Program Funding Alternatives, Washington, D.C.: Author. [Online] Available: http://www.epa.gov/OWOW/NPS/MMGI/funding.html

This manual discusses several innovative funding sources that have been utilized by local governments to pay for environmental protection. The manual covers state revolving funds, public-private partnerships, grants, leases, taxes, fees, bonds, and pollutant trading programs that have been used around the country and provides a bibliography that lists other references and contact information for each type of funding mechanism.

United States Environmental Protection Agency, Office of Water. (1999). Catalog of Federal Funding Sources for Watershed Protection (Second Edition), Washington, D.C.: Author. [Online]. Available: http://www.epa.gov/OWOW/watershed/wacademy/fund.html.

This publication identifies a number of federal funding sources that can be utilized for watershed protection projects. The federal funding sources included in the catalog are for projects related to: agriculture, coastal waters, disaster prevention and relief, economic development, education and research, environmental justice, forestry, Indian tribes, mining, monitoring, pollution prevention and control, watershed and drinking water source protection, wetlands, and wildlife.

General Articles Concerning Stormwater Utilities:

The articles in this section are general discussions of the stormwater utility idea. They would be most useful to people who are not familiar with stormwater utilities and want to gain a general understanding of what they are and how they are organized. These articles may also provide guidelines on how to create a stormwater utility or present basic survey data. However, they are included in this section because of their concise treatment of the subject.

Chinn, S.P. and Crow, M.E. (1993, June). Shelter from the Storm. Civil Engineering, pp. 58-59.

This article discusses the Phase II NPDES permits for stormwater discharges that were proposed in 1993 for communities with populations of less than 100,000. The author offers suggestions concerning management strategies and financing options that can help reduce compliance costs and make the funding for stormwater projects more equitable.

Cyre, H. J. (1983, April). New Options for Stormwater Financing. APWA Reporter, pp. 20-21.

This article briefly discusses problems with traditional stormwater management and financing methods and identifies some of the elements that should be included in a successful financing strategy. The article also includes a chart that displays several stormwater management program components and the most appropriate financing options to use for each type of project.

Cyre, H. J. (1986, September 23). Developing and Implementing a Stormwater Management Utility: Key Feasibility Issues. Presented at the International Public Works Congress and Equipment Show, New Orleans, Louisiana.

This presentation focuses on legal and political challenges that communities may face when trying to implement a stormwater utility and provides recommendations on how to design a program that can withstand legal and political opposition. The author also presents information about how much the development of a stormwater utility can cost, how to implement the project, how long the implementation process should take, how much revenue the project can produce, and what impact a stormwater utility charge can have on its customers.

Cyre, H. J. (1987, March). Developing a Stormwater Management Utility. APWA Reporter, pp. 8-9.

This article is a summary of Cyre's 1986 presentation at the International Public Works Congress and Equipment Show. The article also provides information about the average amount of revenue generated by stormwater utilities, how much existing utilities charge their customers monthly, and what types of customers generally generate the majority of a utility's revenue.

Cyre, H. J. 2000. The Stormwater Utility Concept in the Next Decade (Forget the Millenium), EPA National Conference on Tools for Urban Water Resource Management and Protection, Conference Draft. Cincinnati, OH: United States Environmental Protection Agency, Office of Research and Development.

This presentation reviews the evolution of the stormwater utility concept over the past twenty-five years and looks ahead to the next decade to see where stormwater management is headed. The presentation outlines problems with how communities have managed stormwater in the past and cites several factors that are increasing the popularity of stormwater utilities around the country including more stringent environmental regulations, higher customer service expectations, and high system repair costs. Cyre predicts that stormwater utilities will become more popular due to the NPDES Phase II regulations and the stormwater utility concept will evolve to become more practical for communities of all sizes.

Davis, K., Hatoum, W., & Rose, D. (1999, June). Prepared for a Rainy Day. Water Environment and Technology, pp. 36-41.

This article discusses the need for stormwater management, describes what a stormwater utility is, and provides guidelines on how to design a utility program. The article answers many of the most common questions that community leaders face when investigating stormwater utilities and would be a good article to read at the beginning of the utility creation process.

Doll, A. (1992). Storm Water Management: Financing Local Programs with a Utility Approach. Finance Alert 16 (1A).

This article discusses three major steps in the design of a stormwater utility: estimating revenue requirements, determining the rate structure, and developing the rate base. The article also discusses the potential for the stormwater utility idea to be used by communities who are subject to the NPDES permit requirements.

Kaspersen, J. (2000). The Stormwater Utility: Will it Work in Your Community? Stormwater 1(1) [Online] Available: http://www.forester.net/sw_0011_utilty.html.

This article examines the feasibility of stormwater utilities and features discussions about legal issues, getting support from the public, setting user fees, and finding additional funding sources. The author interviews several stormwater professionals including the president of the Florida Association of Stormwater Utilities and the director of the Griffin, Georgia stormwater utility.

Keller, B. (2001). Buddy, Can You Spare a Dime? What's Stormwater Funding? Stormwater 2(2) [Online] Available: http://www.forester.net/sw_0103_buddy.html.

This article discusses several funding options that are available to communities for stormwater management programs including stormwater utilities, revenue bonds, federal government grants, special purpose local option sales taxes, state revolving loan funds, impact fees, and system development charges. The author uses his experiences as the director of the stormwater program in Griffin, Georgia to illustrate how each funding source can be used for stormwater management.

Lampe, L., Andrews, H., & Kinsinger, K. (1996, September). 10 Issues in Urban Stormwater Pollution Control. American City and County, pp. 36-53.

This article discusses sources of stormwater pollution, clean water regulations, and ten recommendations on how to minimize stormwater pollution. All of the recommendations would be useful to someone interested in establishing a stormwater utility but stormwater utilities are only briefly mentioned in the final paragraph, a recommendation concerning financing stormwater programs using user fees.

LeClere, J. (2000). Trends in Managing Stormwater Utilities. Watershed Protection Techniques 2(4), pp. 500-502. [Online]. Available: http://www.stormwatercenter.net.

This article summarizes the 1995-1996 Black and Veatch survey of stormwater utilities in the United States and discusses five steps toward the creation of a successful stormwater utility.

Pigott, S. (1993). When the Well Runs Dry- Paying for Storm Water, Water Management in the 90's- A Time for Innovation. Proceedings of the 20th Anniversary Conference of the Water Resources Planning and Management Division of the ASCE, New York, New York, pp. 813-816.

This presentation provides an introduction to stormwater utilities, the benefits customers receive from improved stormwater management, and the reasons communities choose to create utilities rather than rely on other funding sources.

Poertner, H. G. (1981, April). Better Ways to Finance Stormwater Management. Civil Engineering, pp. 67-69.

This article briefly discusses the stormwater programs of several western cities and introduces the idea of financing stormwater programs through user charges and stormwater utilities.

Priede, N. (1990, October). Stormwater Management Through User Fees. American City and County, pp. 38-42.

This article covers the rate structure options for stormwater utilities and discusses how communities could finance their NPDES permit programs using user charges by including a capital improvement budget in the rate structure or using a special assessment based on the amount of property each resident owns.

Roesner, L. & Matthews, R. (1990, February). Stormwater Management for the 1990's. American City and County, pp. 44-

This article discusses a more comprehensive approach to stormwater management and identifies seven elements that should be included in a stormwater management plan. The article discusses how to choose the level of drainage service in order to achieve both flood control and water quality goals. The authors also distinguish between structural and non-structural controls, discuss the importance of master planning, and promote the use of a stormwater utility funding system.

Treadway, E. & Reese, A.L., P.E. (2000, February). Financial Strategies for Stormwater Management. APWA Reporter, pp. 12-14.

This article compares stormwater utilities to general tax revenue-based stormwater management programs and discusses stormwater management funding in light of the NPDES Phase II Stormwater Permit requirements. This article contains cost estimates for different levels of stormwater service and estimates the potential costs to communities that are required to obtain an NPDES stormwater permit.

Warren, R.E. (1986, November). Street Fares. Civil Engineering, pp. 50-53.

This article discusses the increasing popularity of user fees as a method of financing needed infrastructure improvements. The author discusses drainage fees, transportation system fees, and the potential for communities with user fees to issue revenue bonds for capital construction.

Water Environment Federation. (1994, June). Is a Stormwater Utility Right for Your Municipality? Water Environment and Technology, pp. 35-36.

This article is an interview with Hector Cyre, a stormwater management consultant, and Gordon Garner, the executive director of the Louisville-Jefferson County Metropolitan Sewer District in Kentucky. The two men were asked to comment on the popularity of stormwater utilities, the steps involved in creating a utility, how utility projects can be funded, and what responsibilities utilities should undertake.

Wilson, H. (1990, June). The Utility Approach to Stormwater Management. Public Works, pp. 82-83.

This article discusses the utility programs of Cincinnati, Montpelier, Union, Wooster, and Zanesville Ohio and lists thirteen recommendations for communities interested in establishing a stormwater utility.

Stormwater Utility Surveys:

Ten reports of surveys related to stormwater utilities were reviewed for this bibliography. The reports were found to have several common elements. The components of each survey are displayed in Table 1 so that the reader can quickly determine the contents of each and easily locate information about a specific topic.

General Questions

The survey reports usually begin with general questions concerning the location of the utility, the size of the community served by the utility, and the number of accounts held by the utility.

Utility Organization

Next, the reports present information about the organization of the utility, what local government branch the utility is organized under, the responsibilities of the utility, and why the utility was formed.

Billing Information

The mechanics of the billing system are usually presented in questions about the base for the user charges, the type of billing system used, the frequency of billing cycles, the average monthly charge for a single family residence, and the available methods of enforcing payment.

Utility Budget

Finally, most of the reports present data concerning the budget of the utility, the total revenue gained from user charges, the percentage of the utility's budget that is covered by user fees, and the costs involved in forming the utility.

Surveys:

Apogee Research. (1992). (See Stormwater Utility Manuals Section).

Black and Veatch. (1992). Stormwater Utility Survey. Kansas City, Missouri: Author.

Black and Veatch's Management Services Division conducted this survey of fifty-four stormwater utilities in order to provide information concerning the organization and finance of existing utilities to other stormwater management agencies. This survey includes most of the common survey elements (see chart) and contains additional questions concerning operation and management expenses, the financing of capital improvements, types of user classifications, and exemptions used by the utilities. Black and Veatch also identified the most common concerns of the utility administrators surveyed so that utility planners can try to eliminate them early in the utility creation process. This survey was summarized by Robert S. Benson in Water Management in the 90's: A Time for Innovation, the proceedings of the American Society of Civil Engineers Water Resources Planning and Management Division 20th Anniversary Conference held in Seattle, Washington from May 1-5, 1993.

Black and Veatch. (1996). Stormwater Utility Survey. Kansas City, Missouri: Author.

This survey presents information about 97 utilities throughout the United States. The survey results include updates to the questions asked in the 1992 survey and additional information concerning rate increases, customer databases, costs for stormwater originating outside the utility service area, credits and incentives, and the utilities' accounting systems. This survey can be used with the 1992 survey to examine changes stormwater utility programs over a four-year period for those utilities that responded to both surveys.

Florida Association of Stormwater Utilities. (1995). Stormwater Utilities Survey. Tallahassee, Florida: Author.

The Florida Association of Stormwater Utilities conducted this survey of forty-two stormwater utilities located in the state of Florida. The survey is intended to provide information concerning the organization, rate structure, billing practices, revenue, expenses, and operation of existing utilities to other utilities and government officials considering the formation of a new utility. This survey includes most of the common survey elements and offers more detailed information about the utilities' budgets by breaking down utility expenses into seven categories. This survey also provides more detailed rate information including credits, exemptions, and the sources of information that were used to create the billing database. The Florida Association of Stormwater Utilities conducts a survey of Florida utilities every two years. The surveys can be obtained by contacting FASU at http://www.fasu.org.

Florida Atlantic University/ Florida International University Joint Center for Environmental and Urban Problems. (1991). A Survey of Florida Stormwater Utilities. Fort Lauderdale, Florida: Author.

This survey reports data from twenty-one stormwater utilities in the state of Florida. The survey was done for the Florida Department of Environmental Regulation to provide fiscal and administrative information about Florida's existing utilities. The report also makes recommendations to communities interested in creating utilities based on the survey responses and an analysis of the survey data. The report discusses the legal authority for utility creation that exists in Florida and reports basic information about each of the twenty-one utilities in the first two chapters. In Chapter Three, the authors provide an analysis of the survey data using Pearson's r coefficient to examine relationships between different utility characteristics. Finally, the survey gives the reader an overview of existing regional management plans and recommendations concerning the establishment of a stormwater utility. This survey is unique because it provides information on the land uses in each utility service area and provides data concerning the correlation factors between certain utility characteristics.

Greely and Hansen. (1993). Study Memorandum No. 1: Survey of Existing Stormwater Utilities. Camp Springs, Maryland: Author.

This survey was prepared for the City of Richmond, Virginia by Greely and Hansen in order to provide the city administration with information concerning the development, organization, and operation of several successful utilities. The survey was completed by thirteen utilities and provides very detailed information on all of the common survey components and additional information concerning funding mechanisms for capital improvements, interim rate structures, public education programs, what types of properties were included in the customer base, and common problems associated with the creation and management of a stormwater utility.

Lindsey, G. (1988). A Survey of Stormwater Utilities. Baltimore, Maryland: Stormwater Management Administration, Maryland Department of the Environment.

The Stormwater Management Administration of the Maryland Department of the Environment surveyed stormwater utilities in the United States in order to research stormwater utility concept as a possible funding mechanism for local governments in the state that were having trouble meeting water quality goals. This survey covers the elements common to most stormwater utility surveys and contains additional information concerning land uses in each utility area, exemptions and credits, public education programs, and the allocation of maintenance responsibilities. The survey also breaks each utility's operating expenses

down into seven different types of expenses in order to give readers an idea of which expenses generally require a large portion of the budget.

Lindsey, G. (1990). Update to a Survey of Stormwater Utilities, Organizing a Self-Sustaining Utility for Stormwater Services. Alexandria, Virginia: Water Pollution Control Federation. WPCF Annual Conference, Washington, D.C., October 7-11, 1990.

This is an update to Lindsey's 1988 survey that was presented at the Water Pollution Control Federation's Technical Practice Committee workshop in 1990. This survey contains updates on the charges to single family homes, total utility revenues, the percentage of each utility's revenue that is generated by user charges, and the number of accounts served by each utility. This update shows how utilities have kept up with operation costs and how user charges have changed during the two-year period between the two surveys.

Raftelis Environmental Consulting Group. (1998). Water and Wastewater Rate Survey, Charlotte, North Carolina: Author.

This survey covers water, wastewater, and stormwater data for 156 systems in the United States. Since it is not a stormwater utility specific survey, many of the systems included are not stormwater utilities. The survey contains valuable information on thirty-three stormwater programs that would be helpful to planners concerning average monthly user fees, billing frequency, billing methods, the basis for user charges, and annual revenues across the country.

Ungan, N. (1997). A Survey of Stormwater Utilities, Environmental Planning Quarterly 14 (1), 5-7.

Ungan provides a survey of several previous surveys concerning stormwater utilities and briefly summarizes the findings of Lindsey (1988 and 1990), the Florida Department of Environmental Regulation (1991), the Florida Association of Stormwater Utilities (1995), and Raftelis (1996). Ungan also conducted her own survey in order to investigate the extent to which utilities and cities rely on user fees and the socioeconomic characteristics of the areas that have established stormwater utilities. This survey includes most of the common questions (see Table 1) and supplies additional information on the types of property that are charged by the utility, whether or not the community has a master plan, the education level and median household income of the population served by the utility, the overall net debt per capita, and the property tax revenue per capita of the community in which the utility is located in.

Components of Stormwater Utility Surveys

Surveys										
Components	**Lindsey (1988)**	**Lindsey (1990)**	**Black & Veatch (1991-1992)**	**Florida Atlantic University (1991)**	**Apogee (1992)**	**Greely & Hansen (1993)**	**Fl. Assoc. of Stormwater Utilities (every two years)**	**Black and Veatch (1996)**	**Ungan (1997)**	**Raftelis (1998)**
Scope of the Survey	19 utilities (national)	19 utilities (national)	54 utilities (national)	21 utilities (Florida)	50 utilities (national)	13 utilities (national)	42 utilities (Florida)	97 utilities (national)	54 utilities 56 cities (national)	33 stormwater programs (national)
Size and Area of the Community Served	x	x	x	x	x	x	x	x	x	x
Utility Organization	x		x		x	x	x	x		
Utility Responsibilities	x		x		x	x		x	x	
When Utility was Formed	x		x	x	x	x	x			
Reasons for Utility Formation	x					x				
Base for User Fees	x		x	x	x	x	x	x	x	x
Type of Billing System	x		x	x	x	x	x	x	x	x
Billing Cycle	x		x	x	x	x	x	x	x	x
Average Monthly Charge	x	x	x	x	x	x		x	x	x
Total Revenues of the Utility	x	x		x	x	x	x	x	x	x
% of Budget from User Fees	x	x	x	x		x	x	x	x	
Amount of Planning Time Required to Implement Utility	x				x	x				
Costs of Forming Utility	x				x	x				
Enforcement Methods for Non-Payment			x	x		x	x	x		

Stormwater Utility Manuals

The stormwater manuals that were reviewed for this work were found to have several common elements. The contents of each of the manuals are displayed in table form so that the reader can quickly find information about any aspect of the utility creation process (See Table 2).

User Pays

Most of the manuals include a discussion of the user pays idea. In order to create a successful stormwater utility, the ideas of "user" and "benefit" must be adapted to fit activities undertaken by a stormwater program. Accordingly, a user is usually defined as a piece of property and stormwater management services are seen as a benefit received by the property.

Legal Requirements

Stormwater manuals usually include a discussion of the legal requirements for the creation of a utility. This section includes guidelines on how to distinguish the user fee from a tax and how to establish a user charge system that is fair and equitable. It may also include guidelines on the elements that should be included in the local ordinances used to establish the utility and the user charge system. Experience has shown that state law must provide local governments with clear legal authority to establish stormwater utilities.

Needs Assessment and Revenue Requirements

Stormwater utility projects usually involve years of planning so the manuals usually break the planning stage into several steps. They advise stormwater managers to begin by assessing their needs, goals, constraints, and existing resources to better determine the scope of the project. Next, they usually discuss methods of determining the total costs of the project and different financing options. For example, the manual may discuss combining tax dollars from the general fund, state revolving fund money, and utility revenues to finance the stormwater management project.

Master Plans, Public Education, and Steps Toward Implementation

In these sections the manuals discuss administrative concerns such as how to assess long-term planning needs, the importance of public education programs, and steps to take toward the full implementation of the utility. Long-term planning needs include funds for the operation and maintenance of stormwater management systems and major capital improvements that have been scheduled. Experience has shown that public education programs are one of the most important components of a successful utility planning program and most manuals provide examples of ways to educate the public about the need for the new utility, the reasoning behind the user charge system, and how the new utility will improve the quality of life for residents of the service area. The manuals usually advise planners to implement the utility program in steps. Often a relatively low interim rate structure is first implemented to prepare land owners and ensure a smooth transition from the old general fund system to the utility. Then, once a stormwater master plan is adopted that includes a list of specific projects to be undertaken, the stormwater utility rate structure is revised to increase the fees, providing the funding that is needed to construct and operate the projects.

Stormwater Charges, Billing Systems, and Credits

The determination of user charges and the formation of the rate base are two of the most difficult aspects of the utility creation process. These sections include guidelines on how to choose the types of properties to be included in the rate base and the types of properties that should bear the greatest cost burden under the new system. These sections discuss the most common type of rate structures - those that use the impervious area of single family residences as the basis for the rate with the use of equivalent residential units (ERUs) for other land uses. This

information is essential to help utility planners determine what the base charge for the utility billing system should be, how the base charge should be calculated, and how to use the base charge in the calculation of the fees for non-residential properties. Finally, some of the manuals discuss the possibility of offering credits to property owners who install on-site stormwater controls in order to minimize stormwater runoff from their property.

Stormwater Utility Manuals:

Apogee Research, Inc. (1992). Storm Water Utilities: Innovative Financing for Storm Water Management. Prepared for the U.S. EPA Water Policy Branch, Office of Policy Analysis, Office of Policy, Planning, and Management, Washington, D.C.

This manual was prepared for the Water Policy Branch of the Environmental Protection Agency's Office of Policy, Planning, and Management to help local governments find ways to raise sufficient funds to support stormwater management programs and comply with EPA regulations. The manual covers the legal, financial, and institutional components of a stormwater utility and discusses some of the most common obstacles to utility formation. Clean Water Act issues, NPDES permits, and other funding sources are also addressed. The guidelines outlined by this manual are based on a survey of fifty utilities nationwide that includes information concerning the general characteristics, billing systems, revenues, and setup of each utility.

Cyre, H. J. (1982). Stormwater Management Financing. Presented to the International Public Works Congress in Houston, Texas, September 16, 1982.

This presentation covers stormwater funding options and discusses the user pays idea. The author provides examples of the rate structures of Bellevue, Tacoma, Boulder, Denver, and Corvallis and discusses the how to assess a community's needs in the utility creation process.

Cyre, H. J. Five Phases in Developing and Implementing a Stormwater Utility. Water Resources Associates, Inc., Kirkland, Washington.

Cyre provides a brief overview of five phases that he believes should be considered when developing a stormwater utility system. The paper is based on the author's professional experiences working with Water Resources Associates and on the experiences of several communities that have established utilities. This paper does not offer detailed step-by-step information on how to establish a utility but would be very useful for communities that are considering establishing a stormwater utility since it focuses on project acceptance and political issues involved in the early stages of the utility formation process.

Doll, A., Lindsey, G., & Albani, R. (1998). Stormwater Utilities: Key Components and Issues. Proceedings: Advances in Urban Wet Weather Pollution Reduction Conference, Water Environment Federation, June 28-July 1, 1998, Cleveland, Ohio, pp. 293- 302.

This paper, based on the 1992 Apogee Research manual, discusses the common components that are needed to set up a stormwater utility with a special emphasis on the political challenges that utility planners could face. The paper also provides case studies of Austin Texas, Bellevue Washington, and Boulder Colorado.

Florida Association of Stormwater Utilities. Establishing a Stormwater Utility in Florida. Tallahassee, Florida: Author. [Online] Available: http://www.fasu.org.

This manual was complied by the Florida Association of Stormwater Utilities to assist Florida communities interested in establishing a stormwater utility. The manual contains information about what stormwater utilities are, legal issues related to the utility creation process, public acceptance of the new utility, establishing the rate structure, setting up the billing system, and the administration of the new utility. The manual is available online at http://www.fasu.org and hard copies may be ordered from the association's website.

Components of Stormwater Utilities Manuals

Components	Cyre, (1982)	Priede (1985)	Priede and Hobel (1986)	Lindsey (1988)	Water Pollution Control Federation (1990)	Institute for Water Resources (1991)	Apogee (1992)	Water Environment Federation (1994)	Water Resource Associates	Cyre	Florida Association of Stormwater Utilities	Doll, Lindsey, and Albani	Texas Nonpoint Source Book	How to Create a Stormwater Utility
User Pays Idea	x	x	x	x		x	x	x	x		x			x
Legal Requirements for Implementation				x	x	x	x	x	x		x	x	x	x
Needs Assessment	x			x	x	x		x	x	x	x		x	
Methods of Determining Utility Costs	x			x	x	x		x	x		x		x	x
Stormwater Financing Options	x	x	x	x		x	x		x	x	x		x	x
Master Plans					x		x	x	x		x		x	
Public Education Programs				x	x	x	x	x	x	x	x		x	x
Steps Toward Implementation		x	x	x	x	x		x	x	x	x		x	x
Calculating Stormwater Charges	x	x	x	x	x	x	x	x	x	x	x	x	x	x
Billing System	x			x	x	x	x	x	x	x	x	x	x	x
Credits				x		x	x				x		x	x

Institute for Water Resources. (1991). Financing Stormwater Facilities: A Utility Approach. Chicago, Illinois: American Public Works Association.

The Institute for Water Resources published this manual for local officials interested in creating a stormwater utility. It is based on the manual that was written by Lindsey in 1988 for the State of Maryland. This manual is more thorough than most on the calculation of user charges and contains a worksheet that can be used in the calculation of stormwater user charges.

Lindsey, G. (1988). Financing Stormwater Management: The Utility Approach. Baltimore, Maryland: Stormwater Management Administration, Maryland Department of the Environment.

This manual focuses on the financial aspects of utility creation. It is based on *A Survey of Stormwater Utilities* that was written by the same author and discusses briefly all of the aspects of utility creation. This manual contains detailed information concerning how to calculate utility charges for each type of property classification and provides four examples of rate structures based on data from Prince George's County, Maryland that would help decision-makers determine what types of properties should be included in the rate-base.

Pioneer Valley Planning Commission. How to Create a Stormwater Utility (or stormwater management program). Chicopee, Massachusetts: Author. [Online]. Available: http://www.pvpc.org/library/docs/environment/stormwater/storm_util.pdf.

This manual was a cooperative effort between the Pioneer Valley Planning Commission, the City of Chicopee, the Town of South Hadley, the Massachusetts Department of Environmental Protection, and the EPA. The manual contains five briefing papers concerning the key components of the stormwater utility creation process and a detailed step-by-step discussion about how to create a stormwater utility. The manual examines Massachusetts law pertaining to the creation of a stormwater utility and provides draft enabling legislation and a model ordinance that could be used by Massachusetts communities interested in creating stormwater utilities. The manual also includes sample public education materials from the City of Chicopee and the Town of South Hadley that other communities could use to design their own public education programs.

Priede, N. (1985). Financing Stormwater Management Through a Utility. Stormwater Management "An Update" University of Central Florida Environmental Systems Engineering Institute Publication 85-1, 183-187.

This article identifies the key components of a stormwater utility program and uses Tallahassee, Florida as an example of how to determine the size of a single family unit (SFU) and how to determine what rate to charge for a SFU in order to get a desired amount of revenue.

Priede, N. & Hobel, M. (1986, September). The Stormwater Management Utility: An Innovative Financing Method. Florida Municipal Record, 68-70.

This paper is an adaptation of Priede, 1985 that was published in the Florida Municipal Record.

Water Environment Federation. (1994). User-Fee-Funded Stormwater Utilities. Alexandria, Virginia: Author.

This manual was prepared by the Water Environment Federation for professionals interested in creating a stormwater utilities. The authors discuss the technical, financial, and institutional requirements for the successful implementation of a stormwater utility in detail and they stress the importance of public education programs. The manual also contains four case histories that discuss the efforts of Bellevue, Washington; Tulsa, Oklahoma; Cincinnati, Ohio; and Louisville-Jefferson County, Kentucky.

Water Pollution Control Federation. (1990). Organizing a Self-Sustaining Utility for Stormwater Services. Alexandria, Virginia: Author.

This is a collection of the papers that were presented at the WPCF's Technical Practice Committee workshop of the same name. It provides an overview of the elements that are necessary for a successful utility program as they were presented during the workshop and includes information on financing, implementation, legal issues, and the management of stormwater utilities. Two of the papers were case histories of two successful utility programs (Bellevue, Washington and the Louisville-Jefferson County Metropolitan Sewer District, Kentucky) that were presented by representatives of each utility.

Water Resource Associates, Inc. Introduction to Stormwater Utility Financing. Kirkland, Washington: Author.

This paper provides a general overview of the stormwater utility creation process by outlining the basic steps to take in each phase of development and identifying potential pitfalls that should be avoided by utility planners. This resource would be most helpful to planners who are investigating the creation of a utility and are determining the feasibility of the creation of a utility in their area.

Manuals on Utility Creation Sub-Topics:

Fort Wayne Stormwater Task Force. (1993). City of Fort Wayne Stormwater Utility Cost of Service Analysis and Rate Study. City of Fort Wayne, Indiana.

This study was prepared by the Fort Wayne Stormwater Task Force to determine what type of rate structure to use, how to deal with the combined sewer overflow problem, and how to resolve certain billing issues related to condominiums, agricultural properties, shopping malls, apartment complexes, and other special utility customers. The study evaluates several different options for each question and would be a valuable resource for another community facing similar issues.

Gray, N.E. (1995). Lessons Learned: Implementing a Storm Water Public Education Program. Virginia Town and City 30(5), 15-18.

This article discusses Norfolk, Virginia's public information program and provides suggestions to other communities on how to design a successful program. The article reports on the achievements of Norfolk's program, how the program is organized, how much the program costs, and how public education can reduce opposition to stormwater utility fees.

Luken, K.M. & Swenson, S. (2001). A Stormwater Management Plan Your Communities, Businesses, and Residents Will Support. Stormwater 2(2) [Online] Available: http://www.forester.net/sw_0103_plan.html.

This article addresses three important questions that planners must answer to make stormwater management programs a reality in their communities: how much will it cost; who will pay for it; and will the public support it?

Municipal Research and Services Center. (1998). Sample Provisions for Storm Drainage Utility. Seattle, Washington: Author. [Online] Available: http://www.mrsc.org/library/compil/cpstorm.htm

This compilation includes stormwater utility ordinances from cities in Washington, a listing of magazine articles about stormwater utilities, a list of agency contacts, and a list of firms that do sewer and stormwater management studies. The compilation is partially available online at http://www.mrsc.org/library/compil/cpstorm.htmand the entire compilation can be obtained by interlibrary loan to Washington state employees and officials.

Scholl, J. E. (1991, January). Stormwater Management Utility Billing Rate Structure. Water Environment and Technology, 47-49.

This article discusses how to develop the utility's rate structure and provides guidelines on how to decide what types of properties to include in the rate base, the calculation of an equivalent residential unit, and how to choose a billing system.

United States Environmental Protection Agency, Office of Water. (1989). Building Support for Increasing User Fees. EPA publication 430/09-89-006. Washington, DC.: Author.

This manual discusses how to structure public education programs in order to gain public support for user fee increases. The guidelines in this manual would also be helpful to stormwater managers designing a public education program to build support for the establishment of a stormwater utility.

URS Corporation. (1987). Drainage Utility Service Charge Customer Account Development Process San Francisco, California: Author.

This manual concentrates specifically on the details of how to set up a customer account system for a stormwater utility. This manual covers determining the service area boundaries, what types of properties should be considered exempt from the charges, and how to construct the rate structure, what data to use for the rate determinations, who will hold the billing data, and who should be responsible for the billing system.

Other Topics Concerning Stormwater Utilities

The papers and articles in this section examine specific topics concerning stormwater utilities. They would be very helpful to utility planners that are looking for information about a specific aspect of the utility creation process. They are usually academic or professional pieces that provide a detailed analysis of the subject.

Center for Watershed Protection. (2000). The Economics of Stormwater Treatment: An Update. Watershed Protection Techniques 2(4), pp. 395-499. [Online]. Available: http://www.stormwatercenter.net.

This article discusses a study undertaken in 1996 by the Center for Watershed Protection to update cost data for stormwater management practices. The study looked at several different pond designs, bioretention areas, sand filters, and infiltration trenches to see if the costs of constructing stormwater management facilities increased over the last decade and find the causes of the cost increases, if any. The study also looked at economies of scale in stormwater practices and determined typical design and engineering costs as a percentage of basic construction costs.

Doll, A. & Lindsey, G. (1999). Credits Bring Economic Incentives for Onsite Stormwater Management. Watershed and Wet Weather Technical Bulletin 4(1), 12-15.

Doll and Lindsey discuss the economic efficiency of allowing property owners to choose to pay the stormwater utility charge that would be applicable to their property or implement on-site stormwater management controls in order to be eligible for reduced charges. The authors cite the experiences of several communities note that many of the credits have never been used, typically due to standards that are difficult to achieve with inexpensive technology. The authors also point out that credits would be more efficient if they were based on runoff quality instead of quantity but the data needed to implement such a credit system is difficult and expensive to collect.

Doll, A., Scodari, P., & Lindsey, G. (1998). Credits as Economic Incentives for On-Site Stormwater Management: Issues and Examples. Presented at the EPA National Conference on Retrofit Opportunities for Water Resource Protection in Urban Environments in Chicago, Illinois, February 9-12, 1998, pp. 113- 117.

This presentation discusses the effectiveness of stormwater utility credits for onsite stormwater control systems. The presentation compares the credit systems of thirteen communities and discusses the impact the credits have had on stormwater utility revenues and water quality.

Indiana Department of Natural Resources. (1995). The Indiana Conservancy Act. Indiana Code 14-33.

This document is the section of the Indiana Code that provides the legal authority necessary to implement a stormwater utility in Indiana. The Indiana Conservancy Act outlines when a conservancy district can be established, how it may be established, what areas may be included in the district, and information concerning how to organize and manage the district. This would be a useful resource for someone who is researching how to establish the legal authority needed to start a stormwater utility program.

Jorgensen, B.S. & Syme, G.J. (2000). Protest Responses and Willingness to Pay: Attitude Toward Paying for Stormwater Pollution Abatement. Ecological Economics 33(10), 251-265.

This journal article discusses a contingent valuation study that was conducted in four Australian cities to examine the public's willingness to pay for stormwater pollution abatement.

Lindsey, G. & Doll, A. (1998). Financing Retrofit Projects: The Role of Stormwater Utilities. From the proceedings of the EPA National Conference on Retrofit Opportunities for Water Resource Protection in Urban Environments, Chicago, Illinois, February 9-12 1998.

This paper evaluates stormwater utilities as a possible funding source for stormwater retrofit projects. The authors discuss the implications of the EPA's stormwater regulations and discuss the utility concept's advantages and disadvantages as compared to a property tax assessment. Finally the authors point out the political challenges involved in implementing user charge systems for stormwater using Vincennes and Indianapolis, Indiana as examples.

Lindsey, G. (1990). Charges for Urban Runoff: Issues in Implementation, Water Resources Bulletin. 26(1), 117-125.

This article compares stormwater charges collected based on property taxes to funding from user charges to evaluate the equity, efficiency, and acceptability of each system using Maryland's Chesapeake Bay Nutrient Reduction Plan as an example. In order to evaluate equity, three types of charge systems were compared in order to see which types of property owners would bear the largest burdens under each. In order to evaluate efficiency, four different charge systems were compared to determine how high user charges would have to be in order to induce property owners to construct on-site stormwater controls. Finally, to evaluate acceptability, assumptions about the behavior of elected officials were compared to the benefits of each charge system in order to determine which payment options would be the most politically feasible.

Meyer, S.P., Salem, T.H., & Labadie, J.W. (1993). Geographic Information Systems in Urban Storm-Water Management. Journal of Water Resources Planning and Management. 119(2), 206-227.

This journal article discusses using GIS systems to prepare, store, update, analyze, and display urban storm water modeling data. The article concludes with a case study of the Greenbriar subdivision located in Fort Collins, Colorado.

Minner, M. et. al. (1998). Cost Apportionment for a Storm-Water Management System: Differential Burdens on Landowners from Hydrologic and Area-Based Approaches. Applied Geographic Studies. 2(4), 247-260.

This research compares five different cost apportionment methods in order to find the most equitable cost distribution method to use for the funding of a stormwater management system. The research was done using data from the Cuppy-McClure watershed near West Lafayette, Indiana where land use is changing from agricultural to commercial and residential with the expansion of the city of West Lafayette. The researchers compared per-acre charges with charge systems based on runoff coefficients, the rational method, the TR-55 method, and the L-THIA method to find out which landowners would bear the heaviest cost burden in each scenario.

Palmer, C. D. (1993). Development and Implementation of Stormwater Utilities in Texas Cities. Water Management in the 90's- A Time for Innovation. Proceedings of the 20th Anniversary Conference of the Water Resources Planning and Management Division of the ASCE, New York, pp. 809-812.

This presentation discusses stormwater utility enabling legislation in Texas and the legal constraints that Texas communities should be aware of when designing a stormwater utility ordinance. The presentation also provides very general information on how most cities in Texas have chosen to design their utility programs.

Water Resources Institute. (1999). State Supreme Court Reverses Durham Stormwater Fee Decision. [Online]. Available: http://www2.ncsu.edu/ncsu/CIL/WRRI/news/nd99stormfees.html.

This article discusses the North Carolina State Supreme Court's decision in August of 1999 that concludes that North Carolina law limits the amount that can be charged by a stormwater utility to the amount of money necessary to maintain the storm drain system and that fees charged by a stormwater utility cannot be used for water quality programs related to stormwater.

Wilson, L. & Lindsey, G. (1995). Authority for Local Stormwater User Fees in Indiana. Indianapolis, Indiana: Center for Urban Policy and the Environment, Indiana University- Purdue University Indianapolis.

This publication explains the stormwater utility concept and discusses the statutory authority for the creation of stormwater utility fees under Indiana law.

Impact Fees

Developer impact fees and system development charges are another option for communities looking for ways to pay for stormwater programs. They are most commonly used for water and wastewater system connections or police and fire protection services but they have recently been used to fund school systems and pay for the impacts of increased traffic on existing roads. Public works projects like the extension of a water line to a new development or the construction of a new sewage treatment facility were once subsidized by federal grants. However, these grants are now low interest loans so more of the cost burden has been transferred to local governments. Faced with the loss of a significant amount of federal funding, local governments have been struggling to find ways to pay for the infrastructure that is needed for new developments without raising taxes and angering the public. Impact fees place the costs of new development directly on developers and indirectly on those who buy property in the new developments. Impact fees free other taxpayers from the obligation to fund costly new public services that do not directly benefit them. They also can be used to promote smart growth in communities because they subject developers to more of the costs involved in a new project.

Impact fees can be charged to fund new storm drainage systems but the amount of money available is dependent on the growth rate of the community. There are also legal constraints that communities must consider when implementing impact fees of any kind. Impact fees have been challenged as takings or illegal taxes in several communities so the fee must be designed carefully in order to show that the fee amount is justified and that the people paying the fee are receiving the benefits of it. Impact fees have also been challenged on the premise of intergenerational equity for requiring new developments to pay their own way while older developments had their infrastructure needs financed by the government.

Impact fees are a helpful funding tool that can be used in conjunction with a stormwater utility or other funding mechanisms. For example, residents of a new development can pay impact fees or system development charges before the construction of their new home or business and remain utility customers after the building is completed. To ensure equity, the community must eliminate possible overpayments by people moving within the community.

The materials concerning impact fees have been divided into four categories. The materials in the general section cover the subject of impact fees, discuss their effects on the economy of a community, and outline how to determine the fee structure. The impact fee surveys discuss how impact fees have been used across the country. The academic articles provide very in-depth analyses of various topics including the economic impact of the fees and the creation of a legal, equitable development fee. The references in the stormwater specific section discuss how to apply the impact fee idea to storm drainage systems and provide more detailed information on how to develop the rate structure and how to protect the system from legal challenges.

General- Impact Fees and System Development Charges

Kolo, J. & Dicker, T.J. (1993). Practical Issues in Adopting Local Impact Fees. State and Local Government Review. 25(3), 197-206.

Kolo and Dicker discuss the concept of impact fees and review many of the most important court cases concerning the implementation of an impact fee system. They also discuss the advantages and disadvantages of using impact fees and provide readers with guidelines on how to implement impact fees successfully.

Municipal Research and Services Center. (1998). Impact Fee Information Part 1 Sample Ordinances. Seattle, Washington: Author. [Online] Available: http://www.mrsc.org/library/compil/cpimpact1.htm

This compilation contains impact fee ordinances from selected Washington state communities. The ordinances are organized by impact fee type into categories for multiple capital facilities, schools, transportation, community parks and roads, and park and recreation facilities. The compilation is partially available online at http://www.mrsc.org/library/comp il/cpimpact1.htmand the full compilation is available through interlibrary loan to any Washington state employee or official.

Municipal Research and Services Center. (1999). Impact Fee Information Part 2 General Information. Seattle, Washington: Author. [Online] Available: http://www.mrsc.org/library/compil/cpimpact2.htm

This compilation contains a listing of publications about impact fees. The publications are divided into three categories: overview articles, ordinances and fee schedules, and rate studies. This compilation is partially available online at http://www.mrsc.org/library/compil/cpimpact2.htm and the full compilation is available through interlibrary loan to any Washington state employee or official.

National Association of Home Builders. (1997). Impact Fee Handbook. Washington, D.C.: Home Builder Press.

The National Association of Home Builders published this handbook for developers who are interested in blocking impact fee legislation. The handbook contains information on what impact fees are, why local governments use them, and the weaknesses of many fee structures. This book would be especially helpful to communities interested in implementing an impact fee system because it outlines the concerns of developers and the most convincing arguments against impact fees. The manual also contains case studies and examples of impact fee enabling laws that have been enacted in several states.

Nelson, A. C. (Ed.). (1988). Development Impact Fees. Chicago, Illinois: Planners Press.

This book contains information on the history of system development charges (SDC's), case studies of four communities that have implemented SDC's, legal considerations for communities interested in SDC's, the effect of SDC's on the local economy, and how to calculate impact fees. The results of several impact fee surveys are reported that could be helpful to communities that are interested in finding out general trends in the construction of impact fees and several model impact fee-enabling statutes and ordinances are provided.

The book also discusses several of the common concerns related to impact fees including their tendency to place a greater burden on low-income households and their possibly disproportionate burden on residents of new developments. This book contains little information about stormwater impact fees, however much of the discussion can be applied to the stormwater case.

Ross, D. H. & Thorpe, S.I. (1992). Impact Fees: Practical Guide for Calculation and Implementation. Journal of Urban Planning and Development 18(3), 106-118.

Ross and Thorpe discuss the history of impact fees and outline the legal constraints that communities must be aware of before implementing an impact fee system. They also discuss the advantages and disadvantages of two general methods for impact fee calculation- inductive and deductive calculations. The authors identify 22 types of facilities that can be financed using impact fees and provide suggestions of what type of impact unit to use for each. The article concludes with steps to take toward the implementation of impact fees and recommendations for the success of the program.

Snyder, T. P. & Stegman, M.A. (1986). Paying for Growth: Using Development Fees to Finance Infrastructure. Washington, D.C.: Urban Land Institute.

This book reviews several financing alternatives including taxes, user charges, development fees, and special benefit districts. The authors evaluate the equity and efficiency of several different financing options and identify legal, political, and administrative challenges that communities could face with each financing option. The book focuses on development fees and provides information on how to set different types of fees and how to assess their impact on the price of housing. The authors end with a case study of Raleigh, North Carolina's development fee system.

Surveys Concerning Impact Fees

Moulder, E. R. (1993). Local Government Infrastructure Financing, Special Data Issue. Washington D.C.: International City/County Management Association.

This is a survey of cities and counties with populations greater than 10,000 that identifies how those communities finance their infrastructure. The 863 communities that responded to the survey answered questions about what forms of financing they use, whether or not they use impact or development fees, what types of fees they charge, and which customers the fees are charged to. The communities also reported whether or not they allowed developers to make non-cash payments in lieu of impact fees, if they employed any cost shifting methods from 1987-1991, which cost shifting methods resulted in the greatest savings, and if the community operated under growth management restrictions. The responses of each community are outlined in table form so that readers can see the responses of each individual community in addition to the summaries.

Simmonds, K. C. (1993). Impact Fees: A Method of Paying for Growth in Florida. International Journal of Public Sector Management 6(3), 3-16.

Simmonds begins by discussing the impact fee concept and the legal and political issues related to the implementation of an impact fee system. Next, he discusses the results of several impact fee surveys that were conducted in Florida by the Advisory Commission on Intergovernmental Relations (ACIR) that include information concerning what types of programs are funded by impact fees, what level of government generally imposes impact fees, and how much impact fees increase the price of a single family home.

Academic and Professional Articles Concerning Impact Fees

Leitner, M. L. & Strauss, E.J. (1988). Elements of a Municipal Impact Fee Ordinance, with Commentary. APA Journal 54 (Spring), 225-231.

The authors provide a sample municipal impact fee ordinance and provide comments on the importance of each ordinance section. They reference several important court cases and provide readers with several options to use in the construction of their own ordinances.

Lippai, I. & Heaney, J.P. (2000). Efficient and Equitable Impact Fees for Urban Water Systems. Journal of Water Resources Planning and Management 126(2), 75-84.

Lippai and Heany use the n-person cooperative game theory to allocate the costs of the construction of a new water system fairly among current and future users. The research was not done using a stormwater system model but the theory can be applied to stormwater systems by using the appropriate stormwater data.

Nelson, A.C., Frank, J.E., & Nicholas, J.C. (1992). Positive Influence of Impact-Fee in Urban Planning and Development, Journal of Urban Planning and Development 118(2), 59-64.

This article examines who pays for impact fees - the seller of undeveloped urban land or the buyer. The authors determine that impact fees have a positive effect on the land market because they increase developers' profits and boost the urban land market, thereby increasing selling prices for undeveloped urban land.

Nicholas, J. C. (1992). On the Progression of Impact Fees. APA Journal 58(4), 517-524.

This article discusses possible ways to make impact fee assessments less regressive (more proportional to a household's ability to pay). Most impact fees are calculated by assigning a portion of the costs of the new infrastructure to each type of housing unit and commercial property in the developing region with no regard for the fee recipient's ability to pay. Nelson examines three different bases for residential impact fees in an attempt to find a less regressive structure: unit value, number of bedrooms, and square feet of living area. Examples are presented from Sarasota County, Florida's road impact fee, Broward County, Florida's park impact fee, and Palm Beach County, Florida's park impact fee.

Stewart, H. A. (1988). So You Want to Adopt a Development Impact Fee Ordinance. APA Journal 54 (Winter), 71-72.

This article is a humorous look at the political struggles involved in the adoption of an impact fee ordinance that is written from the perspective of an attorney who was involved in the ordinance creation process in Orange County, Florida. The author provides an outline of three phases in the preparation of a development impact fee ordinance: the "hell no we won't pay" phase, the "let's study this problem" phase, and the "love it to death" phase. The article provides readers with a clear understanding of how the political process will operate when dealing with the impact fee ordinance and would be a helpful wake-up-call for community planners to read before introducing the idea of impact fees to a local government body.

Nelson, A. C. (1995). System Development Charges for Water, Wastewater, and Stormwater Facilities. Boca Raton, Florida: CRC Press.

This book contains a chapter on how to calculate charges for stormwater facilities using the regional facilities and fee in-lieu of construction approaches and provides a discussion of six other ways to calculate system development charges that can be applied to other types of impact fees. Nelson also discusses the evolution of SDC's, legal challenges to SDC's, and common concerns related to the implementation of SDC's. The author discusses the rational nexus criteria for the legal implementation of a SDC in detail and references several key court cases concerning impact fees that would be helpful to communities that are constructing their own impact fee systems.

Permit Fees

Morandi, L. (1992, May). Wastewater Permitting and Finance: New Issues in Water Quality Protection. NCSL State Legislative Report.

This report includes a discussion of water pollution regulations, stormwater permit requirements, combined sewer overflows, and funding mechanisms. The author provides brief discussions of several stormwater management and combined sewer overflow programs and discusses the increasing popularity of the use of fees to fund clean water programs. Permit fees from New York, Colorado, Washington, and Oregon are used as case studies in order to show readers several different approaches that can be used.

Case Studies of Stormwater Program Financing

Abbott, W. H. Jr. (1985). Ann Arbor Stormwater Utility First in State. Unpublished work submitted to the Michigan Municipal League.

This is a brief paper concerning the creation of the Ann Arbor, Michigan stormwater utility and it's first year of operation. The paper covers the reasons that the utility was formed, how the rate structure was set, and the budget for the utility in its first year.

Apogee Research. (1994). Benefits of Storm Water Management: Case Studies of Selected Communities. Prepared for the U.S. EPA Water Policy Branch, Office of Policy Analysis, Office of Policy, Planning, and Evaluation, Washington, D.C.

This paper provides case studies of five stormwater management programs: Ann Arbor, Michigan; Austin, Texas; Bellevue, Washington; Boulder, Colorado; and Buzzards Bay, Massachusetts. It contains a discussion of the benefits of stormwater management, summarizes each program and its funding mechanisms, and provides an overview of existing federal programs for urban stormwater management. A discussion of the most common components of stormwater utility programs is also included using a similar format to the Apogee Research manual that was completed in 1992. An annotated bibliography of resources concerning storm water utility pricing strategies is included at the end of the paper that could guide readers to other useful papers on the topic.

Atherton, T. & Kutz, T. (1995, January). Utility Solves Stormwater Problems, American City and County. pp. 38-39.

This article discusses the establishment of Fort Wayne, Indiana's stormwater utility program. The Fort Wayne Stormwater Utility Task Force was formed to examine issues concerning the development of a billing system, the data to be used in creating the billing system, and credits for the implementation of on-site stormwater control systems.

Brown, D.S. (1997). Using GIS Technology in the Development and Maintenance of a Stormwater Utility. GIS/LIS '97 Conference Proceedings.

This conference paper describes how the city of Columbus, Ohio has used GIS technology to develop and maintain its stormwater utility.

Brown, L.A. (1980). Political Aspects of Urban Stormwater Management. Journal of the Water Resources Planning and Management Division 106(WR1), 265-273).

This journal article discusses the experiences of DeKalb County, Georgia from 1973-1979 when the County was developing plans to address drainage and flooding problems in urbanizing areas.

Call, C. H. (1992). A Storm Water Utility Case Study, Salt Lake City, Utah, Water Resources Planning and Management: Saving a Threatened Resource- In Search of Solutions. Proceedings of the Water Resources Sessions at Water Forum '92. New York: American Society of Civil Engineers, pp.792-797.

This presentation discusses the stormwater utility that was established in Salt Lake City in 1991. It includes information concerning the stormwater utility's budget and rate structure and provides a sample site plan with the corresponding drainage calculations. This presentation deals mainly with the planning of the utility and its first six months of service so it would be helpful to a community in the beginning stages of developing a stormwater management plan.

Cameron, J., C. Cincar, M. Trudeau, J. Marsalek, and K. Schaefer. (1999). User Pay Financing of Stormwater Management: A Case-Study in Ottawa-Carleton, Ontario. Journal of Environmental Management 57: 253-265.

This article examines the feasibility of implementing a user pay financing system for stormwater management in the Regional Municipality of Ottawa-Carleton, Ontario (RMOC). The authors review the results of the 1996 Black and Veatch survey of stormwater utilities in the United States and discuss the experiences of Regina, Saskatchewan- the only Canadian city to implement a stormwater user charge to-date. The authors created a spreadsheet model to see how revenue from a stormwater user charge in the RMOC would change under several different land use assumptions and concluded that charges would be comparable to those in United States cities.

Collins, P.S. (1996, March). Financing the Future of Storm Water. Civil Engineering, pp. 64-66.

This article discusses the circumstances surrounding the establishment of a stormwater utility in Sarasota County, Florida and two interlocal agreements between the county stormwater utility and several cities within Sarasota County.

Collins, P.S., Marchand, J. P., & Daughters. D. (1993, June). Consolidating Stormwater Management: An Efficient Approach. Public Works, pp. 52-53, 112.

Sarasota County, Florida's NPDES project manager, stormwater utility manager, and city engineer wrote this article about the organization of the Sarasota County stormwater utility and the county's joint NPDES permit application with the Florida Department of Transportation and the cities of Sarasota, Venice, North Port, and Longboat Key. The joint NPDES application and stormwater utility allow for consistent stormwater policies to be applied to the entire region and reduce the costs of compliance with the NPDES permit requirements by consolidating the region's stormwater management efforts into one agency.

Developers Pay Up in Pearland. (1999). American City and County 114(5) p. 22.

This is a short article about the stormwater in-lieu-of fee that was recently implemented by Pearland, Texas. Previously, developers building in flood hazard areas were required to build on-site holding ponds but developers building in other areas were not required to build any stormwater detention facilities. The

new program requires all developers to choose between building their own detention facilities or purchasing space in existing city detention facilities.

Diessner, D. (1993). Storm Water Utility Experience in Bellevue, Washington. Water Management in the 90's- A Time for Innovation. Proceedings of the 20th Anniversary Conference of the Water Resources Planning and Management Division of the ASCE, New York. pp. 817-820.

This presentation outlines the formation of the first stormwater utility in the United States in Bellevue, Washington. The presentation discusses the reasons that Bellevue chose to form a utility, the stormwater problems the community was facing at the time, and the steps that the community took to implement the utility project. The utility is responsible for water quality, flood control, and the operation and maintenance of the storm sewer system. In addition, the utility enforces codes related to stormwater and manages the storm sewer capital improvement program. The presentation concludes with a brief discussion of the difficulties that communities could face in the utility planning process and some of the advantages of a utility program.

Engemoen, M., P.E.& Krempel, R.E., P.E. (1983). A Utility Approach to Comprehensive Storm Water Management. Presented at the 1983 International Symposium on Urban Hydrology, Hydraulics, and Sediment Control.

This paper is a detailed case study of Fort Collins, Colorado's experiences with establishing a stormwater utility that includes a discussion of every phase of the development of the stormwater utility.

England, Gordon, P.E. (2001). Success Stories of Brevard County, Florida Stormwater Utility. Journal of Water Resources Planning and Management 127(3) 180-185.

This article discusses several retrofitting projects that were funded by Brevard County, Florida's stormwater utility and the lessons that were learned by the utility staff from the time the utility was implemented in 1990 to the present.

Ferrari, L. (1987, August). Surface Water Fees Used to Reduce Urban Flooding. Public Works, pp. 66-67.

Ferrari describes the creation of a stormwater utility in King County, Washington. This paper contains a good description of the award-winning public education programs that King County used to ensure the success of its' program and provides an overview of the utility's organization, rate structure, and goals.

Godfrey, K.A. Jr. (1985, December). Tampa Does it with Mirrors. Civil Engineering, pp. 40-43.

This article is a general discussion of Tampa, Florida's storm drainage and transportation utilities that were in the planning stages at the time that this article was published.

Hargett, C. W. Jr. P.E. (1992, September). Creating a Stormwater Utility. Public Works, pp. 65-68, 82.

This article describes St. Petersburg, Florida's utility creation process. The article includes information about the reasons the city decided to create a utility and the utility's billing system, user fees, and public education programs.

Honchell, C. V. (1986, January). Creating a Storm Drainage Utility. APWA Reporter, pp. 10-11.

This article discusses how Roseville, Minnesota created a stormwater utility and provides recommendations for other communities on how to plan and gather support for utility projects.

Keller, B. (1999, October). Georgia City Pioneers Stormwater Utility Fee. Coastlines: Information About Estuaries and Near Coastal Waters. [Online] Available: http://www.epa.gov/owowwtr1/estuaries/coastlines/oct99/gapioneers.html

Griffin, Georgia was the first city in the state to establish a stormwater utility. This article outlines their pioneer program, its budget, and the phases of development the city used to make the program a success.

Keller, B. (2000, February). Stormwater Utility Case Study. Georgia Municipal Association Web Site. [Online]. Available: http://www.gmanet.com/research/resources/environment.stormwater.shtml.

This article discusses the stormwater utility experiences of Griffin and Atlanta, Georgia.

Keller, B. (2001). Public Involvement and Education: The Critical Elements to the Success of Stormwater Utilities. Doctoral Dissertation. Kennedy-Western University School of Engineering.

This doctoral dissertation examines the importance of public involvement and education in the success of a stormwater utility program. The author reviewed the current literature concerning stormwater utilities and conducted a descriptive study with four hypotheses related to staff involvement, elected official support, general public support, and program champions.

Keller, B. & Reese, A.J. (1999, February). Town Finds Answer to Drainage Problems by Forming a Stormwater Utility. APWA Reporter, pp. 22-23.

This article discusses the establishment of a stormwater utility in Griffin, Georgia. Keller and Reese discuss the advantages of stormwater utilities, some of the reasons that Griffin chose to implement a utility, and why the Griffin program has been successful.

Lindsey, G., Rubeleske, J., & Rummel, M. (1996). Issues and Problems in Implementing Stormwater Charges: A Watershed Approach in Vincennes, Indiana. Assessing the Cumulative Impacts of Watershed Development on Aquatic Ecosystems and Water Quality, Proceedings of a National Symposium March 19-21, 1996, Chicago, Illinois.

This paper is a discussion of the problems encountered by planners in Vincennes, Indiana when trying to establish stormwater charges for the city and surrounding watershed. It would be very instructional for planners interested in creating utilities in rural areas as it discusses several problems that are unique to small communities including limited budgets and outdated local record-keeping.

Maniatis, M. (1990). Stormwater Management. MIS Report 22(11), Washington, D.C.: International City Management Association.

This outlines the necessary elements of a city stormwater management program and provides case studies of Bellevue Washington, Cincinnati Ohio, Asheville North Carolina, and Port Orange Florida. The report focuses on stormwater utility programs and provides useful information on how each of the four case study cities chose to design their rate structures and organize their departments.

Nazarenus, D., & Kimsey, J. Financing the Floodplain. City of Fort Collins, Colorado.

The authors provide three examples of fee structures that are used for basins in Fort Collins, Colorado and compare the planned budget to the actual expenses for the years 1983 to 1987 for the most heavily developed basin. The authors identify costs which deviated from the original budget and provide recommendations for other cities that are interested in utilities and attempting to create their own fee structures and master plans.

Niermeyer, J., P.E. (1993). NPDES Municipal Storm Water Permit: A Utility Approach. Water Management in the 90's - A Time for Innovation. Proceedings of the 20th Anniversary Conference, Water Resources Planning and Management Division, ASCE, New York, 805-808.

This presentation is a brief discussion of the stormwater utility that was established in Salt Lake City, Utah in order to fund the city's NPDES stormwater permit application. The presentation contains information about why the city chose to form a stormwater utility and why the city organized the utility under the city's department of public utilities rather than make the program independent.

Null, R. (1995, August). User Fees - The Key to Managing Stormwater Costs. Public Works, pp. 42-43.

This article discusses the reasons that Santa Cruz, California chose to create a stormwater utility, the legal authority under which the utility was created, and how user charges were calculated.

Rice, N.B., Juanitas, C., Kleeburg, C. (1997). 1997-1998 Drainage and Wastewater Financial Plan. Presentation concerning an increase in drainage rates, Seattle, Washington.

This presentation contains information about three possible options for the increase of Seattle, Washington's drainage rate, historical information about Seattle's utility budget, and information about the drainage rates charged by other Washington communities. The report also contains information about what types of properties are included in the rate structure, the contribution of each property class to the utility's budget, and the customer base of the drainage utility.

Stitt, T.A. (1986). Stormwater Management Utility: An Innovative Approach to Drainage Problems of a Mature City. Presented at the APWA International Public Works Congress and Equipment Show.

This presentation discusses the experiences of Cincinnati, Ohio. Stitt reviews why Cincinnati decided to create a stormwater utility, some of the keys to the success of their utility program, and the city's maintenance master plan.