UNC ENVIRONMENTAL FINANCE CENTER

ARC Appalachian Regional Commission

# Drinking Water and Wastewater Infrastructure in Appalachia

## An Analysis of Capital Funding and Funding Gaps

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# Abbreviations

| | |
|---|---|
| AMSA | Association of Metropolitan Sewerage Agencies |
| ARC | Appalachian Regional Commission |
| ASIWPCA | Association of State and Interstate Water Pollution Control Administrators |
| AWWA | American Water Works Association |
| CBO | Congressional Budget Office |
| CDBG | Community Development Block Grants program (of HUD) |
| CIFA | Council of Infrastructure Financing Authorities |
| CSO | Combined sewer overflow |
| CWNS | Clean Watersheds Needs Survey (by EPA) |
| CWSRF | Clean Water State Revolving Fund (of EPA) |
| DENR | Department of Natural Resources (of North Carolina) |
| DWNS | Drinking Water Needs Survey (by EPA) |
| DWSRF | Drinking Water State Revolving Fund (of EPA) |
| ECOS | Environmental Council of the States |
| EDA | Economic Development Administration |
| EFC | Environmental Finance Center (of UNC) |
| EPA | Environmental Protection Agency |
| FIPS | Federal Information Processing Standard |
| HUD | U.S. Department of Housing and Urban Development |
| HUD–CDBG | U.S. Department of Housing and Urban Development, Community Development Block Grants program |
| KIA | Kentucky Infrastructure Authority |
| LIHEAP | Low Income Heating Assistance Program |
| LIWAP | Low Income Water Assistance Program |
| MDE | Maryland Department of Environment |
| MGD | Million gallons per day |
| MHI | Median household income |
| NASBO | National Association of State Budget Officers |
| NPDES | National Pollutant Discharge Elimination System |
| OH PWC | Ohio Public Works Commission |
| OWDA | Ohio Water Development Authority |
| POTW | Publicly owned treatment works (a facility) |
| PSC | Public Service Commission |
| PUMA | Public Use MicroSample Area (of the Census Bureau) |
| PUMS | Public Use MicroSample (of the Census Bureau) |
| RUS | Rural Utilities Service, USDA |
| RWA | Regional Water Authority |
| SDWA | Safe Drinking Water Act |

| | |
|---|---|
| SDWIS | Safe Drinking Water Information System |
| SF | Summary File (of the Census Bureau) |
| SRF | State Revolving Fund |
| STAG | State and Tribal Assistance Grants |
| UNC | University of North Carolina |
| UNCEFC | University of North Carolina Environmental Finance Center |
| USDA | U.S. Department of Agriculture |
| USDA–RUS | U.S. Department of Agriculture, Rural Utilities Service |
| USGS | U.S. Geological Survey |
| WIN | Water Infrastructure Network |
| WRIS | Water Resource Information System (of KIA) |
| WVIJDC | West Virginia Infrastructure and Jobs Development Council |
| WWTP | Wastewater Treatment Plant |

## About the University of North Carolina Environmental Finance Center

The University of North Carolina Environmental Finance Center is an interdisciplinary center for teaching and policy analysis, based at the School of Government at the University of North Carolina at Chapel Hill. Faculty and students working with the center concentrate on helping improve the financing and the delivery of environmental goods and services. For more information, visit www.efc.unc.edu.

The center is one of a group of university-based centers that concentrate on problems in the financing of environmental services. The Environmental Protection Agency established the centers to bring the work of researchers in the universities directly to bear on local environmental problems. For more information on the Environmental Finance Center Network, visit www.epa.gov/efinpage/efc.htm.

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## Executive Summary

The way in which water and wastewater services are funded in the United States changed dramatically from the 1970s to the 2000s. The country moved from a sizable federal grant program that accompanied the passage of the 1972 Clean Water Act to a more complex system in which a smaller amount of funding is delivered through grants and loans administered by a wide variety of federal and state agencies. Around 2000, several national studies concluded that the level of spending on water and wastewater services in this new, more complex system is inadequate to meet the nation's needs.

In light of these conclusions, the Appalachian Regional Commission (ARC), one of the remaining important sources of federal grants for water and wastewater infrastructure in Appalachia, contracted with the University of North Carolina Environmental Finance Center (UNCEFC) to assess the needs and the gaps in funding for water and wastewater infrastructure in Appalachia.[1] The overall goal of the study was to help ARC, as well as other policy makers at local, state, and federal levels who are concerned about the adequacy of water and wastewater services in Appalachia, understand how these services now are provided and funded and what might be done to meet the needs of the region more effectively.

Some of the study's quantitative findings reinforced commonly held beliefs, but others were surprising. In almost every aspect, Appalachia today resists its historical characterization of homogeneity. Its water and wastewater services are no exception. The types and the sizes of water systems, the methods of disposing of wastewater, state-originated funding programs, and institutional models for providing services vary widely across the states and the subregions of Appalachia.

Significantly fewer households in Appalachia have access to centralized drinking water and wastewater services than households in the rest of the country do. On a per capita basis, documented infrastructure needs for Appalachia are on par with the rest of the country. However, the financial capacity of households and communities to meet those needs lags significantly behind the national average. As a result, households in Appalachia with access to centralized systems pay a much higher percentage of their

[1] For ARC purposes, Appalachia consists of 410 counties, encompassing all of West Virginia and parts of Alabama, Georgia, Kentucky, Maryland, Mississippi, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, and Virginia—an area of 200,000 square miles and about 23 million people.

income for water and wastewater services than households in the United States as a whole do, on average.

Some financial management strategies that have helped more advantaged communities in the country reduce the capital gap (for example, asset management and improved pricing) hold limited promise for many disadvantaged Appalachian communities. For many of the smallest and most impoverished communities, nothing short of large grants will bridge existing infrastructure gaps. Nevertheless, grant funding does not appear to be the whole solution. The communities most in need of support often lack the planning capacity to effectively design projects and many communities that receive funding support are unable to support operating and maintenance costs for existing facilities, let alone new ones.

Federal funding and sound financial management and innovation at the local level remain crucial. However, the study helps highlight the major role that state governments play in supporting infrastructure development in the region. Each Appalachian state has developed a unique approach to meeting its communities' infrastructure needs by choosing how it administers federally supported programs and whether or not it offers state-specific programs. The design of funding programs across Appalachia ranges widely, from basic grant funding to sophisticated structured finance programs designed to promote specific local management practices. Many differences in state funding strategies can be tied to state-specific conditions or objectives thereby limiting the usefulness of transferring practices from one state to another. However, there are clear examples of best practices used by some states that have yet to be discovered or implemented by other states.

Most of the analysis carried out for the project relied on existing data sets. Extracting county-level information and aggregate information for Appalachia from many of them proved challenging, given the manner in which the data were collected or compiled. The lack of reliable data to answer fundamental questions such as the percentage of households with onsite systems was in itself a surprising finding. However, in the end, enough data were available to answer many of the key questions related to water and wastewater services in the region.

**What is the current state of water and wastewater services in Appalachia?**

Appalachian communities get their drinking water primarily from two sources. For most people the source is "community water systems"—that is, systems that provide water to the public for human consumption and serve at least twenty-five year-round residents. The technologies and the treatment systems they use vary, depending on the type and the quality of source water (surface water or groundwater) and the age and the size of the facility. Systems that treat surface water use a variety of physical and

chemical processes, including sedimentation, filtration, and disinfection. Groundwater systems, which are common throughout Appalachia, employ simpler treatment systems than surface water systems do. The typical small groundwater system in a community includes wells, pumps, and facilities for disinfection but not for filtration or sedimentation.

The second source of drinking water in Appalachia is the well systems of individual households. These have some similarities with community systems. Normally, though, they do not have disinfection processes.

Appalachia's methods of disposing of wastewater are diverse. Wastewater treatment "chains" include settling and clarifying processes (primary treatment) and reduction of the biological and pathogen contents (secondary treatment) by exposing the wastewater to microorganisms and oxygen. For facilities ending treatment at the secondary level, the treated effluent is disinfected and absorbed into the surface or discharged into a body of water. Secondary treatment has a limited impact on problem nutrients such as phosphorus and nitrogen, so many communities now must employ tertiary (advanced) treatment to reduce nutrient levels before discharge.

Wastewater is delivered from households to centralized treatment facilities through sewer systems, which include "collector lines" through neighborhoods and major "interceptor lines" that serve as the backbone of the system.

Small household systems that use septic tanks have self-contained treatment facilities on their property. Wastewater is typically collected in a tank that allows solids to separate out, provides some biological treatment, and allows relatively clear wastewater to be absorbed into the ground through a drainage facility. Like centralized systems, these systems may develop problems, ranging from septic tanks that get clogged, to drainage fields that lose their absorptive capacity. In many parts of Appalachia, some individual systems are nothing more than "straight piping" (discharging waste directly into a stream).

Federal policy makers should realize that Appalachia is home to the headwaters of almost all the important rivers of the eastern United States. Thus whatever happens to Appalachian waters has major consequences for the nation as a whole.

By any definition Appalachia is a rugged land of extremes. Its generally ample rainfall and, in some subregions, its groundwater resources bless it with water for drinking and waste assimilation. But its topography, its legacy of water pollution from economies built around resource extraction, and the extremely low fiscal capacity of many of its communities make funding water and wastewater improvements difficult.

**Key Findings**

- The 23 million people in Appalachia—8 percent of the U.S. population and 24 percent of the population of the thirteen states in the region—get water and wastewater services in a wide variety of ways, from state-of-the-art centralized systems of treatment and distribution, to individual wells, septic tanks, and straight piping.

- Coverage by community water systems has expanded significantly in the last fifteen years in Appalachia to 74 percent, but still lags significantly behind national coverage (85 percent of the population). Wells remain the primary source in some subregions (more than 75 percent of households in portions of the Highlands).

- More people (33 percent) in Appalachia are served by small and medium-sized systems (those serving 10,000 or less) than people in the nation (20 percent) are. In general, the smaller the system, the higher the costs.

- Community water systems in Appalachia rely much more heavily on surface water sources than systems in the nation as a whole do (18 percent versus 11 percent). Systems that rely on surface water tend to have significantly higher operating and capital costs than systems that treat groundwater.

- Only 29 percent of the Appalachian population whose wastewater is centrally collected have facilities that treat more than 10 million gallons per day, compared with 52 percent for the United States as a whole. In other words, the larger treatment facilities outside Appalachia connect more people per facility than those in Appalachia do.

- Appalachian water and wastewater systems tend to be smaller than average systems nationally, making for higher unit costs.

- Proportionately more people in Appalachia than in the nation as a whole rely on onsite wastewater disposal. In 1990, the last year in which national data were collected by the Census Bureau, about 75 percent of U.S. households reported being served by public sewers, versus 52 percent of Appalachian households.

- In the scattered Appalachian places where careful surveys have been made, substantial numbers of people have failing onsite systems or no wastewater treatment systems at all.

- Some of the highest-quality and most outstanding resource waters in the eastern United States are in Appalachia, but there are many areas where surface water

and groundwater are seriously impaired. West Virginia, for example, has 878 impaired streams, covering approximately 6,170 stream miles.

- Water and wastewater infrastructure and services in Appalachia are intrinsically linked to and influenced by the natural environment of the region. Most of the environmental factors in Appalachia lead to higher costs, especially in the Highlands. Subsurface conditions often are hard rock, making installation and repair of pipes relatively expensive. Groundwater typically occurs in fractures of bedrock, rather than in large, deep aquifers that are predictable in yield and depth. Frequently, soils are thin and unsuitable for onsite waste systems. Slopes are pervasive and often steep, sometimes requiring more and larger pumps.

**What are the critical infrastructure needs in the region?**

Accurately quantifying needs in Appalachia is a challenge, as it is in the rest of the country. Certain attributes of the region—for example, the presence of many small systems that have few staff members and thus have a difficult time responding to requests for information—suggest that current needs assessments may be even more inaccurate than they are in other areas of the country. Nevertheless, enough data exist to shed light on the types and the scale of needs in different areas of the region and to compare them with national needs.

The 2000 Clean Watersheds Needs Survey, coordinated by the Environmental Protection Agency (EPA), documented $162 billion as the nation's current needs for wastewater infrastructure. Appalachia accounts for about $14.4 billion (8.9 percent) of that amount. The 1999 Drinking Water Needs Survey, also coordinated by EPA, generated estimates of $136.3 billion for the twenty-year needs of the United States. The Appalachian portion is estimated at $11.4 billion (8.4 percent).

There is ample evidence from other national needs assessments and from several independent surveys at the state level that communities will actually have to pay far more than this amount to ensure services that meet basic public health and environmental standards. Given the manner in which the EPA surveys were carried out, it is impossible to estimate exactly how much more communities will have to pay. However, detailed needs extrapolations by others suggest that the number could easily be $35 billion–$40 billion. This range does not include the additional funds, certainly in the billions, needed to address the thousands of substandard and failing individual wells, septic tanks, cesspools, and straight pipes. Nor does it include the funds that will be necessary to operate and maintain new facilities or facilities that have been neglected in the past.

**Key Findings**

- Appalachia accounts for about $26 billion of the drinking water and clean water needs documented or projected in recent EPA surveys. This number is clearly a lower limit on the entire water and wastewater needs of the region. The surveys omit or underreport many needs either because of their definitions of what constitutes "need," their methodologies, or their rate of nonparticipation.

- These estimates do not fully include many categories of needs that are disproportionately high in Appalachia, such as improvements to failing septic systems, extension of service to people with inadequate or no central water and wastewater treatment, watershed restoration for areas impaired by historic resource extraction and industrial activity, and stormwater handling.

- National needs estimates are further biased downward by lack of reporting in some Appalachian states. Within individual states some evidence suggests that underreporting is likely to occur in areas served by small systems with limited management resources to document needs and respond to external needs surveys.

- Several states carry out needs surveys that are separate from the EPA surveys. Their definitions of "need" and their methodologies differ widely. There are no clear over- or underestimating trends between the needs estimates of the states and those of EPA. However, the more comprehensive surveys that some states have carried out have uncovered needs not reported in the EPA surveys.

- Some evidence suggests that state and local officials take needs surveys linked to funding allocations at the federal, state, or local level much more seriously than needs surveys not linked to such allocations.

- Physiographic regions may provide a useful way to analyze service needs and other environmental features of the region in the future, but the problems with data integration remain.

- The most disadvantaged counties in Appalachia have per capita needs for wastewater infrastructure similar to those of other counties but fewer well-off rate payers, and fewer rate payers in general, to meet the burden.

- The data suggest but do not conclusively prove that Appalachian states spend less per capita than non-Appalachian states on regulation of water and drinking water quality.

**What capital funding sources are currently available to meet those needs?**

Federally supported and coordinated programs disbursed about $3.6 billion to Appalachian communities for water and wastewater projects between January 1, 2000, and December 30, 2003, and state programs disbursed about $1 billion. More than $1.5 billion was provided to communities as grants, and about $3.1 billion took the form of loans.

Chief among the federal programs disbursing funds are the Clean Water State Revolving Fund and the Drinking Water State Revolving Fund, of the EPA; and the Water and Waste Disposal Loans and Grants Program, of the U.S. Department of Agriculture, Rural Utilities Service. States provide funding assistance through matching contributions to federal programs such as the revolving funds, and through their own stand-alone programs. The single largest state program is the West Virginia Infrastructure and Jobs Development Council's Loan Program.

Some Appalachian communities also have used their own savings, as well as funds from the private capital market, to make water and wastewater improvements. However, these sources of capital are out of reach for most Appalachian communities because of their strained fiscal capacity and limited creditworthiness. Several Appalachian states, such as Alabama, Ohio, and Virginia, use their state bonding capacity to create loan programs as a method of providing communities with access to private capital.

**Key Findings**

- Relatively few communities in Appalachia, especially in disadvantaged counties, have credit ratings for water and wastewater purposes from major rating agencies. This lack of creditworthiness limits their direct access to the private capital market.

- From 2000 through 2003, federal and state programs disbursed about $4.6 billion for water and wastewater infrastructure in Appalachia.

- The special programs established by individual states accounted for 22.8 percent of the public fund investments. Stand-alone state programs have been important in some states and nonexistent in others. States in Appalachia employ vastly different funding strategies, which lead to major differences in the types of assistance and incentives that reach local communities.

- Capital funding comes from a wide variety of sources, making planning and management of applications, and timing of grants, loans, and matches a significant challenge for communities.

- The number of public funding programs and the amount of public funding to upgrade existing wastewater systems in Appalachia or build new, decentralized ones are extremely limited.

- A statistical analysis indicated that needs identified by the EPA's 2000 Clean Watersheds Needs Survey were significantly and positively related to the distribution of water and wastewater infrastructure funding in Appalachia. (A "significant" relationship is one that could not have occurred by chance.) Violations of the National Pollutant Discharge Elimination System also were significantly and positively related to the distribution of funding, as were incidences of waterborne diseases.

- Funding sources for project planning and other up-front aspects of water and wastewater projects are relatively few.

**What types of gaps exist, and what is the capacity to bridge them?**

Appalachia faces several types of interrelated water and wastewater financing challenges, including capital requirement gaps; annual cash-flow shortages; marginal utility/system fiscal capacity; diminishing household ability to pay; and diverse management-oriented needs.

Despite the numerous capital funding programs in the region, a backlog of project funding requests exists in many areas. In other parts of the country, the private capital market provides a large pool of capital funds to supplement limited public capital funds. Although some communities in Appalachia have access to private capital, it is out of reach for the majority of communities in distressed areas.

**Key Findings**

- At the system level, many small utilities have insufficient revenues to cover future cash-flow requirements, once debt repayments and increased operating costs linked to new facilities are taken into account. These utilities are characterized by small and often shrinking customer bases. In some cases, even if grants for capital were available, the utilities would be unable to meet the operating costs associated with their facilities.

- In comparison with the nation as a whole, households in many Appalachian counties are paying a higher proportion of their income for water and wastewater services, so high in several areas for large numbers of households that asking them to pay more for improved service is infeasible. This household affordability gap has become the critical challenge for many utilities.

- Management shortfalls in the region range from small systems that are unable to support trained and educated staff, to large systems that have yet to shift from a reaction-oriented paradigm characterized by high maintenance costs and continual capital stock crises to a more proactive approach that includes asset management systems, proactive investments, and continual staff training.

**What financial management and funding strategies are likely to have the biggest impact on service in the region?**

Given the diversity of the Appalachian communities and the water and wastewater challenges they face, no single strategy or measure will work throughout the region.

**Key Findings**

- In general, no single strategy or group of strategies identified in recent national studies of water and wastewater infrastructure will close the gap between services and needs in Appalachia as a whole. Instead, strategies must be designed and deployed on the basis of particular community characteristics.

- Regionalization—with its attendant consolidation of providers—offers widely varying possibilities for achieving economies of scale. In Appalachia, regionalization has helped some communities pool their resources and reduce costs enough to remain viable. However, before funders and policy makers look too quickly at regionalization as a blanket solution, they should review the political and institutional environments in which various systems operate. Some states, such as Kentucky and West Virginia, have a history of regional entities and have institutional and regulatory frameworks favorable to regional systems. Other states, like North Carolina, have a go-it-alone culture, a historic model of a single provider prevalent in their system of government, and a relative lack of tested regional models. Promoting regionalization in these states requires addressing the structural obstacles.

- Appalachian communities are an example of the willingness of people to make financial sacrifices in order to guarantee sustainable, high-quality services. Appalachia has shown that many communities can contribute to meeting their needs but many communities cannot generate adequate revenue to meet future needs with price increases alone. Full-cost pricing offers only limited gains for bridging the capital gap in many parts of Appalachia, particularly in small and low- or negative-growth communities. The additional revenue from even large price increases will never cover the funding gap for many Appalachian systems. Without external subsidization many of these systems will either collapse completely or slowly decline because of lack of system maintenance and

investment. The issue of full-cost pricing is greatly complicated by the fact that for some communities, affordability limitations are very real, while for other communities the term "affordability" is used to mask the true obstacle —lack of political will.

- Some funding programs encourage or require communities to follow the principles of full-cost pricing to the extent possible before receiving funding. Such inducements or requirements often result in greater community contributions, showing that affordability constraints were less than previously stated.

- Privatization offers some communities a way to attain the economies of scale that regionalization brings, as well as access to greater technical and managerial capacity than is likely in a go-it-alone approach. Equally important, large multiple-jurisdiction for-profit providers offer rate-setting and institutional options not readily available to isolated single-jurisdiction systems.

- However, private systems will not reach the most remote and difficult-to-serve communities in Appalachia. Private providers will seek to serve the systems with relatively low costs and high revenues. In addition, for-profit providers' higher cost of obtaining capital, their profit needs, and their tax burdens inevitably influence the price their customers pay for water. The trade-offs between the benefits of consolidated private systems and the extra revenue requirements must be evaluated case by case throughout the region.

- Many Appalachian systems are behind in implementing basic techniques of asset management, such as maintaining records of assets and repairs. Implementing these techniques is a laudable goal and will provide some marginal cost and water-quality benefits for some systems. However, given the small size and asset base of many systems, implementing the much-heralded advanced techniques of asset management developed in Australia and now being implemented in large U.S. systems will do little to solve their funding problems.

**What steps can funding agencies and technical assistance providers take to improve and expand service in the region?**

The thirteen states in Appalachia each employ different funding programs and strategies for assisting communities. Consultations with public officials at the state and local levels suggest that some of these approaches promote sustainability and improved access to funds more than others do. States that have developed coordinated funding organizations have been able to improve communication and minimize the administrative hurdles. Other states, such as Ohio and West Virginia, have made difficult decisions regarding the eligibility of communities for funds and the types of

funds to make available to communities. These states offer a large proportion of their funds as loans and pay careful attention to the fiscal capacity of communities before granting them. The measures have promoted consolidation and have kept some communities from investing funds in systems that may not be sustainable.

The private capital market in the United States has proven to be an essential component of infrastructure. However, it still is a tool beyond the reach of many communities in Appalachia. Many states have developed innovative methods of pooling loans for small, credit-risky communities to reduce their risk. These pooled-loan programs often operate under the name "bond bank." They follow several designs, but the common approach is to use a combination of state administrative capacity and creditworthiness to obtain private capital at more favorable terms than individual communities could obtain.

Another option for increasing access to private capital is to improve the creditworthiness of local communities by strengthening their financial management capacity and improving their overall economic health. This approach has promise for many communities in Appalachia, but the extreme economic hardship present in some communities makes accessing the private market unlikely even if they can improve their management.

Many public officials and advocacy organizations are convinced that finding additional sources of grant funds is essential to helping the poorest communities. In a survey that UNCEFC conducted as part of the study, it asked funding program managers to estimate the impact that different measures would have in helping communities meet their needs. Eighty-one percent of the respondents indicated a large impact for grants. Further, almost 50 percent felt that the inability of specific programs to offer grants was a major obstacle in the programs' helping distressed communities.

Many funders and policy makers have expressed concern about the process of determining who receives grant funds. Although most funders seem to agree that grant funds should go to communities most in need, some argue that grants made to the most fiscally distressed communities may be counterproductive because they support communities that do not have the managerial and financial capacity to maintain a viable system and in the worst case do not have the funds to operate the system the grant supported. Some states have used grants as an opportunity to encourage or force communities to address their shortcomings in fiscal capacity by partnering with other communities. For such strings to have an impact, a comprehensive funding strategy must be in place. Otherwise, as many officials reported in the UNCEFC survey, communities will play funders off each other and go to the funder that requires the least and provides the most. The West Virginia Infrastructure and Jobs Development Council's system of reviewing project requests to multiple programs and

recommending a comprehensive package has allowed it to distribute grants in a much more planned and focused manner.

**Key Findings**

- For many communities with marginal fiscal capacity, careful manipulation of funding terms may offer the best hope of stretching limited public dollars. In some situations, long-term loans can make a capital project feasible for a community. The U.S. Department of Agriculture, the Ohio Water Development Authority, and West Virginia's Clean Water State Revolving Fund are examples of programs that offer thirty- and forty-year loans under special conditions to disadvantaged communities. Such loans should be made only after careful evaluation of a project. Generally accepted accounting principles dictate that loan terms not exceed the useful life of a facility.

- The degree of cooperation and coordination among different funding programs varies significantly across Appalachia. Some states have coordination strategies and institutions that streamline local funding requests and assist in matching and optimizing different funding sources. In other areas of the region, the go-it-alone approach requires individual communities to navigate the complex funding options and seek the best deal they can get.

- Evidence shows that external grant funding remains an essential component of an overall funding strategy, and that without significant grant funding, a certain of number of communities would be unable to generate sufficient revenue to protect the public health and their surface-water quality. Some states in the region have integrated funding programs and strategies that rely on small amounts of grants to leverage loan funds, enabling communities to access the capital they need while covering the majority of the costs themselves.

- Some individual funding programs and some groups of funding programs carefully design funding packages for communities that include a mix of grant and loan funding. In states where such coordination is weak and grants are not strategically linked to loans, communities consistently seek out grant funding even if they clearly have the ability to take on loan financing.

# 1
# Introduction

This report analyzes the conditions of water and wastewater services in the Appalachian Region and attempts to assess the financial requirements and strategies available to improve the quality of drinking water and wastewater services in the region, particularly in the areas that face chronic economic distress and clear deficiencies in these services. A better understanding of the water and wastewater capital funding challenges and the strategies to address those challenges could make a significant difference in quality of life for the thousands of Appalachians now living in poverty and for thousands more who may be affected by environmental problems related to the integrity of the region's waters.

The report takes the congressional definition of the Appalachian Region as its starting point in determining the jurisdictions for study (see Figure 1-1, which outlines the region by county and highlights the most economically distressed counties).[2] The analyses are based on major data sources compiled by the Environmental Protection Agency (EPA), the U.S. Geological Survey, and the U.S. Census Bureau, as well as private credit-rating agencies. In addition, detailed case studies are developed to examine specific community-level services, issues, and practices.

The way in which water and wastewater services are funded in the United States changed dramatically from the 1970s to the early 2000s. The country moved from a sizable federal grant program that accompanied the passage of the 1972 Clean Water Act to a more complex system in which a smaller amount of funding is delivered through grants and loans administered by a wide variety of federal and state agencies. Around 2000, several national studies concluded that the level of spending on water and wastewater services in this new, more complex system is inadequate to meet the nation's needs.

Between 1997 and 2003, the Appalachian Regional Commission (ARC) invested $129 million in water and wastewater infrastructure for Appalachia, and it leveraged about $562 million more from other federal, state, and local government agencies. As a result of these public-sector investments in improved drinking water and wastewater services, Appalachian communities were able to attract $1.3 billion in private investment for commercial, residential, and industrial site development.

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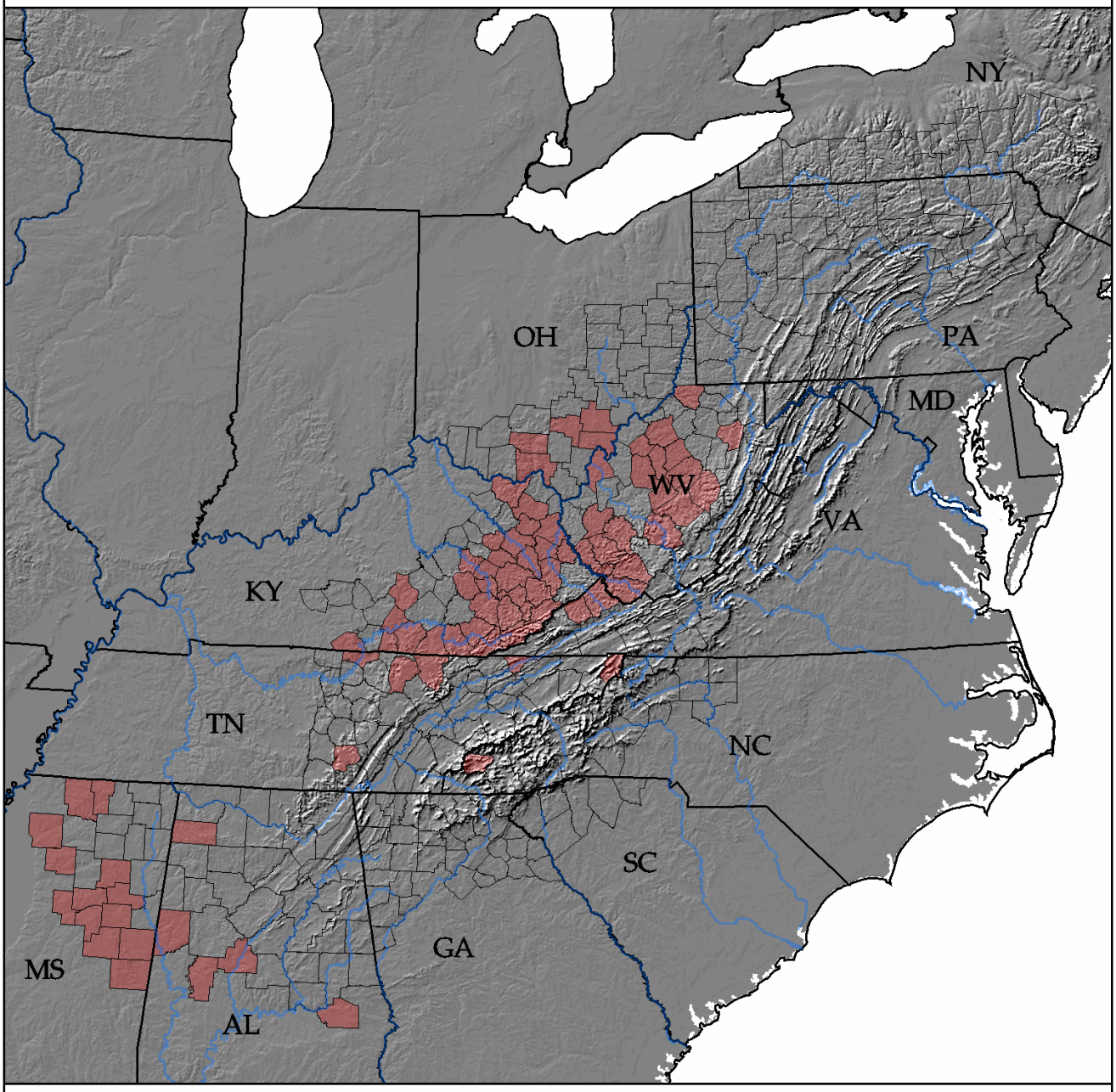
[2] For ARC purposes, "Appalachia" has a precise definition. See the section in this chapter headed Background on the Appalachian Regional Commission.

**Figure 1-1. Economically Distressed Counties of Appalachia**




Data Source: Prepared using U.S. Geological Survey data and 2005 ARC Economic Status data

Appalachian River

Distressed County

According to the ARC,

> these public investments have helped Appalachian localities meet their most critical water and sewer needs . . . Yet many rural Appalachian communities lack even the most basic services . . . and many more communities rely on private septic and private well water systems that are poorly regulated and . . . may present serious environmental problems.[3]

The analyses of national needs issuing from various national agencies at the time were calling attention to the gaps between current levels of spending and projected costs over the first two decades of the twenty-first century:

> These analyses highlight that replacement of aging infrastructure, rising [operating and maintenance] costs to deal with deterioration of the capital stock, increasing environmental regulations, and a lack of research and innovation in management of these systems will likely drive capital investment and [operating and maintenance] expenditures higher compared to current historical levels.[4]

One of the analyses expressed the opinion that "management efficiencies are possible" and higher rates can be absorbed by customers. Yet it conceded that "smaller, rural systems face higher investment costs" and might need additional technical, managerial, and financial assistance.[5]

In June 2003, ARC issued a request for proposals to assess the needs and the gaps in funding for water and wastewater infrastructure in Appalachia. ARC's purpose in contracting for the research was "to provide policy makers and local officials with detailed information on future water and sewer investment requirements and financial strategies to meet these needs, given the fiscal capacity of their communities." ARC also hoped that the findings of the research would "enable state and local officials to target financial assistance and develop strategies for smaller communities to meet their financing needs."[6]

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[3] Appalachian Regional Commission, "Request for Proposals for Assessing Water and Sewer Infrastructure Needs and Gaps in Appalachia" (Washington, D.C.: ARC, June 30, 2003), 2.

[4] *Ibid.*, 3.

[5] *Ibid.*

[6] *Ibid.*, 1.

The University of North Carolina Environmental Finance Center (UNCEFC) submitted a proposal in response to ARC's request, and UNCEFC was selected to undertake the work. This report presents UNCEFC's findings and recommendations.

## Background on Appalachia

Since 1965, regional development has diminished some of the differences between Appalachia and the nation.[7] However, the region still confronts a legacy of poverty and uneven development, as well as the competitive challenges of an internationalized economy. When ARC was established, about 33 percent of Appalachians lived in poverty—a rate 50 percent higher than the national rate of 22 percent. By 2000 the regional poverty rate had been reduced to 13.6 percent, and the spread between Appalachia and the nation had narrowed to 1.2 percentage points. From 1960 to 1980, the number of "distressed counties" in Appalachia (see the next section for a technical definition) declined steadily, but over the ensuing twenty years, it increased slowly, reaching 121 in 2003. In 2004, however, the number decreased sharply to 91, largely because of the impact of the newly available decennial poverty statistics on the calculation methodology.

Appalachia's population is geographically distributed across the urban-rural spectrum, from large urban areas in metropolitan counties to small, remote counties lacking even little urban concentrations. Fifty-six percent of the population lives in metropolitan counties, 27 percent in counties adjacent to metropolitan counties, and 17 percent in remote, rural locations.

## Background on the Appalachian Regional Commission

In 1965, Congress passed the Appalachian Regional Development Act, creating ARC, a federal-state partnership to promote the economic and social development of Appalachia. The act, as amended in 2002, defines the region as 410 counties, encompassing all of West Virginia and parts of Alabama, Georgia, Kentucky, Maryland, Mississippi, New York, North Carolina, Ohio, Pennsylvania, South Carolina, Tennessee, and Virginia—an area of 200,000 square miles and about 23 million people.[8] To promote

[7] The background information on Appalachia and ARC in this and the next section is drawn from ARC, "Request for Proposals," 6–8, and from ARC staff.

[8] Appalachia has undergone several changes in the number of counties officially constituting it for ARC purposes. In 1965, after the inclusion of the New York Appalachian region, it encompassed 373 counties in twelve states (excluding Mississippi). In 1967 twenty counties from Mississippi were added, along with 2 from Alabama, 1 from New York, and 1 from Tennessee, bringing the total to 397. In 1990 a

local planning and implementation of its initiatives, ARC established seventy-two local development districts made up of groups of counties within each of the thirteen states.

For forty years ARC has funded a wide range of programs in Appalachia, including highway corridors; community water and wastewater facilities and other physical infrastructure; health, education, and human resource development; economic development programs and local capacity building; and leadership development.

In 1982, ARC first defined the region's most distressed counties so that the agency could target its resources to the areas of greatest need. ARC's measures of "distressed" evolved, and in 1997, ARC defined four broad categories of county economic status based on comparisons of individual counties with national unemployment and poverty rates and per capita market incomes.[9] In fiscal year 2005, ARC designated Appalachia's 410 counties as follows:

- "Distressed"—82 counties were distressed because they experienced high rates of poverty and unemployment (150 percent or more of the national average) and low rates of per capita market income (67 percent or less of the national average).

- "Transitional"—300 counties were transitional, having higher-than-average rates of poverty and unemployment and lower rates of per capita market income (49 of these transitional counties might be characterized as at risk of returning to distressed status).

- "Competitive"—22 were nearly at parity with national socioeconomic norms.

- "Attainment"—8 counties reached or exceeded national norms.

Preliminary numbers for fiscal year 2006 indicate incremental improvements, with 77 counties designated as distressed, 303 as transitional, 20 as competitive, and 8 as attainment.[10]

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county in Ohio was added, and in 1991 another county in Mississippi was added, raising the total to 399. In 1999, seven more counties were added, 2 in Alabama, 2 in Georgia, 1 in Mississippi, and 3 in Virginia, for a total of 406. In 2003, four more counties joined the region, 2 in Kentucky and 2 in Mississippi, for a current total of 410. Greg Bischak, ARC, memorandum to Jeff Hughes, UNCEFC, 2 February 2005.

[9] "Per capital market income" is per capita income less transfer payments.

[10] For more details, visit ARC's website, at www.arc.gov.

The rationale for ARC's Area Development program is to provide the basic building blocks that will enable Appalachian communities to create opportunities for self-sustaining economic development and improved quality of life. The strategic goals for these efforts were agreed on after a yearlong strategic planning process involving federal, state, and local officials and citizens. The process focused investment in four goal areas:

- Increase job opportunities and per capita income in Appalachia to reach parity with the nation
- Strengthen the capacity of the people of Appalachia to compete in the global economy
- Develop and improve Appalachia's infrastructure to make the region economically competitive
- Build the Appalachian Development Highway System to reduce Appalachia's isolation

Area Development funds are allocated to the Appalachian states on a formula basis and each state has wide discretion in deploying its funds across the four goal areas on the basis of local needs and state priorities. However, an overarching policy mandated by Congress is that ARC resources be targeted at the distressed counties.

## Study Goals and Research Questions

The two primary goals of the study undertaken by UNCEFC were (1) to provide information and insight on water and wastewater investment requirements in Appalachia and (2) to recommend financial management and funding strategies to policy makers and practitioners who work with and on behalf of Appalachian communities. These policy makers and practitioners include local, state, and federal elected officials and managers; regulators; funders; economic developers; finance officers; utility officials; and environmental public interest groups.

To achieve these goals, the UNCEFC research team set out to answer six basic questions:

- What is the current state of water and wastewater services in Appalachia?
- What is the size and the scope of the region's need for investment in water and wastewater infrastructure?

- What capital funding sources are being used in the region to meet these needs?
- What funding gaps exist, and what is the capacity of communities in the region to bridge those gaps?
- Which community financial management and funding strategies are likely to have the biggest impact on water and wastewater services in the region?
- What policies and measures can funding agencies and technical assistance providers implement to have the biggest impact on services and infrastructure in the region?

## Levels of Analysis

To address the study's research questions, the UNCEFC research team carried out analyses at three geographical levels:

- **Appalachian regionwide level:** The team compiled and integrated data for the entire region as defined by ARC. This level of analysis draws out the differences among various parts of the region and highlights the characteristics of the region that distinguish it from other areas of the country.
- **Appalachian subregional and state level:** The team analyzed issues and trends for particular subregions of Appalachia. The availability of some data varies widely across the region. For example, in some states and substate regions, detailed data on water and wastewater rates and utility financial reports are available, whereas in other areas of the region, they are not. This report presents the available data. For some purposes, such as environmental setting and hydrology, the important breakdown is by physiographic region. For other purposes it is by political jurisdiction.
- **Community and system level (case studies):** Macro analyses and subregional analyses are not sufficient to understand all the practices and challenges facing individual communities. Although communities in the region have many similarities, they also have significant differences, which affect their infrastructure needs and their strategies for addressing those needs. To offer an in-depth view, this report presents assessments and analyses of infrastructure finance practices in seven communities selected to cover a broad range of challenges.

## Study Components

The study had five major components, as follows. The study drew on a wide variety of data sets, some compiled by state and federal agencies, others created uniquely for the study.

- **An assessment of water and wastewater services.** Using federal, state, and local data sources, the UNCEFC research team conducted a qualitative and quantitative assessment of current water and wastewater services in the region. Major data sources were the Safe Drinking Water Information System (SDWIS), the databases of the Clean Watersheds Needs Survey (CWNS, formerly referred to as the Clean Water Needs Survey), the Drinking Water Needs Survey (DWNS), and the National Pollutant Discharge Elimination System (NPDES), all coordinated by EPA; U.S. Geological Survey databases and atlases; U.S. Census publications; state utility commission databases; and state reports on capacity development and regulation. **Chapter 2** describes the state of water and wastewater services in the region.

- **An inventory of needs studies and assessments**. The UNCEFC research team reviewed and extracted data from more than fifteen national and state needs assessment reports to characterize and analyze the infrastructure needs of Appalachian communities. To understand the region's ability to meet its needs, the team also collected information on the fiscal capacity of communities, including credit ratings and measures of households' ability to pay. **Chapter 3** summarizes the different approaches to needs assessments used by different studies. **Chapter 4** presents a picture of the capital needs in Appalachia using documented, inventoried, and modeled needs from the assessments. **Appendix A** presents needs information available for individual counties in Appalachia.

- **A comprehensive inventory of public funding.** To document the extent and the importance of public funding in the region, the UNCEFC research team compiled a comprehensive inventory of nonlocal public funding programs currently available to some or all of the 410 counties in the region. It identified all the major programs managed or operated by federal or state governments that operate in the region, and requested county-level funding information from those programs covering January 1, 2000–December 31, 2003. Using these data, the team created a Master Funding Database that includes at least 24,000 records from more than forty-eight funding agencies and offices. **Chapter 5** summarizes analyses that the team carried out using this database. **Appendix B** presents funding information for each county in Appalachia.

- **Consultations with public officials and policy makers**. The UNCEFC research team conducted in-person meetings, telephone interviews, site visits, and structured discussion forums with hundreds of public officials who work for local communities, funding agencies, regulatory agencies, and advocacy groups. The team used information from these consultations to identify needs, challenges, and strategies; cross-

check data; test hypotheses; and identify local communities with particularly noteworthy funding experiences or challenges. The team also sent an Internet-based survey to representatives of 121 funding programs serving the region, to gather funding program managers' opinions and information about current funding policies and trends. Seventy-two respondents (representing a 60 percent response rate) provided information on eighty-six funding programs. Information from the different consultations appears throughout the report. **Appendix C** contains a partial list of the organizations and the individuals that were consulted. It also summarizes the various purposes of the discussion forums that were held and identifies the people who attended. **Appendix D** contains a copy of the survey and a summary of the responses.

- **A selective inventory and case studies of best practices and financial management challenges and strategies.** The UNCEFC research team selected a number of communities in Appalachia whose experiences illustrated the range of needs, challenges, and financial management strategies in the region. They used information and experiences from these communities to cross-check and complement information from public consultations and data analyses. These local-level studies were particularly helpful in identifying and analyzing the community financial management practices presented in **chapter 6**. For example, for each of the communities, actual needs as reported by local practitioners were compared with needs data in state- and national-level needs assessments. Seven of these communities were selected for in-depth study and have been written up in detailed case studies that are included in **appendix E**.

## Study Limitations

Limitations on the strength of this study's conclusions are explained throughout the report, where appropriate. Two large categories of limitations are inherent in the scope of the study, however, and are discussed here. The first concerns the size and the breakdown of the region, and the second concerns limits on available data.

### The Scope of the Region

As noted earlier, this report presents analyses of water and wastewater funding needs and trends at three geographical levels:

- Appalachia as a whole
- Some selected subregions, including political jurisdictions such as states and counties, and physiographic provinces as defined by the geology, the topography, and the rivers of the region
- Some particular water and wastewater systems and the communities they serve

The question of the appropriate geographical size of Appalachia has long been debated, without any consensus emerging from scholars of the region. Thomas R. Ford traced the physiographic divisions used in his encyclopedic study of the southern Appalachians to a 1935 U.S. Department of Agriculture publication.[11] David E. Whisnant has charted the comings and goings of Appalachian boundaries for his classes on the representation of folk culture in the region. His maps are available on the Internet.[12] John Alexander Williams's influential study of the region, published in 2002, presents an even longer historical view of the debate. Williams notes that "Appalachia has no agreed-upon boundaries—nothing comparable to the Mason-Dixon Line or the Hudson River." However, he pragmatically accepts the 1965 boundaries used in the formation of ARC, trying at the same time to define a "core" within these boundaries and to emphasize the importance of physiographic subregions inside the core.[13] Williams also notes that for some purposes, focusing on subregions of Appalachia is useful. This report refers to the region as defined by ARC for the simple reason that a major purpose of the study was to facilitate policy decisions and evaluation that involve ARC funding.

For context in understanding the comparisons presented in this report, Appalachia as defined by ARC consists of widely varying percentages of the thirteen states that occupy some part of the region, from 100 percent of both the population and the area of West Virginia, to 47 percent of the population and 81 percent of the area of Pennsylvania, to 4 percent of the population and 16 percent of the area of Maryland (see Table 1-1). Overall, as noted earlier, in 2000 the region contained about 23 million people—8 percent of the U.S. population and 24 percent of the population of the thirteen states in the region.

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[11] Thomas R. Ford, ed., *The Southern Appalachian Region: A Survey* (Lexington: University of Kentucky Press, 1967), citing U.S. Department of Agriculture, *Economic and Social Problems and Conditions of the Southern Appalachians*, Misc. Pub. No. 205 (Washington, D.C.: USDA, 1935).

[12] David E. Whisnant, Online Syllabus for Hillbilly Highway: Appalachia and America, junior seminar, University of North Carolina at Chapel Hill, Fall 1997, available at www.unc.edu/~whisnant/appal/Sylfal97.htm. Links to the maps are under Class 2, Defining the Region I.

[13] John Alexander Williams, *Appalachia: A History* (Chapel Hill: University of North Carolina Press, 2002), 9.

**Table 1-1. Population and Area of Each Appalachian State in Comparison with Rest of State**

| State | Pop. in App. Counties (2000) | Percentage of Pop. in App. Counties | Area of App. Counties (sq. miles) | Percentage of Area in App. Counties | Pop. Density (App. Counties : Rest of State) |
|---|---|---|---|---|---|
| Ala. | 2,837,224 | 64 | 26,469 | 51 | 107 : 64 |
| Ga. | 2,207,531 | 27 | 11,601 | 20 | 190 : 127 |
| Ky. | 1,141,511 | 28 | 17,907 | 44 | 64 : 129 |
| Md. | 236,699 | 4 | 1,567 | 16 | 151 : 619 |
| Miss. | 615,452 | 22 | 12,567 | 26 | 49 : 64 |
| N.C. | 1,526,207 | 19 | 12,016 | 24 | 127 : 176 |
| N.Y. | 1,072,786 | 6 | 11,909 | 25 | 90 : 488 |
| Ohio | 1,455,313 | 13 | 14,338 | 35 | 101 : 369 |
| Pa. | 5,819,800 | 47 | 36,899 | 81 | 158 : 764 |
| S.C. | 1,028,656 | 26 | 3,991 | 13 | 258 : 111 |
| Tenn. | 2,479,317 | 44 | 19,736 | 47 | 126 : 144 |
| Va. | 665,177 | 9 | 10,369 | 26 | 64 : 218 |
| W.Va. | 1,808,344 | 100 | 24,229 | 100 | 75 : — |
| **Appalachia** | **22,894,017** | **24** | **203,598** | **38** | **112 : 219** |

*Source:* Data from Census Bureau, Census 2000, Summary File 1, Table GCT-PH1-R. Population, Housing Units, Area, and Density: 2000 (last visited 12 May 2005), available at http://factfinder.census.gov/.

Pennsylvania residents constitute the largest proportion of the Appalachian regional population (25 percent), distantly followed by Alabama (12 percent), Tennessee (11 percent), and Georgia (10 percent). Maryland has the smallest proportion (1 percent).

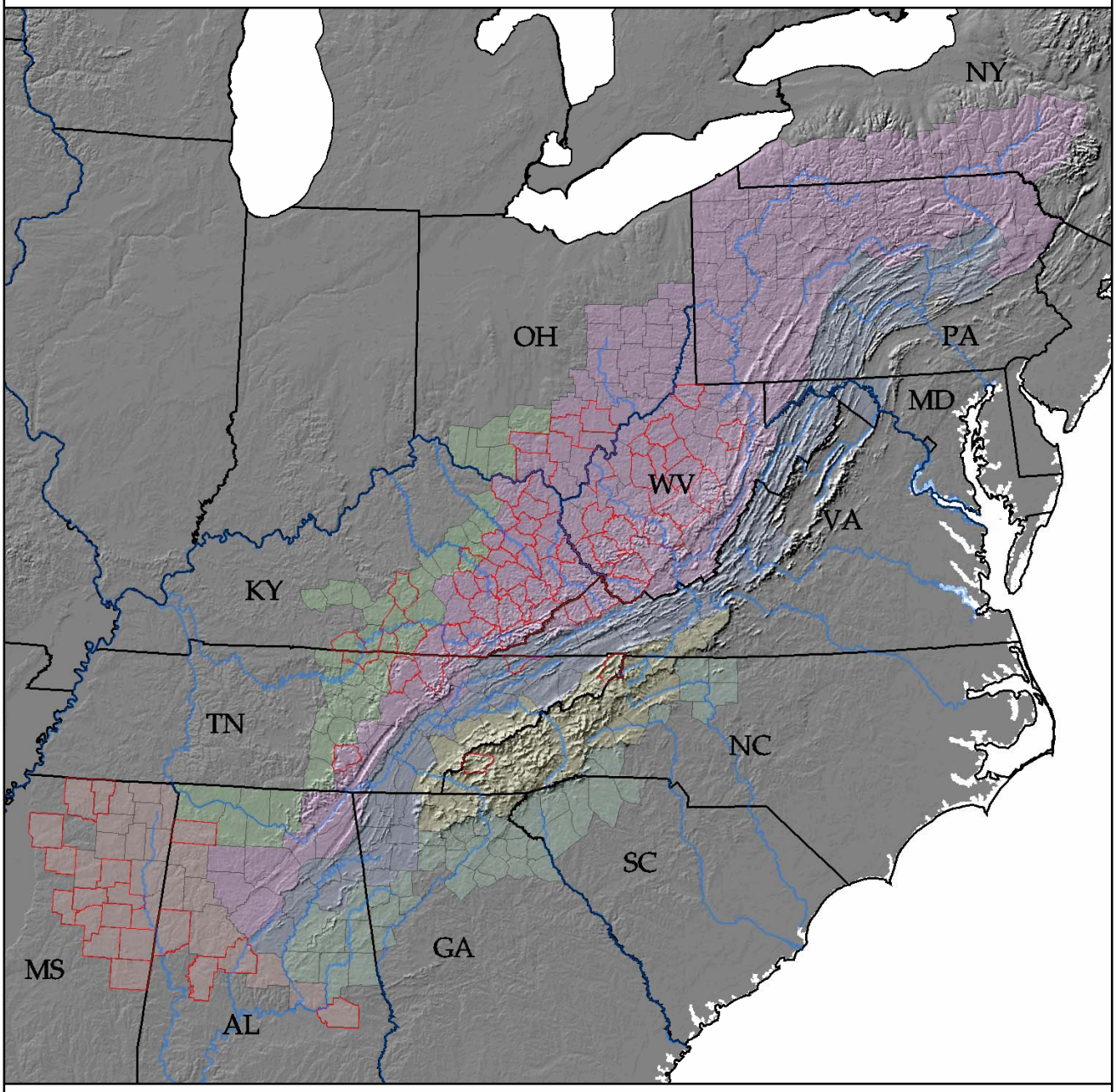
The region as a whole, some 200,000 square miles in area, includes water and wastewater systems at every scale and level of funding and sophistication present in the contemporary United States. Appalachia clearly is not homogeneous. Its large size makes statements about watersheds in the region as a whole necessarily broad and often over generalized. In conjunction with this study, ARC staff laid U.S. Geological Survey data over an ARC county-by-county delineation to produce a map of "physiographic provinces" in Appalachia. On the largest scale, these are the Appalachian Highlands, the Interior Plains, and the Atlantic Plain. They can be broken down further into seven provinces (see Figure 1-2):

<u>Appalachian Highlands</u>
- Appalachian Plateaus
- Valley and Ridge
- Blue Ridge
- Piedmont

<u>Interior Plains</u>
- Interior Low Plateaus
- Central Lowland

<u>Atlantic Plain</u>
- Coastal Plain

**Figure 1-2. Physiographic Regions of Appalachia**




Data Source: Prepared using U.S. Geological Survey data, 2005 ARC Economic Status data and a county-by-county delineation of Appalachia

- Appalachian Plateaus
- Atlantic Plain
- Blue Ridge
- Interior Plains
- Piedmont
- Valley and Ridge
- Distressed County

The UNCEFC research team made use of this division for some calculations of needs and some discussions of environmental setting. It should serve as an independently useful device for further analysis of Appalachian issues related to the environment.

Political jurisdictions, particularly states and counties, also are important analytic units in this report. Much of the relevant data that the research team has analyzed is collected by these jurisdictions. Integrating the data with data on physiographic provinces or comparing them in any way with the data collected by other jurisdictions is difficult. However, the data often are the only and best data available on a given issue of environmental finance. Furthermore, much of the policy making and evaluation that this report aims to assist is and will be done by state and local jurisdictions, for whom these political jurisdictional boundaries are important.

This report occasionally refers to river basins and smaller watershed units, particularly in discussing issues of ambient water quality in the region. On the smallest scale, the report discusses the problems and the projects of particular utility systems and communities. Water and wastewater services themselves represent a juncture between human activity, which is delimited by politically defined service boundaries, and the environment, which is delimited by physiographic boundaries. So different views of the region and its subregions are needed for a useful discussion of water and wastewater services.

## Limits of the Data

Much of the effort behind this report went into integration of various databases that describe water and wastewater funding needs and sources across the region, as well as community and household characteristics. These databases have typically been compiled by different agencies, for different purposes, with different methodologies, and sometimes they have different degrees of reliability. The UNCEFC research team has tried to note, where appropriate, particular problems with data sets and the integration of databases.

Even assuming that data from these disparate sources can be reliably integrated, there are overall conceptual limitations that the reader should understand. First, in the context of water and wastewater services, definitions of "need" vary widely. Most compilations of needs estimates focus exclusively on existing centralized systems, ignoring the needs of private well users and others not on centralized systems. Few data are available on unserved areas. In the scattered Appalachian places where careful surveys have been made—for example, in Weaverville, North Carolina (as reported in the case study in appendix E)—substantial numbers of people have failing onsite systems or no wastewater treatment systems at all. Appalachia has particularly high

needs outside existing centralized systems, so it is reasonable to assume that the national and state needs surveys that the research team has integrated into this report underreport overall needs for the region, perhaps substantially. Historically, to the extent that studies of Appalachia focused on water and wastewater issues at all, they tended to be concerned mostly with plumbing and little with wastewater handling, water quality, or drinking-water quality.

Finally, the study reported here (as well as all the state and federal studies of funding gaps of which the research team is aware) focuses primarily on capital financing, not on operational funding. There is an important relationship between capital needs and operational funding: the better a system's assets are operated and maintained, the longer they last, and the lower the capital funding the system will need over time. Many water and wastewater professionals would say that the human capital needs for system operation and maintenance—that is, the needs for hiring and retaining skilled operators—are the biggest determinants of the adequacy of water and wastewater services. However, neither this study nor the needs databases and reports to which it refers really grapple with the human capital needs of Appalachian systems or their ongoing problems with funding for operations and maintenance. This does not suggest that these issues are not critical, but the extant databases give little insight into them.

Similarly this report mentions but does not dwell at length on (1) the need for adequately funded regulatory systems to ensure that water and wastewater collection and treatment systems are working as they are supposed to work; (2) the magnitude of funding needed to restore watersheds and groundwater that are impaired by past pollution or uncontrolled development; and (3) the similar magnitude of funding needed for improved handling of stormwater, both to lessen the risk of flooding and to reduce the pollutant loading of the region's streams from surface runoff. These are all important components of the full picture of water and wastewater system needs for the region and the country, but they are not adequately captured in the data that the UNCEFC research team has integrated to arrive at capital needs estimates. Once again, then, the estimates in this report quite likely underestimate the true needs, probably by a large amount.

# 2
# Water and Wastewater Services in Appalachia

In his classic 1940s study of Beech Creek (actually Clay County) in eastern Kentucky, the central part of Appalachia, James S. Brown noted,

> All streams are polluted, and the people of the area get water from springs and shallow wells. These are sometimes inconvenient distances from the house and often go dry in summer, making even longer trips for drinking water necessary. Some, but not all, families had privies; others just went in the bushes.[14]

This image of an area where each family fended entirely for itself in obtaining drinking water and disposing of wastewater, frequently with awful results for families and the collective good, persisted through the era of the Great Society and Volunteers in Service to America and endures today. In truth, it is not dead for the most distressed communities in the Appalachian Highlands and the most remote rural residents, those at the "head of the hollow."

On the other hand, many people in the region now are served by modern, centralized systems for water and wastewater, and their problems are different: how to maintain and operate the systems efficiently and how to raise capital for periodic major investments and repairs. So, as with almost everything about Appalachia, presenting a single picture of how water and wastewater services are delivered is at best misleading. One must delve deeper to see the different types of service delivery, their distribution, and their accompanying problems.

## Drinking Water

Households in Appalachia rely primarily on community water systems or individual wells for their drinking water.[15] However, several parts of Appalachia report having incomplete plumbing, an indication that households in these areas may have no access

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[14] James S. Brown, *Beech Creek: A Study of a Kentucky Mountain Neighborhood* (Reprint, Berea, Ky.: Berea College Press, 1988) 27.

[15] A "community water system" is a "public water system" (that is, a system providing water to the public for human consumption) that "serves at least 15 service connections used by year-round residents of the area or that regularly serves at least 25 year-round residents." Safe Drinking Water Act, 42 U.S.C. § 300f(16) (2004).

to drinking water at their residences. The highest percentages of households without complete plumbing are in Kentucky, Pennsylvania, and West Virginia. Cameron County, in Pennsylvania, has the highest proportion of its population without indoor plumbing, at 23 percent.[16] This compares with about 1 percent of households nationally without complete plumbing in 2000.

Although the majority of Appalachia's population (75 percent) is served by community water systems, wells still are the predominant source of water in many areas of the region. In parts of western North Carolina and western Virginia, less than 25 percent of the population is served by community water systems (see Figure 2-1).

The technologies and the treatment systems used by community water systems vary, depending on the type and the quality of source water, the age of the facility, and the size of the facility. Systems that treat surface water use a variety of physical and chemical processes, including sedimentation, filtration, and disinfection. Many in Appalachia and across the country have modified their disinfection systems over the last decade to meet more stringent regulations. Some still depend on the traditional method, chlorination. Others have implemented new systems, such as ozonation.

Groundwater systems are common throughout Appalachia. In general, they employ simpler treatment systems than surface water systems do. The typical small groundwater system in a community includes wells, pumps, and facilities for disinfection but not for filtration or sedimentation.

The well systems of individual households have some similarities with community systems. Normally, though, they do not have disinfection processes, making the protection of private wells even more important.

Many states in Appalachia have made expansion of coverage by a community water system a policy priority. As a result, over the last fifteen years, the region has seen significant gains in the number of people served by community water systems to 74 percent of the population, but still lags significantly behind national coverage (85 percent of the population) (see Figure 2-2) [17].

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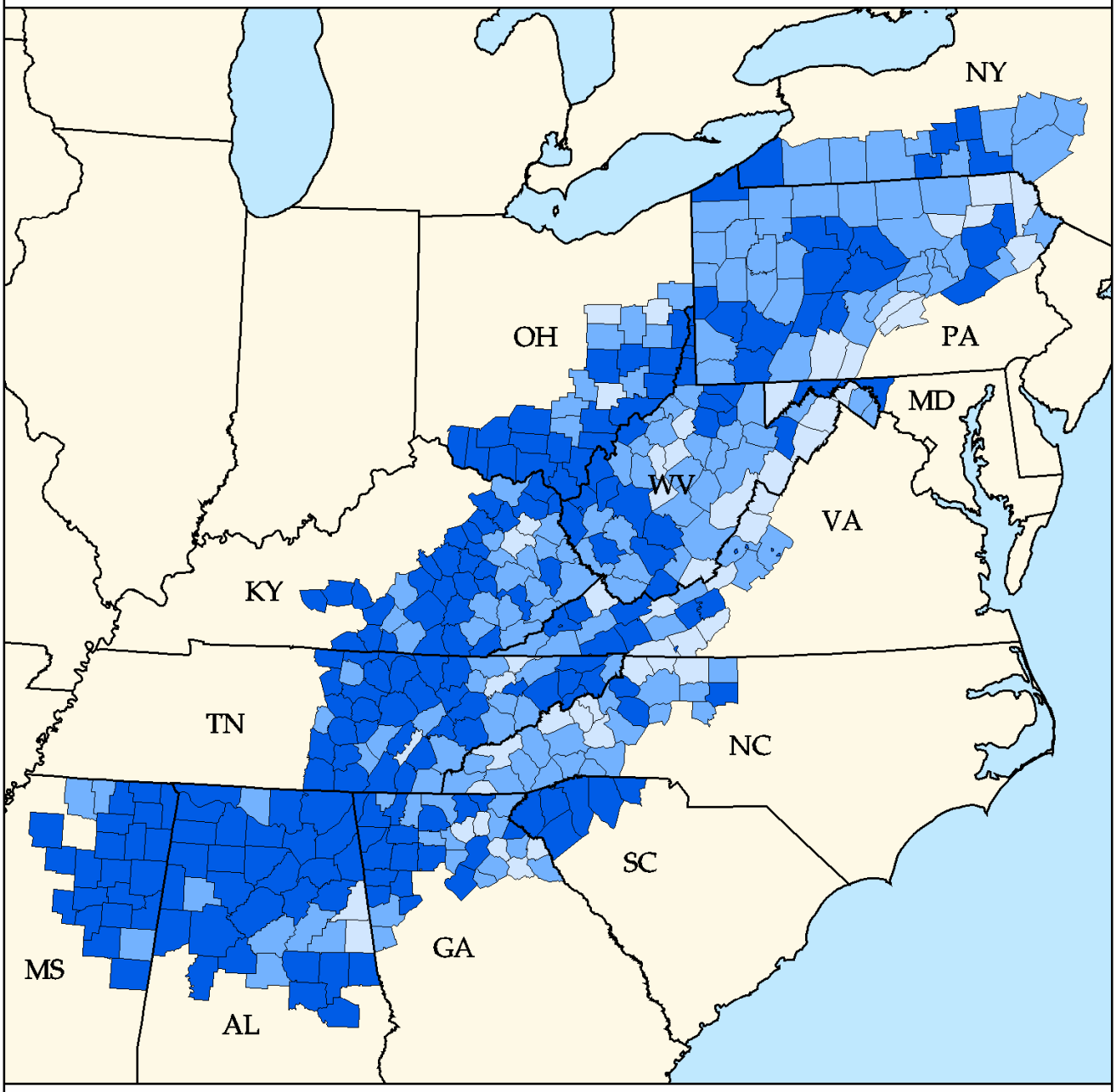
[16] Census Bureau, Census 2000, Summary File 3, Table H47.

[17] U.S. Geological Survey, Water Use Data 2000, county-level data, available at water.usgs.gov/watuse/data/2000/index.html.

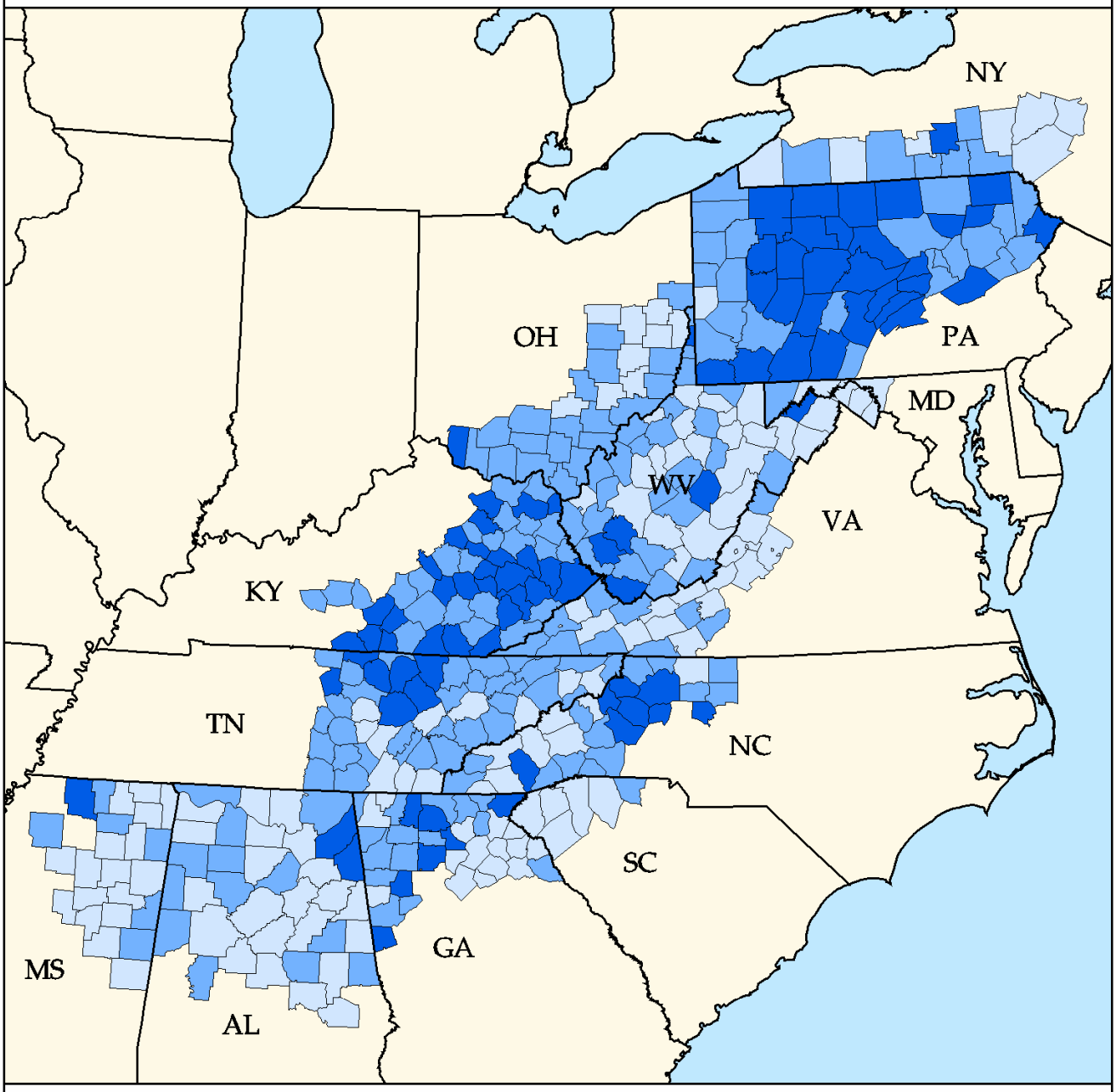
**Figure 2-1. Percentage of Appalachian Population with Public Water Service, 1995**




Data Source: U.S. Geological Survey, Water Use 1995
County Data Files, available on water.usgs.gov/watuse/spread95.html.
Data compiled by UNCEFC using
'PS-TOPop' and 'TotalPop' fields.

Less than 33%
33 through 67%
More than 67%

**Figure 2-2. Increase in Percentage of Population with Public Water Service, 1985-1995**




Data Source: U.S. Geological Survey, Water Use 1995
County Data Files, available on water.usgs.gov/watuse/spread95.html
(data compiled by UNCEFC using 'PS-TOPop' and 'TotalPop' fields),
and Water Use 1985 County Data Files, available on
water.usgs.gov/watuse/wudl.county.ascii.html
(data compiled by UNCEFC using 'po-total' and 'ps-popto' fields).

Less than 1%
1 through 20%
More than 20%

A little less than 10 percent (5,234) of the nation's 54,064 community water systems are in Appalachia (see Table 2-1). Fourteen percent of the nation's medium-sized systems (those serving 3,301–10,000 people) are in the region, compared with only 6 percent of the nation's very large systems (those serving more than 100,000).

**Table 2-1. Community Water Systems in Appalachia and U.S.**

| | Community Water System (CWS) Classification: Population Served per CWS | | | | | |
|---|---|---|---|---|---|---|
| | **Very Small 500 or less** | **Small 501–3,300** | **Medium 3,301–10,000** | **Large 10,001–100,000** | **Very Large > 100,000** | **Total** |
| Number of CWSs in Appalachia | 2,621 | 1,586 | 644 | 363 | 20 | 5,234 |
| Percentage of CWSs in Appalachia | 50 | 30 | 12 | 7 | 0 | 100 |
| Percentage of CWS–served population in Appalachia | 2 | 12 | 19 | 44 | 23 | 100 |
| Number of CWSs in U.S. | 31,688 | 14,149 | 4,458 | 3,416 | 353 | 54,064 |
| Percentage of CWSs in U.S. | 59 | 26 | 8 | 6 | 1 | 100 |
| Percentage of CWS–served population in U.S. | 2 | 8 | 10 | 37 | 44 | 100 |
| Percentage of U.S. CWSs in Appalachia | 8 | 11 | 14 | 11 | 6 | 10 |

*Source:* Data from Environmental Protection Agency, SDWIS, database for 4th quarter, fiscal year 2003, frozen in January 2004; downloaded from www.epa.gov/OGWDW/data/pivottables.html and compiled by UNCEFC

Nationally, 242 million people (85 percent of the country's population) obtain their water from community systems.[18] Most receive it from large or very large community systems (those serving more than 10,000 people).[19] Seven percent of the nation's systems serve 81 percent of the people who are served by such systems (see Table 2-1).

In 1995, seventy-five percent of the Appalachian population was served by community water systems. Thus the region was more dependent on onsite water systems than the nation as a whole was.

[18] U.S. Geological Survey, Water Use Data 2000, county-level data, available at water.usgs.gov/watuse/data/2000/index.html.

[19] Environmental Protection Agency, *2000 Community Water System Survey* (Washington, D.C.: EPA, December 2002), available at www.epa.gov/safewater/cwssvr.html.

Furthermore, other aspects of water provision are significantly different in Appalachia. For example, the average service size of a community water system in Appalachia (3,800 people) is smaller than the average service size of all U.S. community water systems (4,900 people). Typically, smaller size means higher unit costs.

Certain subregions of Appalachia, notably the Highlands of the Blue Ridge (with 1,937 people per community water system) and the Appalachian Plateaus (with 3,396 people per community water system), tend to have even smaller facilities, with corresponding difficulties obtaining the economies of scale achieved elsewhere in the country. In general, the Appalachian portions of each state tend to be served by smaller systems than the non-Appalachian portions. For example, the average size of a water system in the Appalachian region of Ohio is 43 percent the average size of a system in the non-Appalachian region, in terms of population served.

More people (33 percent) in Appalachia are served by small and medium-sized systems (those serving 10,000 or less) than people in the nation (20 percent) are. Compared with the rest of the country, far fewer people are served by very large systems. Nationally the 353 largest water systems (those serving more than 100,000 people) provide water to 44 percent of the community water population. In Appalachia the 20 largest systems provide service to 23 percent of the community water population.

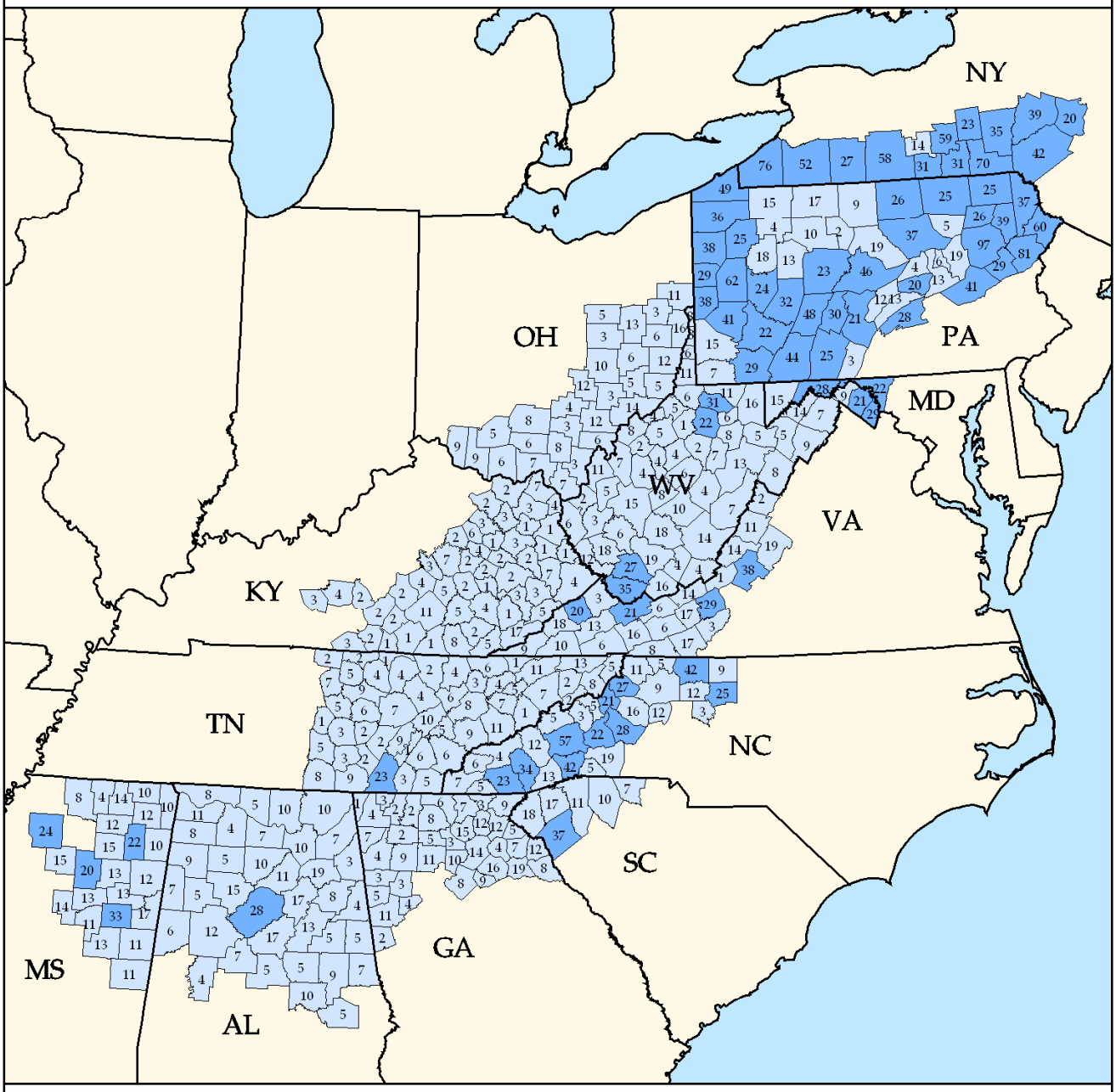
Kentucky, which has made reducing its number of small community water systems a priority, tends to have fewer systems than most other Appalachian states.[20] New York, North Carolina, and Pennsylvania have an abundance of small systems. Chautauqua County, New York, currently has 76 systems, and Buncombe County, North Carolina, 57. Every Appalachian county has at least 1 system. Fifty counties have 1 or 2, and thirty-six counties have more than 30. (For the number of systems in each Appalachian county, see Figure 2-3.)

Operating and capital costs correlate with the size of a community water system.21 In general, the smaller the system, the higher the costs. They also correlate with the type of community water system. Such systems fall into three general categories based on their source of water: groundwater, which they treat and then distribute; surface water, which they treat and then distribute; and water (either ground or surface) that they purchase from another system and then distribute. (For the distribution of community

[20] Staff of Kentucky Infrastructure Authority, telephone conversations with authors, Fall 2004.

[21] Environmental Protection Agency, *Drinking Water Infrastructure Needs Survey: Second Report to Congress* (Washington, D.C.: EPA, 2001).

**Figure 2-3. Number of Community Water Systems in Appalachia**



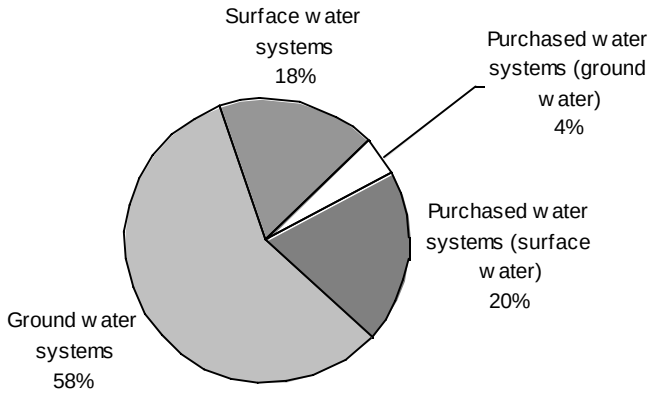

Data Source: Environmental Protection Agency, Safe Drinking Water Information System database for 4th quarter fiscal year 2003 frozen in January 2004, downloaded from www.epa.gov/OGWDW/data/pivottables.html and compiled by UNCEFC. Noncommunity water systems are excluded. There were 5,234 community water systems in Appalachia in January 2004

Fewer than 20

20 or more

water systems and the population served in Appalachia by source of water, see Figures 2-4 and 2-5.) Systems that rely on surface water tend to have significantly higher operating and capital costs than systems that treat groundwater or systems that purchase water. Nationally, 11 percent of the community water systems rely primarily on surface water, 74 percent on groundwater, and 15 percent on purchased water. In Appalachia, the corresponding proportions are 18 percent, 58 percent, and 24 percent. On the whole, 68 percent of the national population is served by the 22 percent of systems that receive their water (purchased or not) from surface sources. In Appalachia, 82 percent of the population served by community water systems is served by the 38 percent of systems that receive their water from surface sources.

**Figure 2-4. Community Water Systems in Appalachia, by Source of Water**

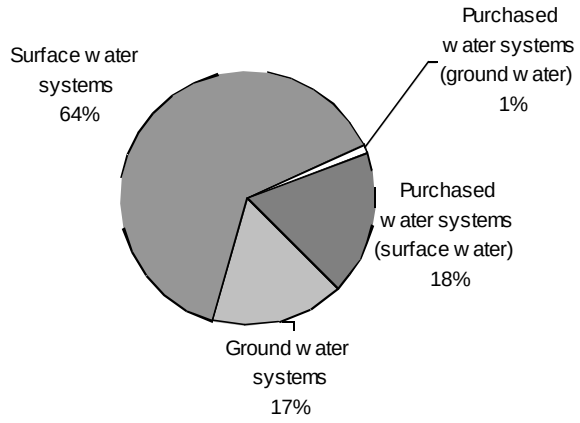



*Source:* Data from Environmental Protection Agency, SDWIS, database for 4th quarter, fiscal year 2003, frozen in January 2004; downloaded from www.epa.gov/ OGWDW/data/pivottables.html and compiled by UNCEFC. Noncommunity water systems are excluded. There were 5,234 community water systems in Appalachia in January 2004.

In sum, community water systems in Appalachia tend to face higher operating and capital costs than the national average because of their smaller size and their greater reliance on surface water.

The water treatment facilities that serve the population of Appalachia range in size from small groundwater systems that treat several thousand gallons per day with packaged chlorinators, to large surface-water treatment plants, such as a facility in Pittsburgh, Pennsylvania, that treats 117 million gallons per day (and serves 250,000 customers).

**Figure 2-5. Appalachian Population Served by Community Water Systems, by Source of Water**




*Source:* Data from Environmental Protection Agency, SDWIS, database for 4th quarter, fiscal year 2003, frozen in January 2004; downloaded from www.epa.gov/OGWDW/data/pivottables.html and compiled by UNCEFC. Noncommunity water systems are excluded. Percentages total to 100% of Appalachian population that is served by community water systems.

Water systems may be owned by public government organizations, such as municipalities, counties, and special government districts, or by private (nongovernment) organizations. Private owners fall into several categories, ranging from for-profit water companies to not-for-profit corporations to ancillary organizations that provide water as a secondary responsibility. Although a slight majority of systems in the United States are owned by nongovernment private entities, the size of most of these systems is small, so the majority of the U.S. population gets its water from public systems.

Forty-seven percent of the community water systems in Appalachia are privately owned and operated. They serve 18.3 percent of the community water population (compared with 15 percent of the U.S. community water population served by privately owned and operated systems).

In several Appalachian states, the number of private systems and the percentage of the population served by private systems are much higher. For example, in Ohio and West Virginia, 67 percent and 34 percent, respectively, of the community water population are served by private systems. In Alabama, only 2.1 percent of the community water population is served by private systems. North Carolina leads Appalachia in percentage of private systems, with almost 80 percent of the 482 community water systems in Appalachia in private hands. However, these systems serve only 14.6 percent of the state's community water population.

On a county basis, 65 percent of Appalachian counties (268) have less than 10 percent of their community water population served by private systems (see Figure 2-6). Pockets of high coverage by private systems occur in Ohio, northeast Pennsylvania, and West Virginia. Only 12 of the 104 Appalachian counties in the southern states of Alabama, Georgia, Mississippi, and South Carolina have more than 10 percent of their community water population covered by private systems.

The type of ownership can have a significant impact on how systems are managed and regulated. Different ownership models result in different eligibilities for funding sources, different financial incentives, and different governance structures. Under the Safe Drinking Water Act Amendments of 1996, privately owned and operated community water systems have access to Drinking Water State Revolving Funds (DWSRFs).[22] However, many states, such as North Carolina, have state laws that prohibit making those funds available to private for-profit systems.[23] The U.S. Department of Agriculture's Water and Waste Disposal Loans and Grants Program is available to nonprofit private systems but not to investor-owned systems.

The institutional models for, responsibilities of, and regulations regarding government-owned water systems are primarily established at the state level. Thus they vary across Appalachia. In West Virginia, government systems include municipalities, counties, and public service districts. All these systems must submit their financial statements to the state's Public Service Commission. Public service districts also must have their rates and charges reviewed and approved by the commission. In North Carolina, government systems include municipalities, counties, and several regional models, including water and sewer authorities and sanitary districts. These systems must have their financial statements reviewed by the North Carolina Local Government Commission, but they have autonomy over their rate-setting practices.

In some states, such as Kentucky and West Virginia, regional government utility models have become increasingly important as systems have consolidated. These models have influenced how systems have evolved over the last few years in a number of Appalachian states. Models in Kentucky, for example, have facilitated the growth of larger regional systems. In North Carolina the number of districts has been relatively constant, and municipalities are the main government service providers. In 2002 there

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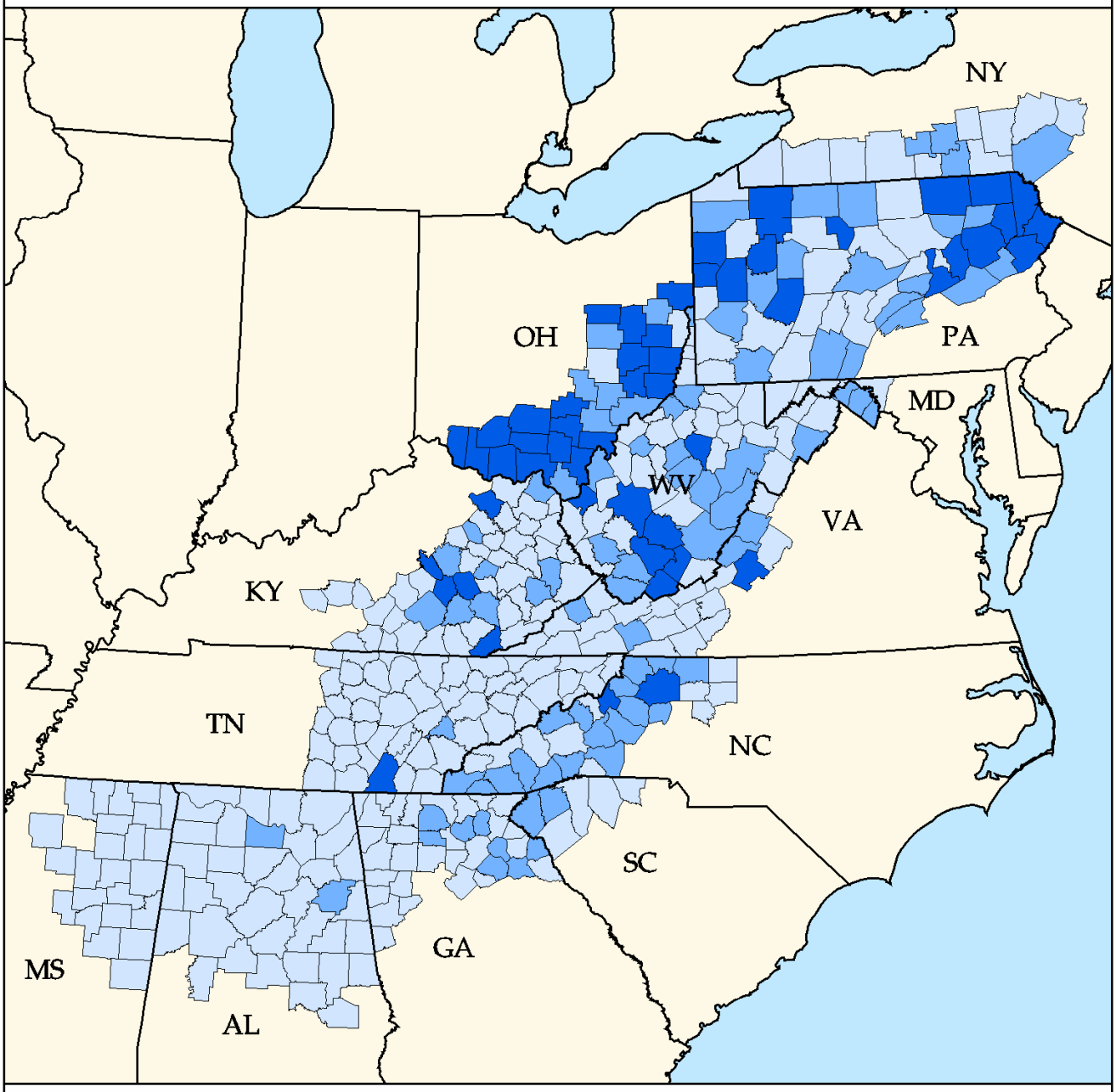
[22] Safe Drinking Water Act Amendments of 1996, 42 U.S.C. § 300j-12(a)(2).

[23] See N.C. Gen. Stat. § 159G-3(2) ("applicants" are restricted to local government units or nonprofit water corporations that exist solely to provide community water or wastewater services and are eligible for funding from the Rural Utilities Service of the U.S. Department of Agriculture).

**Figure 2-6. Percentage of Appalachian Community Water Population Served by Private Systems**




Data Source: Environmental Protection Agency, Safe Drinking Water Information System database for 4th quarter fiscal year 2003 frozen in January 2004, downloaded from www.epa.gov/OGWDW/data/pivottables.html and compiled by UNCEFC. Noncommunity water systems are excluded.

Less than 10%
10 through 50%
More than 50%

were 1,357 special government districts and authorities in Appalachia providing water and wastewater services (see Table 2-2). Pennsylvania has more than half of these districts.

**Table 2-2. Number of Special Government Districts and Authorities in Appalachia**

| | Water Supply | Sewerage | Sewerage and Water Supply— Combination of Services | Total |
|---|---|---|---|---|
| Pa. | 226 | 419 | 127 | 772 |
| W.Va. | 112 | 52 | 43 | 207 |
| Tenn. | 122 | — | 12 | 134 |
| Ala. | 76 | — | 4 | 80 |
| Ky. | 52 | 1 | 6 | 59 |
| Ga. | 15 | — | 14 | 29 |
| Ohio | 14 | 6 | 4 | 24 |
| S.C. | 14 | 3 | 4 | 21 |
| Va. | 4 | 7 | 3 | 14 |
| N.C. | 4 | 3 | 2 | 9 |
| Miss. | 1 | 1 | 2 | 4 |
| Md. | 1 | 1 | 2 | 4 |
| **Total** | **641** | **493** | **223** | **1,357** |

*Source:* Census Bureau, Governments Integrated Directory of the 2002 Census of Governments, available at www.census.gov/govs/www/gid2002.html. Data on special district governments downloaded and compiled by UNCEFC using Type 4 and Function Codes 91 (Water Supply), 80 (Sewerage), and 98 (Sewerage and Water Supply – Combination of Services).

Several studies have gathered data on the age and the condition of community water systems across the country. An EPA survey suggests that large systems tend to have a higher percentage of older pipe than small systems do (see Table 2-3).

## Table 2-3. Percentage of Pipe in Each Age Category, by Ownership

| Ownership Type | System Service Population Category | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | 100 or less | 101–500 | 501–3,300 | 3,301–10,000 | 10,001–50,000 | 50,001–100,000 | 100,001–500,000 | Over 500,000 | All Sizes |
| **Public Systems** | | | | | | | | | |
| Percentage of Pipe that is: | | | | | | | | | |
| Less than 40 years old | 76.3 | 81.5 | 81.1 | 77.6 | 76.2 | 65.2 | 61.4 | 54.9 | 72.6 |
| Between 40 and 80 years old | 23.6 | 18.3 | 17.5 | 18.4 | 19.7 | 26.9 | 29.2 | 35.8 | 22.4 |
| More than 80 years old | 0.1 | 0.1 | 1.4 | 4.0 | 4.2 | 7.9 | 9.4 | 9.3 | 5.0 |
| Observations | 18 | 72 | 173 | 135 | 122 | 88 | 160 | 40 | 808 |
| **Private Systems** | | | | | | | | | |
| Percentage of Pipe that is: | | | | | | | | | |
| Less than 40 years old | 92.4 | 92.8 | 98.7 | 96.2 | 95.8 | 86.6 | 56.5 | 67.7 | 92.9 |
| Between 40 and 80 years old | 7.6 | 7.2 | 1.3 | 3.3 | 3.1 | 12.0 | 34.1 | 23.8 | 5.8 |
| More than 80 years old | 0.0 | 0.0 | 0.0 | 0.6 | 1.1 | 1.4 | 9.4 | 8.5 | 1.3 |
| Observations | 137 | 94 | 31 | 19 | 21 | 12 | 14 | 5 | 333 |
| **All Systems** | | | | | | | | | |
| Percentage of Pipe that is: | | | | | | | | | |
| Less than 40 years old | 90.6 | 88.3 | 85.7 | 84.3 | 81.4 | 70.2 | 60.9 | 56.3 | 78.0 |
| Between 40 and 80 years old | 9.4 | 11.7 | 13.3 | 12.9 | 15.3 | 23.4 | 29.7 | 34.4 | 18.0 |
| More than 80 years old | 0.1 | 0.1 | 1.0 | 2.8 | 3.4 | 6.4 | 9.4 | 9.2 | 4.0 |
| Observations | 155 | 166 | 204 | 154 | 143 | 100 | 174 | 45 | 1,141 |

*Source:* Reprinted from Environmental Protection Agency, *Community Water System Survey 2000*, vol. 2, *Detailed Tables and Survey Methodology* (Washington, D.C.: EPA, December 2002), 68, available at www.epa.gov/safewater/consumer/pdf/cwss_2000_volume_ii.pdf.

*Note:* The table reports the percentage of pipe on average in each age category in the nation. It is not the percentage of pipe per system.

## Wastewater

Appalachia's methods of disposing of wastewater are as diverse as the region's cultural and economic environment. In many areas, households still discharge untreated waste directly into streams ("straight-piping"). For example, in 1990 in Madison County, North Carolina, 7 percent of the households surveyed used some type of straight-pipe system.[24] At the other end of the spectrum, Greenville, South Carolina (and surrounding areas connected to the Mauldin Road treatment plant of the Western Carolina Regional Sewer Authority), provides advanced tertiary treatment to the waste that it collects from residents before discharging the waste into Hollow Creek.

Treatment of drinking water is largely a physical and chemical process. In contrast, treatment of wastewater involves using biological systems. Wastewater treatment "chains" include settling and clarifying processes (primary treatment) and reduction of the biological and pathogen contents (secondary treatment) by exposing the wastewater to microorganisms and oxygen. Small communities often rely on "package plants," which involve primary and secondary treatment within a compact physical space. For facilities ending treatment at the secondary level, the treated effluent is disinfected and absorbed into the surface or discharged into a body of water. All discharging facilities are regulated at the federal and state level. Secondary treatment has a limited impact on problem nutrients such as phosphorus and nitrogen, so many communities now must employ advanced or tertiary treatment to reduce nutrient levels before discharge.

Wastewater is delivered from households to centralized treatment facilities through sewer systems, which include "collector lines" through neighborhoods and major "interceptor lines" that serve as the backbone of the system. Aging sewer systems throughout the country and in Appalachia often have "inflow" and "infiltration" problems that involve rain water entering the sewer system through cracks and improperly designed manholes. Inflow and infiltration problems can lead to sewer overflows and overwhelmed treatment facilities, if not corrected. In some parts of the country, sewer systems were intentionally designed to collect rain water in addition to wastewater. These combined-sewer-overflow (CSO) systems now are granted permits by the EPA, and under the permits they must be modified or separated at huge expense to the system owners.

Small household systems that use septic tanks have self-contained treatment facilities on their property. Wastewater is typically collected in a tank that allows solids to separate out, provides some biological treatment, and allows relatively clear wastewater to be absorbed into the ground through a drainage facility. Like centralized systems,

[24] Estimates from Census Bureau, Census 1990, Summary File 3, Tables H23, H24.

these systems may develop problems, ranging from septic tanks that get clogged because they are not emptied of solids, to drainage fields that lose their absorptive capacity and discharge clear but pathogenic effluent, which bubbles onto the surface. In many parts of Appalachia, space or soil constraints limited what households could install, and some individual systems are nothing more than a straight pipe that runs directly to a stream.

How one characterizes wastewater disposal depends on one's perspective. People in households without indoor plumbing may view the world as divided into "flushing" and "not flushing." Environmentalists may believe that the degree (or lack) of treatment is the most important variable. Regulators may explain the wastewater universe by whether or not a system discharges to surface water. The variation in wastewater systems and the lack of national data on them make quantifying the differences between Appalachia and the United States as a whole significantly more difficult than it is for water systems.

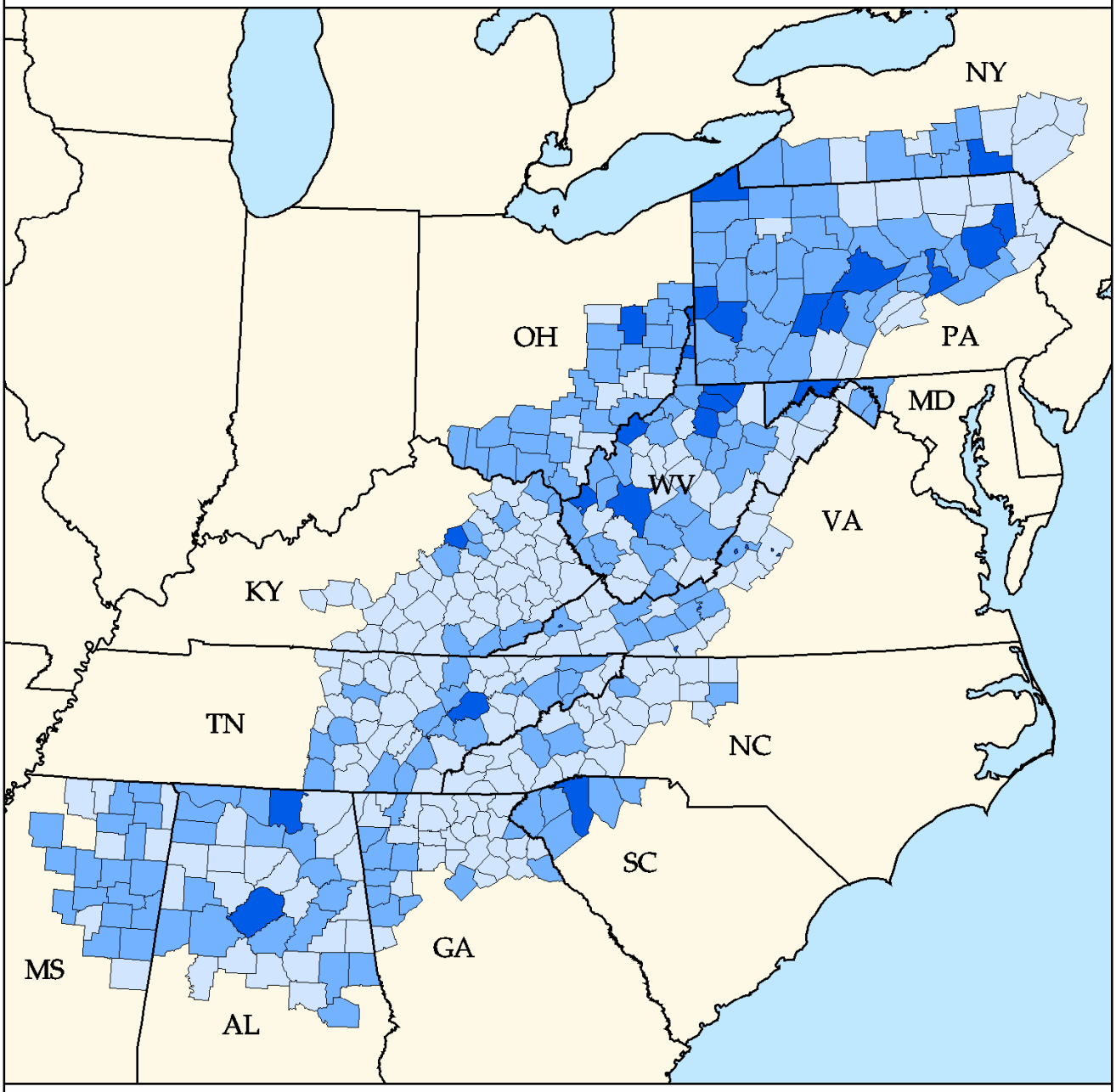
The last time that individual households were asked to indicate whether or not they were connected to a public sewer system was during the 1990 Census. About 75 percent of U.S. households reported being served by public sewers, versus 52 percent of Appalachian households. At the county level, sewerage coverage in Appalachia ranged from 2 percent in Bland County, Virginia, to 89 percent in Ohio County, West Virginia. In 1990, coverage was lowest in the Blue Ridge area of Appalachia and in eastern Kentucky (see Figure 2-7).

The lack of public sewers in Appalachia is not a problem in itself, in fact the use of well designed and maintained onsite systems such as septic tanks are considered by many to be a more appropriate and cost effective means of wastewater treatment for many rural communities.[25] Unfortunately, surveys of existing septic systems continue to suggest that many onsite systems are improperly designed and more prone to failure than centralized sewers.[26]

[25] Craig Lindell, Decentralized Wastewater Management, *Public Management* 87:6, 33-35 (July 2005).

[26] National Environmental Services Center, *A Summary of the Status of Onsite Wastewater Treatment Systems in the United States During1998: National, Regions I through X*, (Morgantown, WV: National Small Flows Clearinghouse, 2001).

**Figure 2-7. Percentage of Applachian Population with Public Sewer Service, 1990**




Data Source: Census 1990 Summary Tape File 3
Tables H23 and H24.

Less than 33%
33 through 67%
More than 67%

Documenting the prevalence of public sewers or conversely the prevalence of onsite systems remains a major challenge. Regulatory (and documenting) responsibility for onsite systems normally rests with county health departments with little accurate data aggregation done at the state, let alone national level. The US EPA maintains coverage data for centralized systems that suggests current centralized wastewater coverage (50 percent) have not changed that much since the 1990 Census (52 percent). However, when the EPA data is used to analyze coverage for specific counties, the limits of the more recent EPA data becomes apparent with many Appalachian counties appearing to have more people covered by centralized systems than are reported to live in the county.[27]

EPA reports data on publicly owned wastewater treatment facilities by the current flow rate at the facility (see Table 2-4). Eleven percent of the nation's wastewater treatment facilities are in Appalachia. Only 29 percent of the Appalachian population whose wastewater is centrally collected have facilities that treat more than 10 million gallons per day, compared with 52 percent for the United States as a whole. In other words, the larger treatment facilities outside Appalachia connect more people per facility than those in Appalachia do. Appalachia accounts for 34 percent of the national facilities that treat less than 10 million gallons of sewage per day. The smallest treatment facilities (constituting 79 percent of all facilities) collect sewage from only 26 percent of the connected Appalachian population.

**Table 2-4. Publicly Owned Wastewater Treatment Facilities, by Flow Rate, 2000**

| Flow Rate (in MGD) | 0.001–0.1 | 0.1–1.0 | 1.0–10 | 10–100 | > 100 | Total |
|---|---|---|---|---|---|---|
| Number of treatment facilities in Appalachia | 550 | 871 | 354 | 27 | 1 | 1,803 |
| Percentage of treatment facilities in Appalachia | 31 | 48 | 20 | 1 | 0.1 | 100 |
| Percentage of population receiving collection from treatment facilities in Appalachia | 4 | 22 | 45 | 22 | 7 | 100 |
| Number of treatment facilities in U.S. | 6,583 | 6,462 | 2,665 | 487 | 46 | 16,255 |
| Percentage of treatment facilities in U.S. | 40 | 40 | 16 | 3 | 0.3 | 100 |
| Percentage of population receiving collection from treatment facilities | 2 | 12 | 32 | 37 | 17 | 100 |

[27] Environmental Protection Agency, *Clean Watersheds Needs Survey 2000 Standard Report – Facilities in Operation*, available at http://cfpub.epa.gov/cwns/populationp.cfm. Data on population presently served by publicly owned wastewater treatment facilities currently in operation compiled and analyzed by UNCEFC. County population estimates were obtained from Census 2000 Summary File 1 Table P1.

| Flow Rate (in MGD) | 0.001–0.1 | 0.1–1.0 | 1.0–10 | 10–100 | > 100 | Total |
|---|---|---|---|---|---|---|
| in U.S. | | | | | | |
| Percentage of U.S. treatment facilities in Appalachia | 8 | 13 | 13 | 6 | 2 | 11 |

*Source:* Data from Environmental Protection Agency, *Clean Watersheds Needs Survey 2000* (Washington, D.C.: EPA, 2003), compiled by UNCEFC.

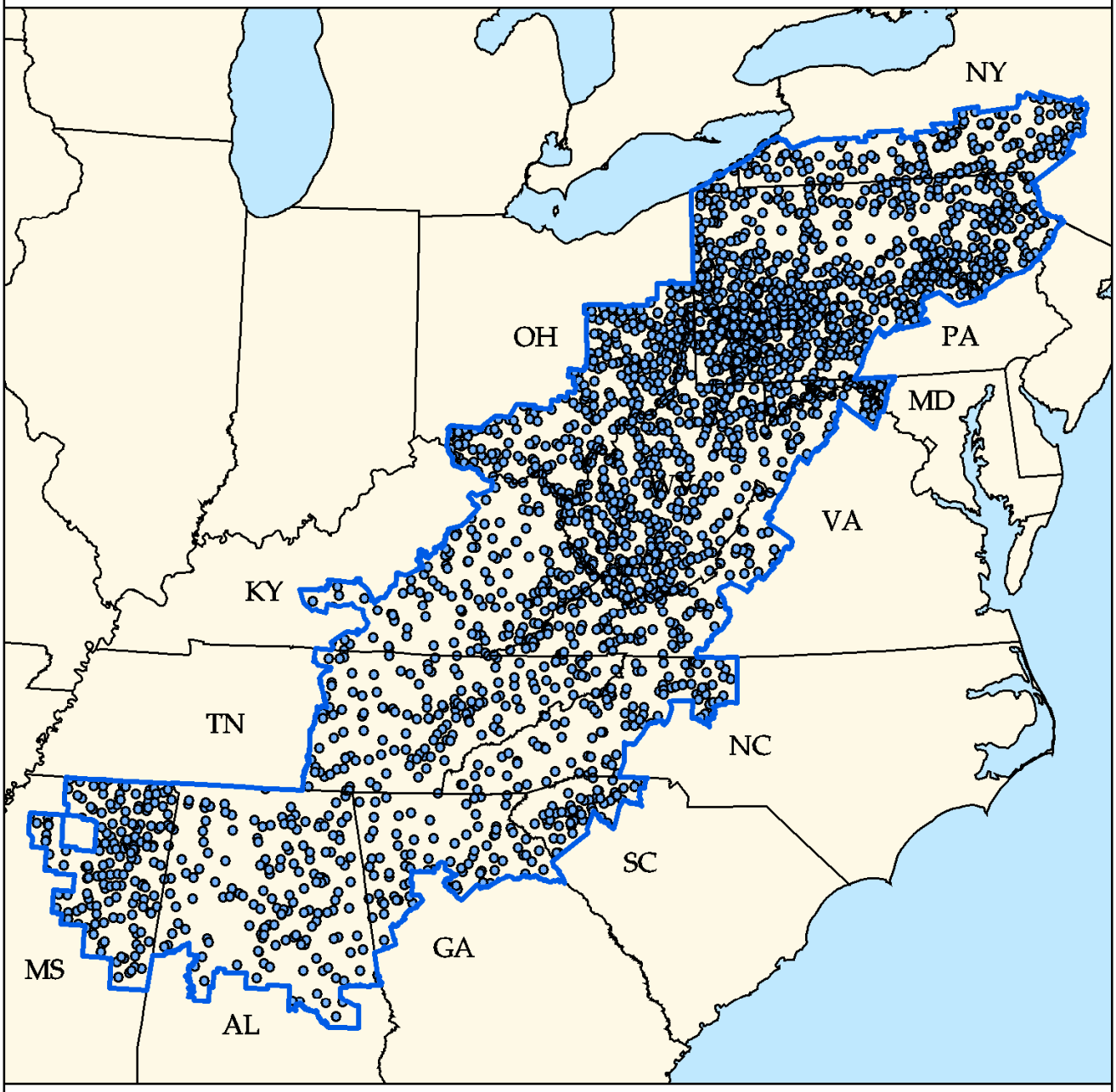
*Note:* MGD = millions of gallons per day.

More than 4,000 facilities (both in operation and planned) are in the CWNS database for Appalachia (see Figure 2-8). Each state is responsible for identifying the facilities that are entered into this database, and the choice of facilities to include varies from one state to another. Despite this limitation, the map helps illustrate the areas of Appalachia that are served or will be served by community wastewater systems.

Despite the expansion of wastewater systems in some areas of Appalachia, septic tank systems still are abundant. In 1990, households in the region were as likely to have a septic tank as they were to be connected to a public sewer system. Four million households in the region used septic tank systems in that year. (For the number of septic tanks per square mile for counties in Appalachia, see Figure 2-9.)

In 1990, about 70 percent of the counties in Appalachia had more than 50 percent of their households served by onsite systems such as septic tanks or unlined systems commonly referred to as "cesspools" (see Figure 2-10). These systems served more than 75 percent of households in counties along the Blue Ridge and in the Valley and Ridge areas, from northern Georgia to southwestern Virginia (see Figure 2-11).

**Figure 2-8. Treatment Facilities and Collection Systems in Appalachia, 2000**

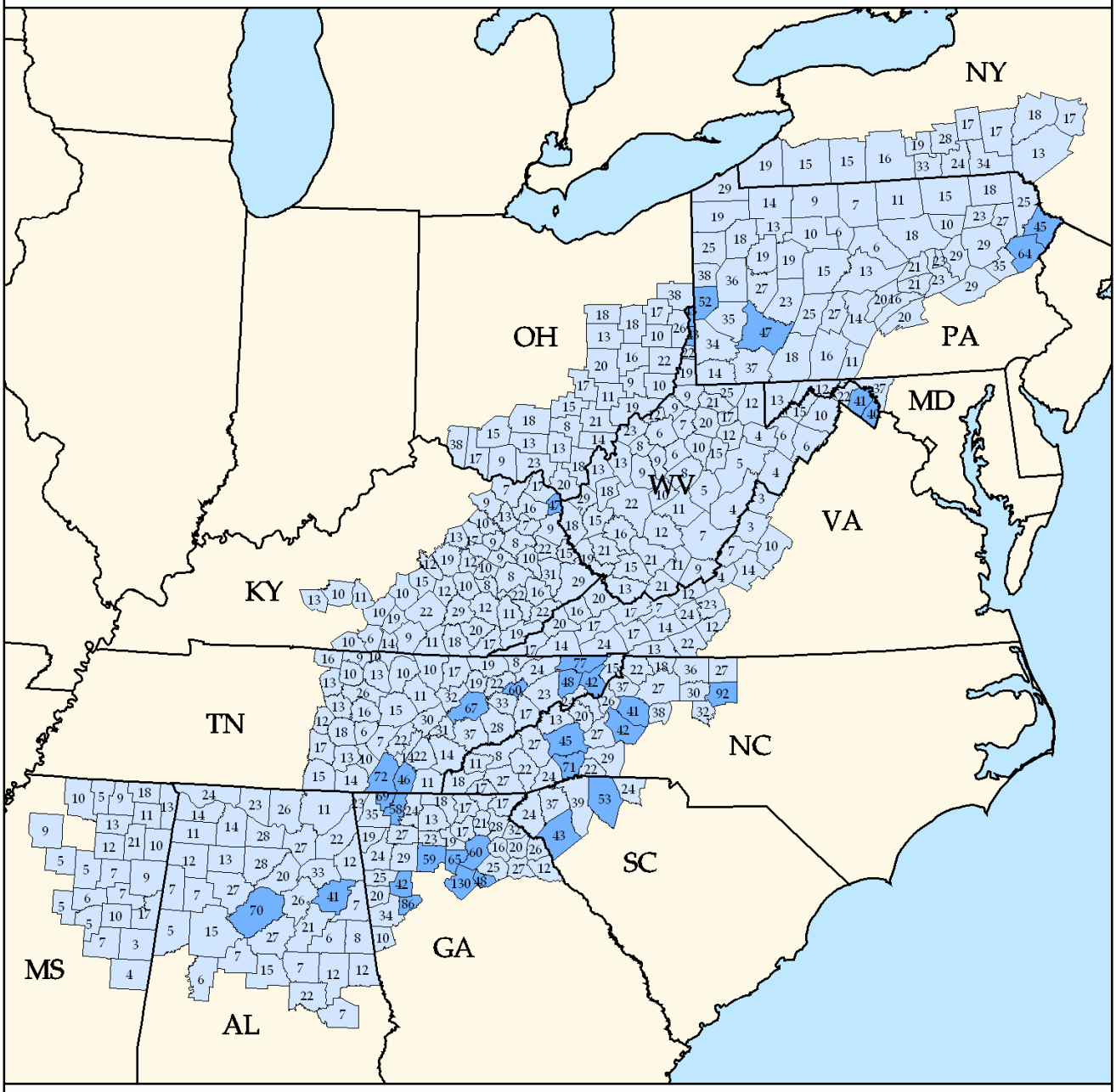



Data Source: Longitude and latitude data and mapping of wastewater systems from Clean Watersheds Needs Survey 2000 (Washington, D.C.: EPA, 2003), provided by email to the author from the Environmental Protection Agency on October 20, 2004. Data available on Enviromapper at maps.epa.gov/enviromapper/

Facility/Collection System

ARC Boundary

**Figure 2-9. Number of Septic Tanks Per Square Mile in Appalachia, 1990**

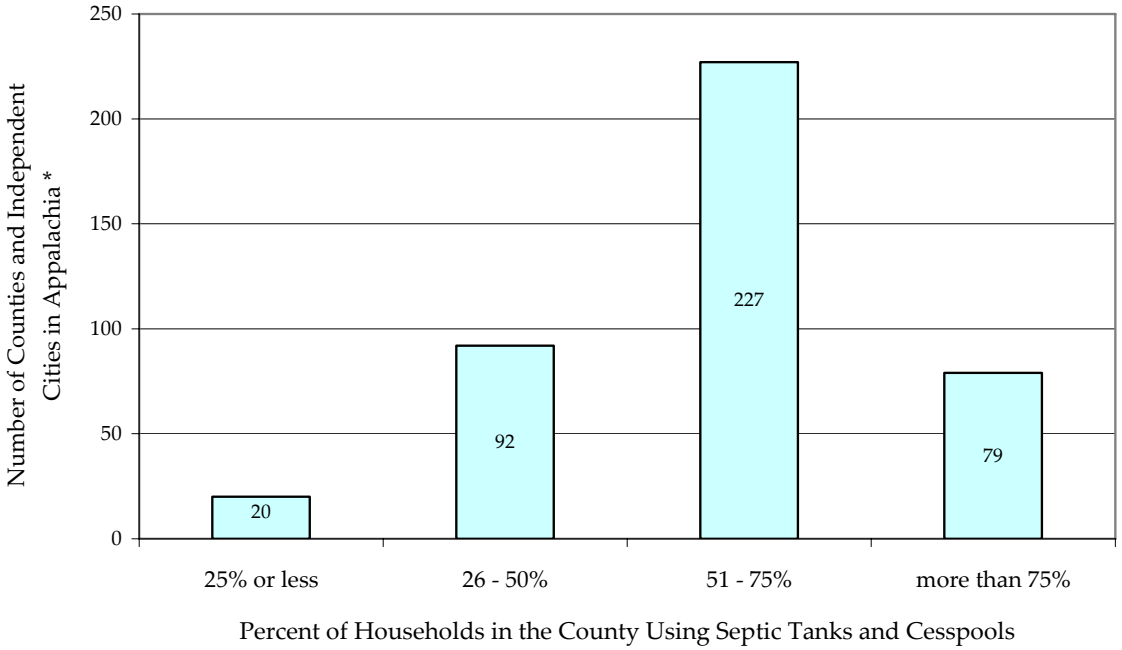



Data Source: Census 1990 Summary Tape File 3
Tables H23, H24

Fewer than 40

40 or More

**Figure 2-10. Percentage of Appalachian Households Using Septic Tanks and Cesspools, 1990**




*Source:* Data from Census Bureau, Census 1990, Summary File 3, Tables H23 and H24.

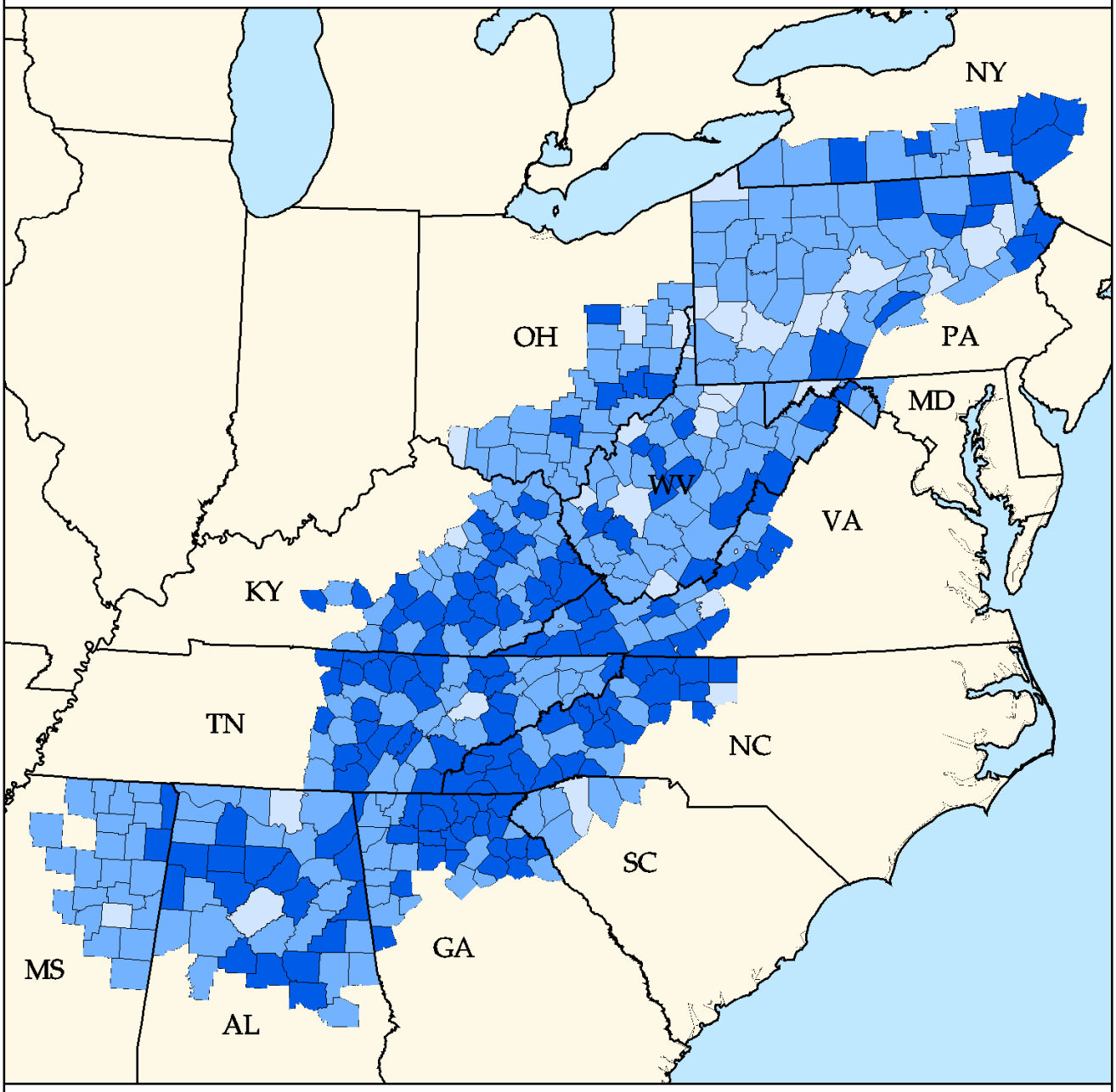
* Eight Virginia Independent Cities are analyzed separately, totaling to 418 counties and independent cities in Appalachia.

## Ambient Water Quality

"You are what you drink." The connection between health, drinking water, and the quality of raw water used for drinking is quite clear. In most cases the quality of bodies of water receiving discharge is the primary factor that dictates wastewater treatment requirements. Some of the highest-quality and most outstanding resource waters in the eastern United States are in Appalachia. This is not surprising, given the abundant precipitation, the remaining forest cover, and the headwaters location of most Appalachian streams.

High-quality, high-quantity water is reflected in the diversity of water-dependent species, both amphibians and fish. "The southern Appalachians are a world center of diversity for salamanders and have 68 species of a unique group of lungless salamanders that evolved in this region of well-oxygenated streams and high rainfall,"

**Figure 2-11. Percentage of Households in Appalachia Using Septic Tanks and Cesspools, 1990**




Data Source: Census 1990 Summary Tape File 3
Tables H23 and H24

Less than 33%
33 through 67%
More than 67%

write Peter White and colleagues.[28] Appalachia is a major contributor to the southeastern United States' status as the richest region for diversity of freshwater fish of any temperate area of comparable size in the world.[29]

However, as White and his colleagues point out, this diversity is largely attributable to the numerous, narrowly restricted endemic species in a lot of the headwater streams. Many of these species depend on very good water quality and are accordingly threatened by changes in the environment that might not be as significant in ecologies involving larger, downstream bodies of water. Thus White and his colleagues find a much higher percentage of species endangered or threatened in Appalachia than in other parts of the Southeast (see Table 2-5).

**Table 2-5. Endangered or Threatened Species, by Region**

| Faunal Region | Percent of Species Endangered or Threatened |
|---|---|
| Southern Appalachians | 18.3 |
| Interior Plateau | 11.4 |
| Atlantic Slope | 7.1 |
| Lower Appalachicola River basin | 6.3 |
| Lower Mississippi River | 6.0 |
| Lower Mobile River basin | 4.9 |
| Peninsular Florida | 4.1 |

*Source:* From Peter White et al., *Environments of the Southeast* (Delray Beach, Fla.: St. Lucie Press, n.d.), available at biology.usgs.gov/s+t/SNT/noframe/se130.htm.

Some writers, including noted critic of the Appalachian mining industry Harry M. Caudill, have viewed Appalachia's abundance and high quality of water as great assets.[30] Appalachia is home to the headwaters of almost all the important rivers of the eastern United States (see Figure 2-12). Thus whatever happens to Appalachian waters has major consequences for the nation as a whole.

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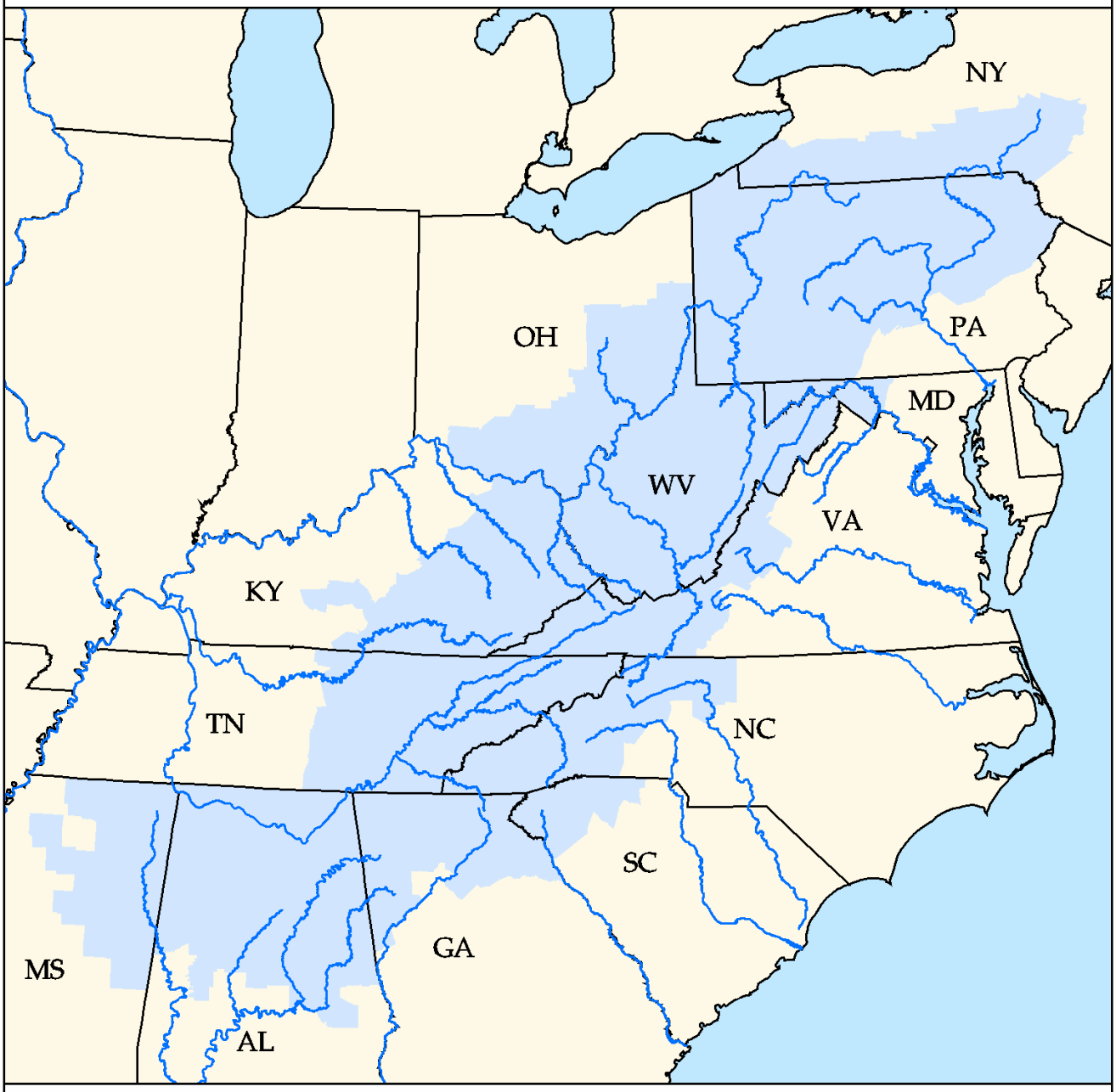
[28] Peter White et al., *Environments of the Southeast* (Delray Beach, Fla.: St. Lucie Press, n.d.), available at biology.usgs.gov/s+t/SNT/noframe/se130.htm.

[29] *Ibid.*

[30] See Harry M. Caudill, *The Watches of the Night* (Boston: Little, Brown, 1976), 253–54, on water as the future of the region.

**Figure 2-12. River Basins of Appalachia**




Data Source: Provided by by Jeff Levy of the Bluegrass Area Development District on May 24, 2005

Appalachian River

Appalachia also is home to some serious problems with ambient water quality. Recent reports submitted by the Appalachian states to EPA, as required by Section 305(b) of the Clean Water Act of 1972, contain lists [required by Section 303(d)] of water segments in each state that are too polluted to attain their designated use (swimming, fish consumption, drinking, aquatic life, and other purposes). The Section 303(d) list is updated in even years. The Section 305(b) reports have serious limitations, but given that the United States has no real national accounting of the extent and the costs of water pollution, they are a reasonable second-best assessment. If a state deems a water body to be impaired and includes it in the Section 303(d) list, that water body certainly has some significant water-quality problems. West Virginia serves as a good example of problems with water quality. All the river basins in West Virginia are in Appalachia, and they drain the Appalachian Plateaus province, except for rivers on the east and northern borders of the state. West Virginia's 2004 Section 303(d) list identifies 878 impaired streams, covering approximately 6,170 stream miles. The most common impairments of water quality still are those related to mine drainage, bacterial contamination, and acid rain. Mine-drainage streams often are impaired by acidity (low pH) and/or elevated concentrations of metals, including iron, aluminum, and manganese. Many of these streams also fail tests of biological integrity (ability to support aquatic life).

Mercury deserves special mention. Aerial deposition of mercury is a national problem but one with special significance for Appalachia. Mercury contamination in fish tissue at levels above health standards is found in every state, and a recent EPA study found detectable levels in every single fish sample taken during a broad national sampling effort.[31] All the Appalachian states have issued fish consumption advisories for mercury, especially for pregnant women and for children.

One of the major sources of this pollution is combustion of coal—hence the special significance for Appalachia, especially its coal-producing areas. The Appalachian states collectively accounted for 44 percent of the United States' reported atmospheric emissions of mercury and mercury compounds in 2002. Of the top 100 electric utilities emitting airborne mercury, 28 were in Appalachia. The total reported emissions of mercury from these 28 sources in 2002 equaled 15,643.6 pounds.[32]

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[31] See EPA's study website, at www.epa.gov/waterscience/fishstudy, for updated information. The first two years of data are analyzed by the U.S. Public Interest Research Group in *Reel Danger: Power Plant Mercury Pollution and the Fish We Eat* (August 2004), available at cta.policy.net/reports/reel_danger/reel_danger_report.pdf.

[32] Data from Environmental Protection Agency, Toxic Release Inventory 2002, available at www.epa.gov/tri/tridata/tri02, compiled by UNCEFC.

### Environmental Characteristics Influencing Service

Water quality in Appalachia—and therefore the cost of providing water and wastewater services—is intrinsically linked to the region's physical environment. Without an understanding of the physical environment's attributes, fully assessing the current and future challenges for water and wastewater service is impossible. The physiographic province map (Figure 1-2) includes shaded relief showing topography in Appalachia. The region includes all the mountain areas of the eastern United States that are south of New England. Also, it extends into piedmont terrain on the east and into interior plains on the west and the south. Topology, geology, soils, precipitation, and groundwater are intimately related. Ultimately they are important to consideration of a region's comparative advantages, disadvantages, and costs in delivery of water and wastewater services. Appendix F discusses these environmental factors in detail by physiographic province. The remainder of this chapter provides an overview of the interplay of these characteristics in Appalachia and offers some specific illustrations in the various provinces.[33]

Most of the environmental factors in Appalachia lead to higher costs, especially in the Highlands. Subsurface conditions often are hard rock, making installation and repair of pipes relatively expensive. Groundwater typically occurs in fractures of bedrock, rather than in large, deep aquifers that are predictable in yield and depth. Frequently, soils are thin and unsuitable for onsite waste systems. Slopes are pervasive and often steep, sometimes requiring more and larger pumps and leading to a dispersed population, as settlements concentrate linearly along river bottoms.

Appalachian water quality suffers disproportionately from acid rain, especially of sulfates. The acid water can be buffered for drinking. However, it takes a toll on the region's aquatic life.

Other airborne pollutants, such as mercury (discussed earlier), are potentially more serious in the region than they are nationally. Further, there are areas of elevated, naturally occurring radionuclides in the groundwater. The mercury, the radionuclides, historically rapacious extractive industries, and widespread inadequacies in wastewater handling all contribute to significant water-quality problems in the region.

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[33] Most of the information in this chapter on geology and its consequences for the water resources of Appalachia is extracted from Henry Trapp Jr. and Marilee A. Horn, *Atlas of the United States: Delaware, Maryland, New Jersey, North Carolina, Pennsylvania, Virginia, West Virginia* (Washington, D.C.: U.S. Geological Survey, 1997), chap. 730-L (available at capp.water.usgs.gov/gwa/gwa.html), along with related information from other authors of the U.S. Geological Survey's atlases for the relevant physiographic regions, including chapter 730-K for the Appalachian Plateaus and chapter 730-G for the southern portions of the Appalachian Plateaus as well as the Atlantic and Interior Plains.

On the positive side of the ledger, the region receives ample precipitation, and as the headwaters area for the entire eastern United States, it faces fewer problems with upstream contamination than communities in the lower Piedmont, Coastal Plain, and Mississippi River corridor face. The corollary of this fact, though, is that the quality of Appalachian waste treatment is linked directly to the costs and the risks of surface water treatment downstream, in the rest of the eastern United States.

Another positive environmental factor is that the soils support an abundance—indeed, a huge diversity—of plant life, notably trees, both hardwoods and softwoods. Where the forest cover has been restored since its historic clearing from 1870 to 1930, or where it has expanded as a result of the reduction in grazing on ridges, the canopy and the riparian vegetation help stabilize soils and minimize suspended sediment in rivers and streams.

The Appalachian Plateaus province provides a good illustration of the interplay of environmental features and drinking water and wastewater service. The province is characterized by high, sharp ridges, low mountains, and narrow valleys. In the more southerly part of the province, geological processes have produced long, steep ridges running parallel from southwest to northeast. Elevation of the Highlands ranges from 1,000 to 4,500 feet, with a few peaks higher. Local relief generally ranges from 1,000 to 2,500 feet. The bedrock is overlain by residuum, colluvium, and alluvial material. Sandstone and some of the tougher carbonates hold up most of the upland portions; weaker carbonates and shale underlie most valleys.

Most of the precipitation that falls on the Plateaus moves quickly down the slopes, rather than sinking into the typically thin soils. Thus there is not as ample a bedrock aquifer as there is in the Valley and Ridge province.

The chemical quality of water in the freshwater parts of the bedrock aquifers is variable but usually satisfactory for municipal supplies and other purposes. Most of the water in the upper parts of the aquifers is not greatly mineralized and is suitable, or can be made suitable, for most uses. However, fresh groundwater generally circulates only to shallow depths. In much of the area, saline water or brine is not far below the land surface. Around Pittsburgh for example, wells drilled deeper than 100 feet below the level of the nearest major stream often yield saline water.

In southwestern Pennsylvania the rocks nearest the surface are mostly coal-bearing formations that consist of sandstone, shale, conglomerate, clay, coal, and minor limestone. The sandstones are the most productive aquifers, although coal beds and limestones also yield water. The limestones, however, are thin compared with those of the Valley and Ridge province.

In the Appalachian Plateaus, active, underground mining of coal disturbs the natural system of groundwater flow. Mines use artificial drains to dispose of unwanted water. Mines can create new fractures and thus increase the permeability of the soil. When the drains are effective, they can lower the regional water table, and the directions of groundwater flow can change in some cases until flow moves across former groundwater divides into adjoining basins. Groundwater tends to flow toward mines, which usually have pumps removing water from them. Adverse effects of mine drainage on well yields are greatest where the mines are not much deeper than the bottoms of the wells and where vertical fractures connect the aquifers and the mines. Abandoned mines can collapse. This causes fracturing of the rocks that overlie the mine and also may leave a depression on the land surface.[34]

**Land Use and Land Cover**

The fecund forest of Appalachia has been noted since the days of the earliest European visitors. For example, botanist John Banister wrote in 1680,

> This is a Country excellently well water'd & so fertile that it does or might be made yield anything that might conduce to the pleasure or necessity of life..[35]

As recently as 1902, James Wilson, a trained observer, noted that

> remote from the railroads the forest on these mountains is generally unbroken from the tops of ridge and peak down to the brook in the valley below, and to-day it is in much the same condition as for centuries past.[36]

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[34] Trapp and Horn, *Atlas of the United States*, chap. 730-L.

[35] John Banister, Letter to Dr. Robert Morison, reprinted in *The Height of Our Mountains: Nature Writing from Virginia's Blue Ridge Mountains and Shenandoah Valley*, eds. Michael Branch and Daniel Philippon (Baltimore: Johns Hopkins Press, 1998).

[36] James Wilson, Report on the Forests and Forest Conditions of the Southern Appalachian Region (Washington, D.C.: Government Printing Office, 1902), reprinted in *The Height of Our Mountains: Nature Writing from Virginia's Blue Ridge Mountains and Shenandoah Valley*, eds. Michael Branch and Daniel Philippon (Baltimore: Johns Hopkins Press, 1998),. Wilson was secretary of agriculture under Presidents McKinley, Roosevelt, and Taft. He personally visited the region and indicted the forestry practices then under way, in text and photographs.

With the coming of the railroads from 1870 to 1930, though, the forests of the region were nearly all cut. This clear-cutting had profound negative effects on water quality and quantity—namely, huge losses of already rare topsoil, and devastating floods.[37]

Woody cover across the region may be increasing. However, some experts believe that forest cover peaked in the 1960s and now is declining because of changes in the frequency of fires and the aging and demise of old-field pine that colonized many abandoned farms across the region in the mid and late nineteenth century.[38] Timber is an integral component of the region's water-quality system.

## Summary

As with everything else about Appalachia, simple generalizations about water quality are impossibly misleading. There are areas of high-quality water and water uses in the eastern United States, and there are areas so contaminated by decades of uncontrolled discharges that the prospect for cleanup at any foreseeable time is grim.

What is perhaps most important to an understanding of water and wastewater funding in the region is that most expressed needs for capital spending account minimally, if at all, for the costs of watershed restoration. If Appalachia is ever to attain Harry Caudill's vision of a region that would use its water to draw urbanites and their money from all over the eastern United States, much more funding will have to be found to improve ambient water quality.

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[37] See Ronald D. Eller, *Miners, Millhands, and Mountaineers: Industrialization of the Appalachian South, 1880–1930* (Knoxville: University of Tennessee Press, 1982); Ronald L. Lewis, *Transforming the Appalachian Countryside* (Chapel Hill: University of North Carolina Press, 1998); Ronald L. Lewis, "Railroads, Deforestation, and the Transformation of Agriculture in the West Virginia Back Counties, 1880–1920," in *Appalachia in the Making: The Mountain South in the Nineteenth Century*, eds. Mary Beth Pudup, Dwight B. Billings, and Altina L. Waller (Chapel Hill: University of North Carolina Press, 1995), 297–320; John Alexander Williams, *Appalachia: A History* (Chapel Hill: University of North Carolina Press, 2002).

[38] Peter White et al., *Environments of the Southeast* (Delray Beach, Fla.: St. Lucie Press, n.d.), available at biology.usgs.gov/s+t/SNT/noframe/se130.htm.

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# 3
# Assessments of Needs for Water and Wastewater Infrastructure in Appalachia

The dialogue concerning water and wastewater services is usually dominated by discussion of needs for physical capital infrastructure. This is not surprising, given that a new or expanded water or wastewater treatment plant, a new sewerage collection system, or an expanded water distribution system often is the most expensive public project carried out in or by a community. In addition to having large price tags, these projects bring pride, improved health, and economic development. When funds for the projects are not available, public leaders often make finding funds their number one priority. Water and wastewater needs related to decentralized systems, regulatory oversight, training, stormwater handling, source-water protection, watershed restoration, and system operation and maintenance rarely get the same attention either locally or nationally. As a result of the interest in capital, there are many more surveys of capital needs and sources of information on them, than there are of other types of needs.

Over the last ten years, a number of national, state, and advocacy organizations have completed water and wastewater infrastructure studies that cover parts of Appalachia (for a summary, see Tables 3-1 and 3-2). These studies have varied in scope, purpose, and method of implementation. Understanding the variations is crucial in determining how to extract and estimate Appalachian needs from the studies.

## Table 3-1. Differences among National Infrastructure Needs Surveys and Reports

| Author | Title | Geographic Coverage | Scope (Systems Surveyed or Methodology) | Smallest Geographical Subunit | Report Year | Report Frequency | Time Horizon | Private Utility Needs Included? | Include Currently Unserved Areas? |
|---|---|---|---|---|---|---|---|---|---|
| EPA | *Drinking Water Infrastructure Needs Survey: 2nd Report to Congress* | Nation | 100% of large CWSs, American Indian and Alaska Native Village water systems, and extrapolation from of medium CWSs, 599 small CWSs, 100 non–CWSs | State | 2001 | Every 4 years | 20 years | Yes | Yes if experiencing drinking water public health problems |
| EPA | *Clean Watersheds Needs Survey 2000* | Nation | Surveyed facility list includes most centralized discharging facilities and many collection systems | Utility | 2003 | Every 4 years | Identified needs as of 1/1/2000; varies in horizon | No | Yes |
| AWWA | *Dawn of the Replacement Era: Reinvesting in Drinking Water Infrastructure* | Nation | Extrapolation from 20 utilities | Nation | 2001 | Special | 30 years | Yes | No |

| Author | Title | Geo-graphic Coverage | Scope (Systems Surveyed or Method-ology) | Smallest Geo-graphical Subunit | Report Year | Report Fre-quency | Time Horizon | Private Utility Needs Included? | Include Currently Unserved Areas? |
|---|---|---|---|---|---|---|---|---|---|
| CBO | *Future Investment in Drinking Water and Wastewater Infra-structure* | Nation | Top-down macro estimate | Nation | 2002 | Special | 20 years (2000–2019) | Yes | Only extensions due to public health threats |
| EPA | *The Clean Water and Drinking Water Infra-structure Gap Analysis* | Nation | DWNS & CWNS plus modeled estimates | Nation | 2002 | Special | 20 years (2000–2019) | Yes | Per DWNS and CWNS |
| Water Infra-structure Network | *Clean and Safe Water for the 21st Century: A Renewed National Commitment to Water and Wastewater Infra-structure* | Nation | Top-down macro estimate | Nation | 2000 | Special | 20 years | Yes | Indirectly (capital cost of building new infrastruct ure is included) |

## Table 3-2. Differences among State Infrastructure Needs Surveys and Reports

| Author | Title | Geo-graphic Coverage | Scope (Systems Surveyed or Methodology) | Smallest Geo-graphical Subunit | Report Year | Report Fre-quency | Time Horizon | Private Utility Needs Included? | Currently Unserved Areas Included |
|---|---|---|---|---|---|---|---|---|---|
| West Virginia Infrastructure and Jobs Development Council | *PWS and PWWS Inventory & Needs Assessment Report 2002* | West Virginia | All 557 CWSs and all 292 community sewage systems | Utility | 2002 | Every 3 years | Identified needs | Yes | Yes |
| North Carolina Rural Center | *Clean Water: Our Livelihood, Our Life* | North Carolina | 405 water and 254 sewer systems in 75 predominantly rural counties | Utility | 1998 | Special | Identified needs | Yes | Yes |
| Ohio Public Works Commission | *Capital Improvement Reports* | Ohio | All water or sewer systems that apply for funds from OPWC (some *Capital Improvement Reports* are outdated) | Utility | Last-updated Capital Improvement Reports between 1999 and July 22, 2004 | Contin-uous | 5 years | Yes | No |

| Author | Title | Geo-graphic Coverage | Scope (Systems Surveyed or Methodology) | Smallest Geo-graphical Subunit | Report Year | Report Fre-quency | Time Horizon | Private Utility Needs Included? | Currently Unserved Areas Included |
|---|---|---|---|---|---|---|---|---|---|
| Kentucky Governor's Water Resource Development Commission | *Water Resource Development: A Strategic Plan* (1999) | Kentucky | All extensions of service planned by 2020 (not current infra-structure needs) | Utility | 1999 | Special | 20 years (2000–2020) | No | Yes |
| Kentucky Governor's Water Resource Development Commission | *Water Resource Development: A Strategic Plan for Wastewater Treatment* (2000) | Kentucky | All extensions of service planned by 2020 (not current infra-structure needs) | Utility | 2000 | Special | 20 years (2000–2020) | No | Yes |
| Tennessee Advisory Commission on Intergov-ernmental Relations | *Building Tennes-see's Tomorrow: Anticipating the State's Infra-structure Needs* | Tennessee | All projects during 2002–2007 costing at least $50,000 | County | 2004 | Annually | 5 years (2002–2007) | No | No |

### Scope and Implementing Organizations

Some surveys estimate national needs, whereas others estimate state or substate needs. EPA coordinates the national CWNS and the national DWNS every four years. The results of the CWNS conducted in 2000 were published in 2003.[39] Included are all wastewater capital needs that were present at the time of the survey, regardless of time period. The CWNS reports a total national need of $181.2 billion (in 2000 dollars), including $161.9 billion for wastewater collection and treatment facilities. The results of the DWNS conducted in 1999 were published in 2001. Included are national capital needs for 1999-2019.[40] The DWNS reports a total national need of $150.9 billion (in 1999 dollars), including $136.3 billion for the nation's community water systems and $3.1 billion for not-for-profit noncommunity water systems.

EPA also has published an analysis that uses needs studies as well as supplementary data and modeling to estimate drinking water and wastewater needs and the infrastructure gap for the entire country. The *Gap Analysis* suggests that the nation's twenty-year needs for investment in wastewater facilities are $331 billion–$450 billion (in 2001 dollars). The figure for investment in drinking water facilities is presented as $218 billion (in 2001 dollars).[41]

The Water Infrastructure Network (WIN) and the American Water Works Association (AWWA) carried out national-level studies as well.[42] Finally, the

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[39] Environmental Protection Agency, *Clean Watersheds Needs Survey 2000* (Washington, D.C.: EPA, 2003).

[40] Environmental Protection Agency, *Drinking Water Infrastructure Needs Survey: Second Report to Congress* (Washington, D.C.: EPA, 2001). The 2003 DWNS has been completed. However, the data will not be available for analysis until late 2005.

[41] Environmental Protection Agency, *The Clean Water and Drinking Water Infrastructure Gap Analysis* (Washington, D.C.: EPA, 2002).

[42] Water Infrastructure Network, *Clean and Safe Water for the 21st Century: A Renewed National Commitment to Water and Wastewater Infrastructure* (Washington, D.C.: the Network, 2000), available at www.amsa-cleanwater.org/advocacy/winreport/winreport2000.pdf; American Water Works Association, *Dawn of the Replacement Era: Reinvesting in Drinking Water Infrastructure* (Denver: the Association, 2001).

Congressional Budget Office (CBO) carried out an analysis of needs and past studies to generate additional numbers.[43]

All these studies provide national estimates. Some of them, such as the EPA needs surveys, have sufficient data and were carried out in a manner that permits presenting needs information at the state level. Others, such as the WIN and AWWA studies, are top-down modeling efforts that cannot readily be used to determine subnational needs.

The EPA needs surveys are carried out primarily by state needs coordinators, and each state is responsible for collecting data. The CWNS is done on a system- or facility-wide basis, so state-collected data can be used directly to estimate state needs. The DWNS involves some sampling at the state and national levels, so generating state estimates requires modeling done at the national level.

Several states in Appalachia carry out state-level infrastructure needs assessments separate from the EPA studies.[44] Some, such as Kentucky and West Virginia, collect data statewide at the project or system level so that they can generate needs estimates at substate levels. Others—for example, North Carolina—rely on sampling and then modeling to arrive at a state estimate. The resulting information cannot be easily disaggregated at the substate level.

Finally, some assessments, such as that reported in the *Virginia Coalfields Regional Water Study*, have focused on the need in a particular area of Appalachia.[45] The organizations responsible for state and regional needs surveys include economic

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[43] Congressional Budget Office, *Future Investment in Drinking Water and Wastewater Infrastructure* (Washington, D.C.: CBO, 2002), available at www.cbo.gov/showdoc.cfm?index=3983&sequence=0.

[44] Kentucky Governor's Water Resource Development Commission, *Water Resource Development: A Strategic Plan* and *Water Resource Development: A Strategic Plan for Wastewater Treatment* (Frankfurt: the Commission, 1999, 2000); North Carolina Rural Economic Development Center, *Clean Water: Our Livelihood, Our Life* (Raleigh: the Center, 1998); data from Ohio Public Works Commission, Capital Improvement Reports, provided on 22 July 2004, and analyzed by UNCEFC; Tennessee Advisory Commission on Intergovernmental Relations, *Building Tennessee's Tomorrow: Anticipating the State's Infrastructure Needs* (Nashville: the Commission, 2004); West Virginia Infrastructure and Jobs Development Council, *Public Water Systems & Public Wastewater Systems Inventory & Needs Assessment Report 2002* (Charleston: the Council, 2002).

[45] Thompson & Litton, for LENOWISCO and Cumberland Plateau Planning Districts, *Virginia Coalfields Regional Water Study* (Duffield, Va.: LENOWISCO, 1998), available at www.lenowisco.org/lenowisco%20library.htm.

development groups (as in Maryland, North Carolina, and Tennessee) and funding agencies (as in Kentucky and West Virginia).

## Purpose

The stated goal or purpose of a needs assessment dictates how it is carried out, what types of needs are included, and how the data are presented. Surveys such as those done by WIN, AWWA, and the North Carolina Rural Economic Development Center are primarily used to provide information for policy debate. As a result, these surveys tend to be more top-down than other types of surveys. The numbers they generate are not very useful in understanding needs in smaller, or different, areas than were covered by the original estimate.

In other cases, survey results are used to allocate capital funds. For example, the DWNS is used to determine capitalization grant allocations for states' DWSRF programs.

Some surveys are used to register needs so that projects can be considered for funding. Examples are those conducted in Kentucky, Ohio, and West Virginia (see Table 3-2).

## Frequency and Planning Period

Needs surveys may be done on a one-time basis, periodically, or on an ongoing basis (see Tables 3-1 and 3-2). Studies such as the EPA *Gap Analysis* and the WIN report, and state surveys in Kentucky, North Carolina, and Virginia have been commissioned over the years to respond to special policy and information needs. The EPA needs surveys and state surveys in Tennessee and West Virginia are done at regular intervals. Needs databases maintained by funding organizations such as the Kentucky Infrastructure Authority, the Ohio Public Works Commission, and the West Virginia Infrastructure and Jobs Development Council are updated continually to reflect newly identified projects.

Surveys of capital needs solicit information for stated planning periods, typically 5–20 years. Surveys that are used to evaluate projects for funding focus on shorter-range planning periods. The databases maintained by the Kentucky Infrastructure Authority and the Ohio Public Works Commission primarily include needs (facilities) scheduled (or desired) to be constructed within five years. Both organizations also collect data for longer horizons, but the data are assumed to be incomplete and less accurate. The DWNS asks systems to identify all their needs for twenty years. The CWNS requires that facility needs be documented and includes all needs documented at the time of the

survey, whether they are for five years or longer. Thus the planning period for the CWNS varies from facility to facility.

## Methodology

Understanding the different methodologies provides insight into how data from each of the surveys can and should be used to generate accurate estimates for Appalachia. No two needs surveys are alike. Some begin with the collection of project estimates at the system level, then aggregate them to the state or national level. This bottom-up approach is used by the CWNS and, to a lesser extent (because of sampling), by the DWNS.

The CBO classifies reports as top-down or bottom-up. However, many surveys are really hybrids of the two techniques.[46] For example, the AWWA survey uses a detailed engineering analysis of twenty systems to model needs across the country.

Information at the local level, if used at all, is collected differently for different surveys. The EPA provides general guidelines to states in collecting needs information, but the actual process varies. Some states hire contractors to collect information or conduct analyses. Other states rely almost exclusively on survey responses, with little follow-up. Still others visit each surveyed system.

The North Carolina Department of Environment and Natural Resources takes a very active role in the DWNS. EPA sends the department the survey, and the department hand-delivers it to systems. The department follows up with site visits to assist systems, especially small ones, in filling out the survey. It also conducts local meetings if there are several utilities in an area. After it collects the surveys, the department does an extensive review of the costs before sending the surveys on to EPA.

On the other hand, the Maryland Department of Environment uses a private contractor to conduct the state's CWNS. The department collects some data but sends them on to the contractor to interpret and review.

Needs surveys done by state organizations, such as the Kentucky Infrastructure Authority and the West Virginia Infrastructure and Jobs Development Council, use a variety of methods to gather information. The Kentucky Infrastructure Authority's Water Resource Information System is a database that collects infrastructure data through a Water Project Profile system. Individual development districts in Kentucky identify water and wastewater needs in their district and enter them as project profiles.

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[46] CBO, *Future Investment*.

The Water Resource Information System database is used as an electronic clearinghouse to connect needs and funding.

The West Virginia Infrastructure and Jobs Development Council collects needs data through its voting members, who meet monthly to assess needs. The council includes representatives from the Bureau for Public Health, the Department of Environmental Protection, the Water Development Authority, the Housing Fund, and the Economic Development Authority. West Virginia's eleven regional planning and development councils assist communities in entering projects into a database that tracks pending and funded projects, as well as unserved needs.

## Accuracy

The current systems for assessing and assigning dollar values to infrastructure capital needs are far from perfect. Indeed, there is strong evidence that the estimates, particularly for rural systems without planning staff, are less than actual capital needs. Lack of incentives to provide accurate information and lack of planning resources at the state and local levels are some of the factors that affect the accuracy of the estimates and contribute to a general sentiment on the part of state officials that the surveys are inaccurate.

Of all the national surveys and studies, the CWNS faces the most challenges in accurately portraying needs. For example, the 2000 CWNS shows a documented need in Accident, Maryland, of $206,000. Actual project investments have been significantly higher. Between 2001 and 2004, Accident invested $110,000 to correct sanitary sewer problems, and in 2004 it received and spent an additional $2.9 million in grants and loans to repair and reconstruct its water and wastewater systems. For another example, Northfork, in McDowell County, West Virginia, needs a new treatment plant. According to the CWNS, however, Northfork has no needs.

Reasons for missing data can be linked to the manner in which the CWNS is implemented and the perceived incentives or disincentives that systems have for providing information. Another major factor relates to the capacity of a particular system to provide information. Ironically the systems with some of the greatest needs, such as Northfork, also have the fewest human and financial resources to identify, plan for, or report needs.

At the time this report was written, Jasper, New York, was about to spend $2.86 million on a new sewer system. Not only do the town's needs not appear in the CWNS, but the name Jasper does not appear in the comprehensive list of New York systems used to identify needs. Jasper is not included because until Jasper spends its money, it

does not have a system or a facility. The CWNS is a bottom-up survey beginning at the level of existing systems.

The lack of incentive to respond to surveys affects the DWNS as well, even though the information is used for funding allocations. Systems that have not used the State Revolving Fund (SRF) programs, or systems that are not allowed access to the SRFs (such as private, for-profit systems in North Carolina and West Virginia), have little direct incentive to help their state acquire more federal SRF funds.[47]

The UNCEFC research team's interviews with state needs coordinators in the Appalachian states highlight the variation in how EPA and state surveys are implemented and how the quality of the data is perceived. Perceptions about the CWNS ranged from "not worth the paper it is printed on" to being "very accurate" for the state. The state whose coordinator perceived the CWNS as "very accurate" approaches the CWNS with the belief that Congress might start using it to allocate the federal Clean Water State Revolving Fund (CWSRF) monies among the states on the basis of each state's portion of the national needs, as it does with the DWNS.

The other group of state officials who have the closest ties to these surveys are those who manage funding programs, some of whom use the data as part of their funding process. One surprising result of the UNCEFC survey was the discovery that many funding program managers are unaware of the EPA needs surveys (30 percent of respondents were unaware of the DWNS, and 40 percent of the CWNS) despite the use of the EPA data to make state allocations. When asked to comment on the accuracy of EPA and state surveys, funding program managers had the most doubts about EPA survey accuracy and were generally more accepting of the state surveys' estimates. Sixty percent of the respondents said that the state surveys accurately estimate their state's needs, while 70 percent and 60 percent said that the DWNS and the CWNS, respectively, underestimate their state's needs). (For the results of the UNCEFC survey of funding program managers, see appendix D.)

In 1997, EPA carried out follow-up visits in 200 communities included in the 1995 DWNS and found significant underreporting. As a result, for its *Gap Analysis*, EPA used multipliers that significantly inflated needs survey data to estimate actual needs (see Table 3-3).

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[47] The Safe Drinking Water Act permits private for-profit-systems to access SRF funds. However, many states—North Carolina, among them—have enacted state rules that limit access to not-for-profit or public government systems.

**Table 3-3. Adjustment Factors Used by EPA in One Approach to Estimating National Drinking Water Needs from 1997 DWNS**

| Characterization of Community Water System | Pipe Needs | Non-Pipe Needs |
|---|---|---|
| Large Systems (serving more than 40,000 people) | 1.61 | 1.49 |
| Medium Systems (serving 3,300 – 40,000 people) | 1.61 | 1.49 |
| Small Systems (serving fewer than 3,300 people) | 1.00 | 1.00 |

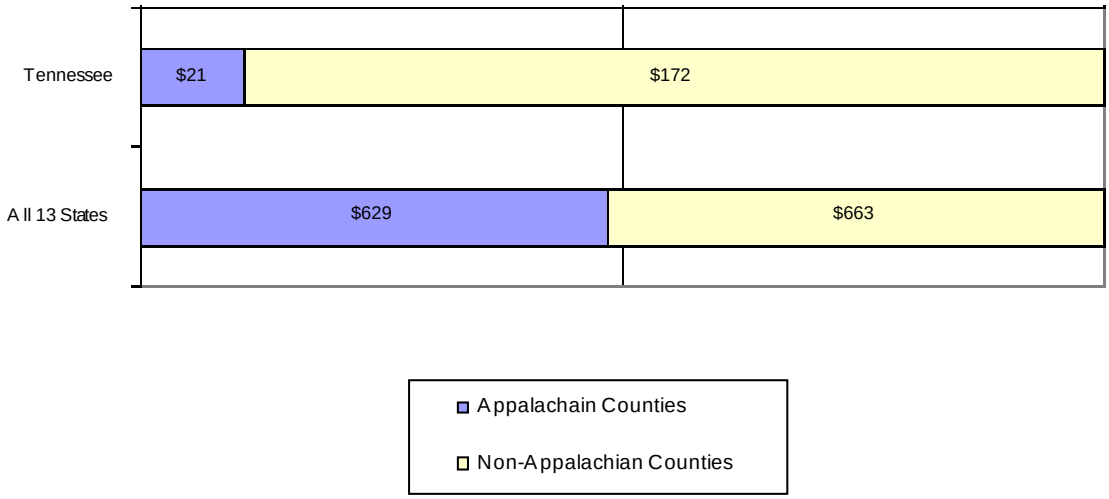
*Source:* Reprinted from Environmental Protection Agency, *The Clean Water and Drinking Water Infrastructure Gap Analysis* (Washington, D.C.: EPA, 2002), 31.

At the state level, the situation in North Carolina illustrates the sensitivity of needs surveys to the resources that state governments can devote to them. The 1999 DWNS occurred at the same time that North Carolina Public Water Supply officials were managing the largest public infrastructure funding initiative in the history of the state. They had few extra resources to perform follow-up visits. According to the North Carolina DWNS coordinator, in 2003 the staff was able to devote considerably more effort to follow-up visits. The provisional results of the 2003 needs survey far exceed the 1999 numbers. That is especially surprising, considering that the state pumped at least $388 million into water systems from 2000 to 2003. The likely conclusion is that the need was there in 1999 but not captured.

Data from needs surveys suggest that when states do not have sufficient resources or incentives to carry out the surveys, overall numbers are low, and harder-to-reach areas such as those found throughout Appalachia are particularly underreported. For this reason, in conducting the DWNS, EPA carries out structured visits with a sample of small systems (those with fewer than 3,300 customers) rather than relying on state-provided data. Unlike the DWNS, the CWNS relies on state-collected information for small systems.

The needs results for Tennessee from the 2000 CWNS illustrate the potential magnitude of underreporting in some states. Tennessee officials, like many consulted for this project, expressed concern that the CWNS is not currently used for a purpose that benefits the state and that as a result they find it difficult to make the survey a priority. In estimates of the clean water needs of Appalachia, Tennessee is clearly a major outlier, with a much lower estimate of needs per capita than the average for Appalachia as a whole (see Figure 3-1). The level of reporting in the Appalachian counties of Tennessee is low, thereby underestimating Appalachia's overall needs. The data for Tennessee also suggest that when a state is unable to do much follow-up work, rural areas with limited staff are likely to report even less in needs, as suggested by the sharp disparity between the Appalachian counties' and the non-Appalachian counties' estimates of needs per capita.

**Figure 3-1. Documented Clean Water Needs per Capita, Tennessee Counties versus All Counties in Appalachian States, 2000**




*Source:* Environmental Protection Agency, Needs Report data for *Clean Watersheds Needs Survey 2000*, available at www.epa.gov/owm/mtb/cwns, downloaded and compiled by UNCEFC. Total headquarters-accepted needs are used in this analysis. Population estimates from Census Bureau, Census 2000, Summary File 1, Table P1.

## Undocumented and Unidentified Needs

The preceding section comments on the underreporting of needs that should have been included according to the definition of the surveys. In many parts of Appalachia, a far greater issue than underreporting of needs is the purposeful exclusion of needs from consideration because of the focus of the surveys and the criteria that they use to define needs. For example, capital needs for upgrading or repairing individual septic tanks are not systematically included in the CWNS. As described in chapter 2, the average Appalachian family is much less likely to be served by a centralized wastewater system than the average U.S. family is.

Needs data often are presented and used for policy purposes without reference to the types of infrastructure needs included in the numbers. Both of the EPA needs surveys are oriented toward centralized systems, although some participating states include system extensions (extensions of water distribution lines and sewer collection lines) aimed at providing service to new customers with existing health or environmental problems. Neither survey includes cost estimates for improving existing decentralized systems for communities and households. Providing centralized water and wastewater services in many parts of Appalachia is not technically or financially feasible. However, the existing decentralized systems still require significant capital investments, ranging from installation of new systems where straight piping occurs, to complete replacement of failed systems. The Kentucky wastewater needs study

estimates that $3.5 billion–$7 billion will be needed to bring current onsite systems into compliance.

Two other types of needs that put pressures on local communities but are rarely included in needs surveys are infrastructure to accommodate growth and economic development. The need for the former is a problem in some southern parts of Appalachia that have more than doubled their population in the past 20–30 years. Although needs assessments that are used primarily for infrastructure funding, such as the DWNS and the assessment of the Ohio Public Works Commission, understandably focus on capital infrastructure, policy-oriented studies like the EPA *Gap Analysis* and the CBO study show that operation and maintenance needs also are significant.

Since many projects identified as needs in Appalachia are for new infrastructure, many communities soon will face completely new capital-related operation and maintenance needs. The West Virginia Infrastructure and Jobs Development Council's needs inventory in 2002 includes seventy-eight wastewater facilities for utilities or local governments that do not currently provide centralized wastewater treatment service. Among them are the six new facilities proposed for McDowell County (see Table 3-4). The 2000 CWNS needs estimates do not include the $22.3 million in capital needs for the new Davy, Dry Fork Public Service District, and McDowell County Commission wastewater facilities. Further, in each of these cases, once the facilities are constructed, the communities will become responsible for all the costs associated with operating the facility, as well as the costs of providing the necessary ancillary services linked to billing, customer service, and utility management. Hence the Appalachian needs estimates obtained from the federal needs surveys, already not including the capital needs required for many of the new facilities in the region, also underestimate the total financial needs of the communities by not including the operating and maintenance costs of systems that will come online.

**Table 3-4. New Wastewater Treatment Plants and Collection Systems Proposed for McDowell County, W.Va.**

| System Name | Assessment of System Needs | Needs |
|---|---|---|
| Anawalt | Construct gravity sewer lines, force mains, 3 pump stations, etc. | $ 4,800,000 |
| Davy | Construct treatment and collection system | 2,943,000 |
| Dry Fork Public Service District | Construct treatment and collection system (Cucumber, Bishop, Avondale, Squire, and Bradshaw) | 13,839,000 |
| Elkhorn Public Service District | Wastewater collection system | 9,146,200 |

| System Name | Assessment of System Needs | Needs |
|---|---|---|
| Ieager | Construct treatment and collection system | 3,167,000 |
| McDowell County Commission | Construct treatment and collection system (in Mohawk and Panther) | 5,474,000 |

*Source:* West Virginia Infrastructure and Jobs Development Council, *Public Water Systems & Public Wastewater Systems: Inventory & Needs Assessment Report* (Charleston, WV: the Council, 2002).

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# 4
# Capital Needs for Water and Wastewater Infrastructure in Appalachia

Despite the number of needs assessments that have covered parts of Appalachia, no one existing survey is perfectly suited for generating needs estimates for Appalachia as a whole. Different studies provide complementary and occasionally conflicting information about the needs facing Appalachian communities. Furthermore, the UNCEFC research team's examination of selected local communities across the region suggests that even the most comprehensive needs efforts often fail to portray the reality of the on-the-ground challenges facing communities.

Those limitations aside, having even rough estimates can provide Appalachian policy makers with a basic understanding of how the region compares with the rest of the country and, more important, how the needs relate to current resources for public capital funding (explored in detail in chapter 5). This chapter offers estimates of the portion of needs from state and national studies that can be reasonably attributed to Appalachia.

## The Clean Watersheds Needs Survey

The CWNS is the only needs survey that covers all of Appalachia and includes data that can be accurately presented at the county level without additional modeling. The documented needs for each Appalachian county based on the 2000 CWNS data appear in appendix A. The CWNS covers nine categories of needs (see Table 4-1). Categories I–V focus on the needs for infrastructure to collect and treat wastewater that are most commonly included in state inventories. Categories VI–IX cover needs that are linked to activities affecting surface-water quality but that are not normally considered water and wastewater needs.

**Table 4-1. CWNS Needs Categories**

| Category | Description |
|---|---|
| I | Secondary wastewater treatment |
| II | Advanced wastewater treatment |
| III-A | Infiltration/inflow correction |
| III-B | Sewer replacement/rehabilitation |
| IV-A | New collector sewers and appurtenances |
| IV-B | New interceptor sewers and appurtenances |
| V | Combined-sewer-overflow correction |
| VI | Stormwater management programs |

| Category | Description |
|---|---|
| VII | Non-point-source pollution control |
| VIII | Confined animal-point-source pollution control |
| IX | Mining-point-source pollution control |

*Source:* Environmental Protection Agency, *Clean Watersheds Needs Survey 2000* (Washington, D.C.: EPA, 2003).

The moment that a community decides to collect wastewater from individual homes, it becomes responsible for a chain of interrelated facilities and processes, all of which have associated capital costs. In most cases, "collector" lines carry wastewater from homes along side streets to larger "interceptor" lines. As these lines age, they develop cracks and holes that allow water to flow in freely or to filter in. Even the newest systems have some problems with "inflow" and "infiltration," but many older systems have so many infiltration problems that they become completely overloaded during wet weather. When that happens, a mixture of untreated wastewater and inflow water overflows from manholes or overloads small treatment plants, resulting in insufficient treatment before being discharged. Wastewater treatment plants employ different treatment technologies. However, almost all plants rely on the same physical and biological processes to carry out primary and secondary treatment. Treatment standards for wastewater effluent are highly dependent on where the wastewater is discharged. Communities that discharge wastewater into impaired or nutrient-sensitive waters often are required to implement advanced treatment to improve effluent quality and to reduce further the concentration of nutrients like phosphorus and nitrogen.

The data that EPA collects and reports for categories I–V are based exclusively on actual documented needs, whereas the data that it collects and reports for categories VI–IX include needs that were calculated through modeling. Both treatment facilities and collection systems planned and in operation (hereafter referred to as "facilities") were listed in the 2000 CWNS.[48] Thirty-eight percent (1,571) of Appalachia's 4,110 included facilities reported having project needs (see Table 4-2). The needs ranged from a few thousand dollars for improvements in collection systems in dozens of small communities, to more than $1.4 billion for the Jefferson County (Ala.) Valley Creek Wastewater Treatment Plant. (Of the ten project needs with the highest price tags, Jefferson County, which includes the city of Birmingham, has four, totaling $2.1 billion. That is 15 percent of the total category I–V needs of Appalachia.)

[48] Many of the facilities did not complete the survey, but all provided their names.

**Table 4-2. Documented Needs for Wastewater and Collection Systems in Appalachia (in Thousands of Dollars), by Type**

| Appalachian Counties in . . . | Category I | Category II | Category III-A | Category III-B | Category IV-A | Category IV-B | Category V | Categories I–V Total |
|---|---|---|---|---|---|---|---|---|
| Ala. | $ 1,312 | $ 922,542 | $112,497 | $1,127,855 | $ 342,902 | $ 43,866 | – | $ 2,550,974 |
| Ga. | 52,973 | 94,286 | 18,515 | 20,908 | 849 | 828 | – | 188,359 |
| Ky. | 158,849 | 51,907 | 14,409 | 68,982 | 323,364 | 141,654 | $ 7,677 | 766,842 |
| Md. | 11,063 | 70,724 | 12,586 | 14,034 | 16,767 | 10,025 | 151,940 | 287,139 |
| Miss. | 14,976 | 17,484 | 12,697 | 5,242 | 35,651 | 8,975 | – | 95,025 |
| N.C. | 48,171 | 29,575 | 42,259 | 73,369 | 244,201 | 183,528 | – | 621,103 |
| N.Y. | 110,260 | 40,885 | 14,175 | 5,098 | 47,080 | 22,718 | 306,867 | 547,083 |
| Ohio | 91,556 | 22,901 | 61,544 | 3,713 | 132,043 | 95,414 | 192,170 | 599,341 |
| Pa. | 623,979 | 146,150 | 62,752 | 57,100 | 747,554 | 123,682 | 3,482,948 | 5,244,165 |
| S.C. | 394,372 | 56,557 | 30 | 2,382 | 11,124 | 50,243 | – | 514,708 |
| Tenn. | 12,588 | 5,275 | 3,131 | 939 | 26,911 | 3,380 | – | 52,224 |
| Va. | 59,179 | 3,373 | 11,062 | 6,726 | 223,186 | 97,632 | – | 401,158 |
| W.Va. | 297,949 | 12,086 | 133,612 | 48,014 | 691,236 | 478,246 | 869,116 | 2,530,259 |
| Appalachia Total | $1,877,227 | $1,473,745 | $499,269 | $1,434,362 | $2,842,868 | $1,260,191 | $5,010,718 | $14,398,380 |
| Percentage of Appalachia's Documented Needs | 13% | 10% | 3% | 10% | 20% | 9% | 35% | 100% |
| U.S. Total | $36,833,000 | $20,419,000 | $8,165,000 | $16,762,000 | $14,265,000 | $14,844,000 | $50,588,000 | $161,876,000 |
| Percentage of U.S.'s Documented Needs | 23% | 13% | 5% | 10% | 9% | 9% | 31% | 100% |
| Percentage of U.S. Needs in Appalachia | 5.1% | 7.2% | 6.1% | 8.6% | 19.9% | 8.5% | 9.9% | 8.9% |

*Source:* Environmental Protection Agency, Needs Report data for *Clean Watersheds Needs Survey 2000*, available at www.epa.gov/owm/mtb/cwns, downloaded and compiled by UNCEFC. Headquarters-accepted Categories I–V needs are used in this analysis. U.S. national needs by category obtained from Environmental Protection Agency, *Clean Watersheds Needs Survey 2000* (Washington, D.C.: EPA, 2003).

The documented needs for categories I–V for all of Appalachia account for $14.4 billion of the national documented needs of $162 billion, or close to 9 percent. In each of the categories, the total Appalachian needs range from 5.1 percent to 9.9 percent of the national needs, with the exception of category IV-A (new collector sewers and

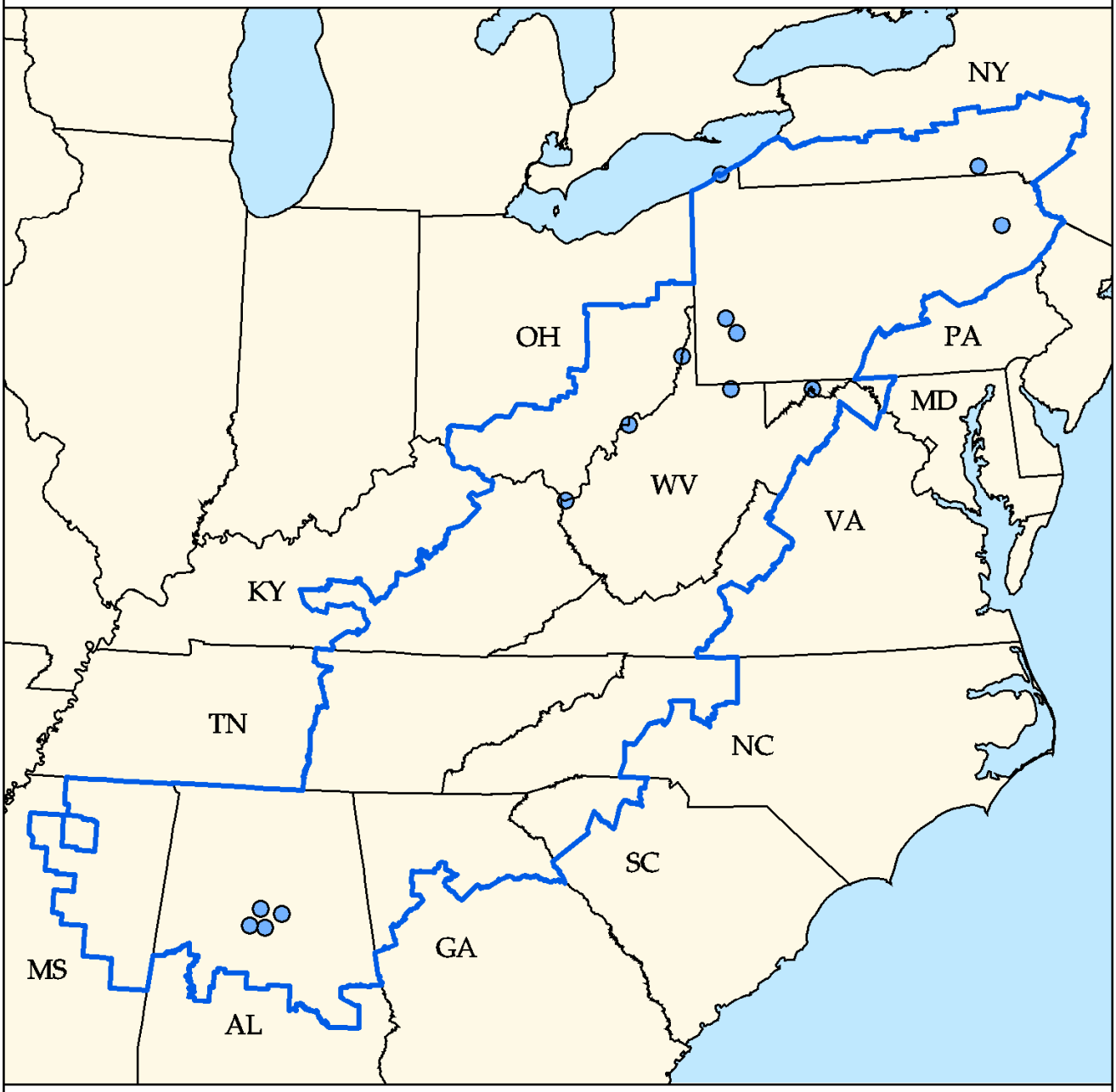
appurtenances), in which the Appalachian needs account for 19.9 percent of the national needs. A substantial portion of the nation's new sewers are being planned in Appalachia, indicating that significant activity is taking place to extend sewer service to households that are not currently connected to wastewater treatment plants. Needs for new collector sewers and appurtenances account for 20 percent of Appalachia's documented needs.

Many older sewer systems were designed to collect both wastewater and stormwater. During wet weather these combined systems commonly overload their treatment facilities, resulting in large amounts of untreated wastewater reaching the environment. Appalachia has considerable problems with combined-sewer overflow, as evidenced by the $5 billion worth of needs to correct them—35 percent of the total documented needs in the region. Nationwide, 31 percent of the documented needs are for these types of corrections. In Appalachia, in total numbers, the problem looks significant for the entire region. However, only six states have correction needs in their Appalachian counties. Pennsylvania accounts for $3.5 billion, or 70 percent of all such needs in Appalachia.

Fourteen facilities in Appalachia represent $4.5 billion in needs, or 31 percent of the total needs of Appalachia (for the facilities' locations, see Figure 4-1). The inclusion of large needs estimates for communities such as Birmingham follows a trend that occurs in many needs surveys: large facilities are much more likely than small systems to have their needs accounted for in the totals (but many more small systems than large ones have their needs included). Not only do needs assessors exert more effort to ensure that large systems participate in needs studies, but the large systems typically have more attention paid to documenting their needs, resulting in more accurate estimates. Both Jefferson County, Alabama, and Accident, Maryland, are under consent decrees to improve their wastewater systems. At the time of the needs survey, Jefferson County, with its legion of engineering reports, was able to produce large, detailed estimates of its needs, whereas Accident was able to identify and document only a small percentage. As is true of many small towns, Accident does not have a capital improvement program. Problems in places like Accident often remain hidden until the last possible moment. Accident is currently making about $3 million worth of repairs to its facilities—$2.8 million beyond what was included in the CWNS.

Across Appalachia, there is great variation in per capita needs per county (see Figure 4-2). In the 2000 CWNS, they ranged from $6,592 in Mingo County, West Virginia, to zero in eighty-two counties. The needs within each county and the variation across counties and states should be viewed in the context of the facilities that actually reported needs. For example, the absence of needs in most of Tennessee is primarily attributed to the abnormally high number of facilities that did not participate in the survey or reported zero needs.

**Figure 4-1. Facilities in Appalachia with Greatest Needs in Categories I-V**

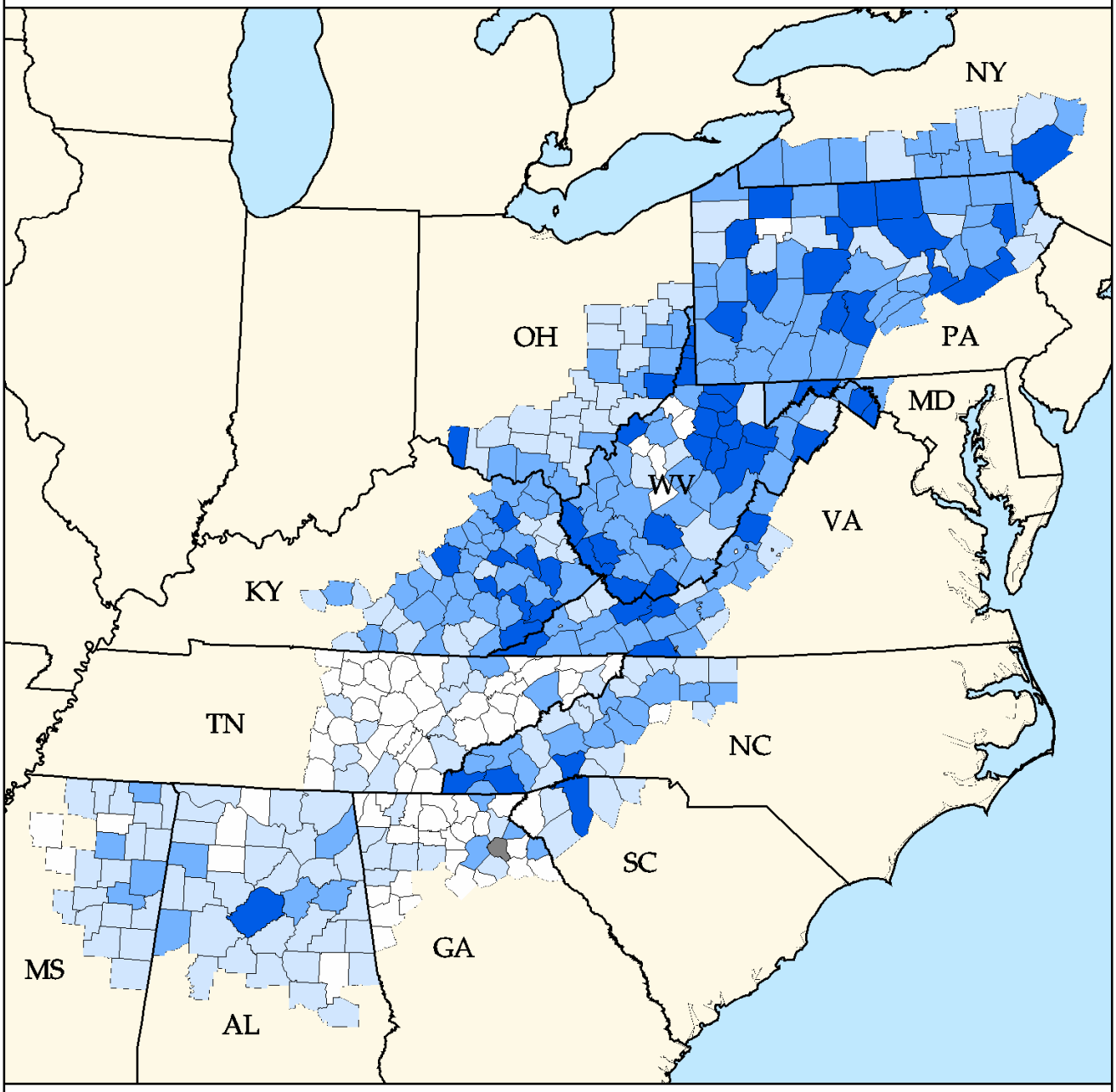



Data Source: Environmental Protection Agency, Needs Report data for Clean Watersheds Needs Survey 2000, available on www.epa.gov/owm/mtb/cwns, downloaded and compiled by UNCEFC. Total headquarters-accepted Categories I-V needs are used in this analysis.

Facilities with Greatest Needs

ARC Boundary

**Figure 4-2. Documented Needs per Capita in Categories I-V**




Data Source: Environmental Protection Agency, Needs Report data for Clean Watersheds Needs Survey 2000, available on www.epa.gov/owm/mtb/cwns, downloaded and compiled by UNCEFC. Total headquarters-accepted Category I-V needs are used in this analysis. Population estimates from Census 2000 Summary File 1 Table P1. Level of documenting needs by wastewater facilities varied greatly between states, and 62 percent of all facilities in Appalachia did not document any Category I-V needs.

- Did Not Participate in CWNS
- No Documented Needs
- Less than $250
- $250 through $1000
- More than $1000

More than half of all the facilities in Appalachia do not have any documented needs for wastewater and collection systems (for the locations of these facilities, see Figure 4-3). These facilities either did not respond to the needs survey, did not have any projected needs in categories I–V, or did not provide the required documents for their needs to be accepted by EPA in the CWNS. Overall, 62 percent of the facilities did not have documented needs. The proportion ranged from 20 percent in Kentucky's Appalachian facilities to 92 percent in Tennessee's (see Table 4-3). This range underlines the different weight placed on, and the different approaches taken by, the various states in responding to the CWNS.

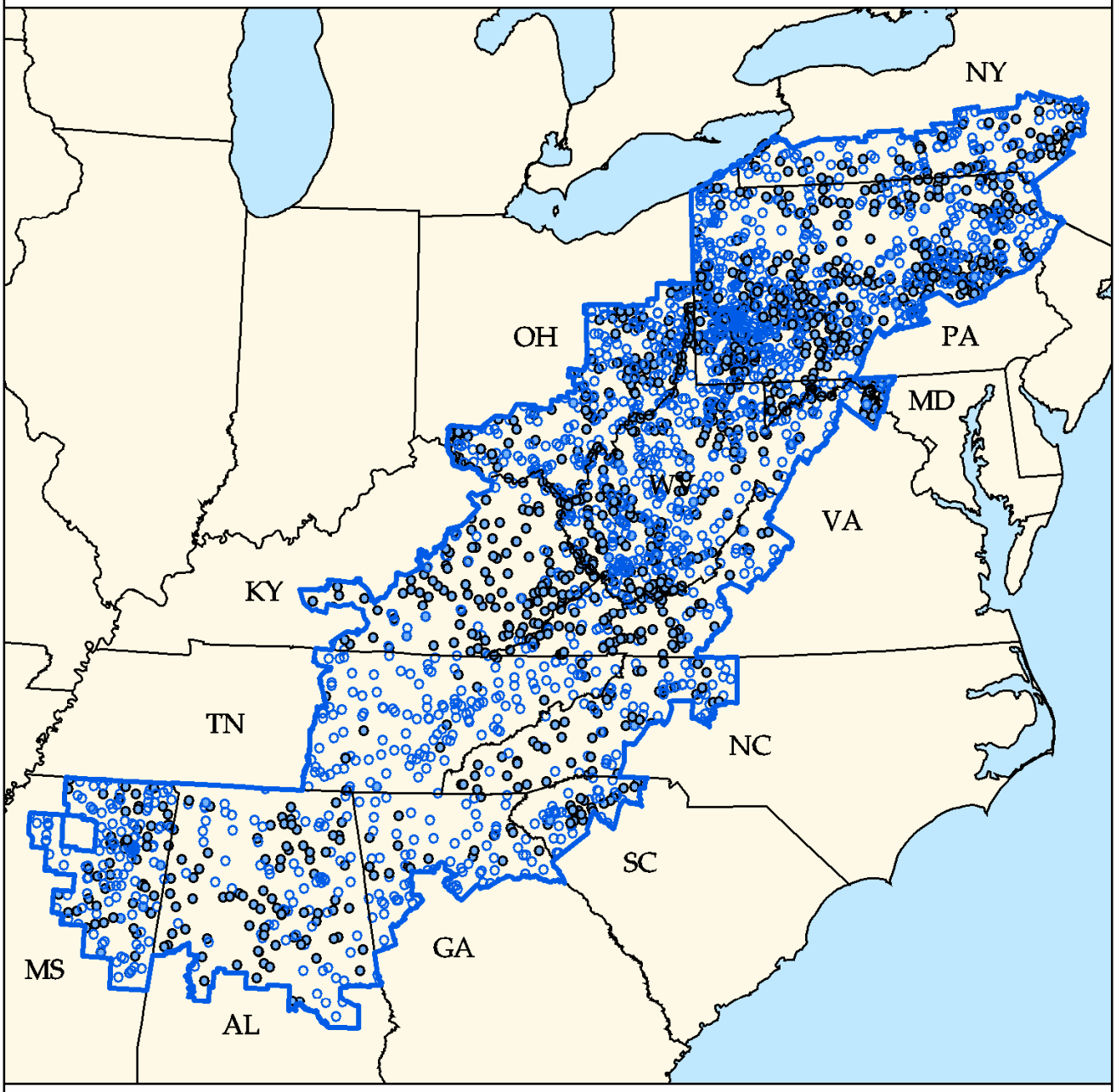
**Table 4-3. Facilities with No Documented Needs in Categories I–V**

| Appalachian Counties in . . . | Number of Participating Facilities in Appalachia | Number of Facilities with No Documented Needs (Categories I–V) | Percentage of Facilities with No Documented Needs (Categories I–V) |
|---|---|---|---|
| Kentucky | 187 | 38 | 20 |
| Virginia | 156 | 57 | 37 |
| Maryland | 67 | 26 | 39 |
| Alabama | 171 | 83 | 49 |
| West Virginia | 684 | 379 | 55 |
| North Carolina | 181 | 112 | 62 |
| New York | 202 | 127 | 63 |
| Ohio | 371 | 234 | 63 |
| South Carolina | 67 | 44 | 66 |
| Pennsylvania | 1,559 | 1,069 | 69 |
| Mississippi | 211 | 147 | 70 |
| Georgia | 90 | 72 | 80 |
| Tennessee | 164 | 151 | 92 |
| **Appalachia** | **4,110** | **2,539** | **62** |

*Source:* Environmental Protection Agency, Needs Report data for *Clean Watersheds Needs Survey 2000*, available at www.epa.gov/owm/mtb/cwns, downloaded and compiled by UNCEFC. Total headquarters-accepted Categories I–V needs are used in this analysis.

Analysis of the documented needs per capita for the Appalachian portion of each state is instructive (see Table 4-4). Such an analysis is important for several reasons. As pointed out in chapter 3, the extreme variation in per capita needs, when combined with the variation in effort put in by the needs assessors, suggests that the variation in per capita needs has more to do with how the surveys were done than with actual needs. However, without further research this cannot be proven.

**Figure 4-3. Facilities with and without Documented Needs in Categories I–V**




Data Source: Environmental Protection Agency, Needs Report data for Clean Watersheds Needs Survey 2000, available on www.epa.gov/owm/mtb/cwns, downloaded and compiled by UNCEFC. Total headquarters-accepted Category I-V needs are used in this analysis. 62 percent of all facilities in Appalachia did not document any Category I-V needs.

No Documented Needs

Documented Needs

ARC Boundary

**Table 4-4. Per Capita Documented Needs in Appalachia**

| Appalachian Counties in . . . | Per Capita Needs |
|---|---|
| Tennessee | $ 21.06 |
| Georgia | 85.33 |
| Mississippi | 154.40 |
| North Carolina | 406.96 |
| Ohio | 411.83 |
| South Carolina | 500.37 |
| New York | 509.96 |
| Virginia | 603.08 |
| Kentucky | 671.78 |
| Alabama | 899.11 |
| Pennsylvania | 901.09 |
| Maryland | 1,213.10 |
| West Virginia | 1,399.21 |
| **Appalachia** | **628.91** |
| **U.S.** | **$ 575.00** |

*Source:* Environmental Protection Agency, Needs Report data for *Clean Watersheds Needs Survey 2000*, available at www.epa.gov/owm/mtb/cwns, downloaded and compiled by UNCEFC. Total headquarters-accepted Categories I-V needs in each county are used in this analysis. Population estimates from Census 2000 Summary File 1 Table P1.

As noted earlier, the CWNS is a bottom-up survey that relies on accurate information for each facility to ensure that it is represented in the total needs figure. The fact that so many facilities in Appalachia either have not reported their needs (62 percent) or have underreported their needs suggests that the total needs estimate for Appalachia is likely to be much less than what communities will actually need to spend in the coming years. Given the overall high percentage of nonreporting communities and the high variation in reporting across states, the UNCEFC research team thinks that it is impossible to estimate or model accurately what the true need is for Appalachia as a whole or for communities that were not included in the survey. In the face of all the evidence of missing needs and underreporting, the research team concludes that the $14.4 billion estimate in needs for the Appalachian communities that participated in the CWNS can and should be considered as the lower bound of any realistic range. This finding is supported by state needs estimates and by consultations with and surveys of public officials throughout the study region. For example, about 50 percent of the funding program managers who completed the UNCEFC funding survey and were familiar with the needs studies thought that the studies underestimated actual needs. Even EPA, which conducts the CWNS, has concluded that the wastewater needs of the country are

significantly higher than are documented in the CWNS.[49] Other efforts to generate more realistic needs numbers using past CWNS surveys, such as those carried out by the CBO, suggest that actual needs may be as high as two times the raw CWNS estimates.[50]

### The Drinking Water Needs Survey

The sampling and modeling methodologies of the DWNS are designed to generate statewide needs totals. After reviewing the modeling approaches and consulting with DWNS analysts, the UNCEFC research team developed a modified modeling procedure that uses national and regional data and Appalachian system stratification to generate needs estimates for community water systems (for a detailed description of the modeling procedure, see appendix G). This modeling approach estimates that $11.4 billion (8.4 percent) of the $136.3 billion needed for community water systems in the United States, is needed for such systems in Appalachia (see Table 4-5). The $11.4 billion estimate amounts to $496 per capita, slightly higher than the national need of $484 per capita. The figures for Appalachia and the United States are similar, partly because the national data were used to estimate Appalachia's needs. If only sampling data from Appalachia are used for the small systems (those serving fewer than 1,000 people), Appalachia's needs increase to $11.6 billion, or $505 per capita (see appendix G for more details).[51]

**Table 4-5. Extrapolated Community Water System Needs in Appalachia**

| Appalachian Counties in . . . | Number of Community Water Systems | Extrapolated Community Water System Needs | Extrapolated Needs per Capita |
|---|---|---|---|
| Alabama | 331 | $ 1,278,689,572 | $451 |
| Georgia | 265 | 992,411,921 | 450 |
| Kentucky | 174 | 788,488,678 | 691 |

[49] Environmental Protection Agency, *The Clean Water and Drinking Water Infrastructure Gap Analysis* (Washington, D.C.: EPA, 2002).

[50] Congressional Budget Office, *Future Investment in Drinking Water and Wastewater Infrastructure* (Washington, D.C.: CBO, 2002).

[51] Analysis by UNCEFC of average per-system needs estimates from data used in *Drinking Water Infrastructure Needs Survey: Second Report to Congress* (Washington, D.C.: EPA, 2001) shows that in Appalachia, per-system needs of small water systems (serving fewer than 1,000 people) are up to 1.5 times greater than the national average per-system small water system needs. Also, more than 61 percent of all community water systems in Appalachia are small water systems.

| Appalachian Counties in . . . | Number of Community Water Systems | Extrapolated Community Water System Needs | Extrapolated Needs per Capita |
|---|---|---|---|
| Maryland | 65 | 98,968,226 | 418 |
| Mississippi | 341 | 521,557,507 | 847 |
| North Carolina | 482 | 575,952,763 | 377 |
| New York | 584 | 621,167,425 | 579 |
| Ohio | 324 | 733,688,883 | 504 |
| Pennsylvania | 1,437 | 2,836,744,852 | 487 |
| South Carolina | 100 | 422,908,429 | 411 |
| Tennessee | 274 | 995,869,970 | 402 |
| Virginia | 301 | 409,452,309 | 616 |
| West Virginia | 556 | 1,079,500,918 | 597 |
| **Appalachia Total/Average** | **5,234** | **$ 11,355,401,455** | **$496** |

*Source* Number of community water systems in Appalachia from Environmental Protection Agency, SDWIS, database for 4th quarter, fiscal year 2003, frozen in January 2004; downloaded from www.epa.gov/OGWDW/data/pivottables.html and compiled by UNCEFC. National needs estimates from Environmental Protection Agency, *Drinking Water Infrastructure Needs Survey: Second Report to Congress* (Washington, D.C.: EPA, 2001). State needs estimates compiled by UNCEFC from SDWIS and average per-system needs estimates from data used in *Drinking Water Infrastructure Needs Survey: Second Report to Congress* (Washington, D.C.: EPA, 2001). Population estimates from Census Bureau, Census 2000, Summary File 1, Table P1.

In generating its *Gap Analysis* estimates, EPA studied data from follow-up visits to compare actual needs with reported needs. It determined that the numbers reported in the needs survey were substantially lower than actual needs. This led EPA to use multipliers of about 1.5 for some types of needs for large and medium-sized systems.

## Other National Studies

Extracting Appalachia's numbers for county and state needs from other national studies is much more difficult than extracting them from the CWNS and the DWNS, given the top-down nature of the estimates. In many cases the national numbers presented in these studies are based on national-level assumptions that make disaggregating the numbers to the county or state level unreliable.

However, studies like the WIN study, the AWWA study, and the EPA *Gap Analysis* can provide valuable insight into Appalachian needs in relation to the needs of other areas of the country. One of the twenty systems analyzed in the AWWA study, Charleston, West Virginia, is in Appalachia. As is true of many systems in the central

part of the region, much of the Charleston system was constructed in the first half of the twentieth century (for a case study of Charleston, see appendix E). Systems installed during this period are estimated to reach their peak replacement needs earlier than the average U.S. system.[52]

## State-Level Studies

Some state needs surveys can be broken down at least to the county level, so Appalachian county needs can be extracted from the state totals (for the Appalachian portion of several state needs surveys, see Table 4-6). For states such as Tennessee, whose CWNS numbers are clearly inaccurate, the state-generated numbers suggest that Tennessee's needs are closer in scope to communities in other Appalachian states than the CWNS indicates. The table also illustrates the apples-and-oranges nature of needs surveys that makes accurate comparisons so difficult.

**Table 4-6. Water and Wastewater Needs in Appalachia as Determined by State Surveys**

| State | State Survey Title | Description of Needs | Type | Total Needs | Estimates from EPA Needs Surveys |
|---|---|---|---|---|---|
| Ky. | *A Strategic Plan* (1999) | 20-year needs to extend sewer service | Sewer | $1,052,710,000 | $ 766,842,000 |
| | *A Strategic Plan for Wastewater Treatment* (2000) | 20-year needs to extend water service | Water | 878,311,000 | 995,869,970 |
| Ohio | *Capital Improvement Reports* (1999–2003) | 5-year water and wastewater needs | Sewer<br>Water | 456,779,424<br>415,387,782 | 599,341,000<br>733,688,883 |
| Tenn. | *Building Tennessee's Tomorrow: Anticipating the State's Infrastructure Needs* (2004) | 5-year water and wastewater needs | Water and sewer | 1,454,880,037 | 1,048,093,970 |

[52] American Water Works Association, *Dawn of the Replacement Era: Reinvesting in Drinking Water Infrastructure* (Denver: the Association, 2001).

| State | State Survey Title | Description of Needs | Type | Total Needs | Estimates from EPA Needs Surveys |
|---|---|---|---|---|---|
| W.Va. | *Public Water System and Public Wastewater System Inventory & Needs Assessment Report* (2002) | All 557 community water systems and all 292 community sewage system needs | Sewer<br>Water | 3,104,717,185<br>692,455,713 | 2,530,259,000<br>1,079,500,918 |

*Source* EPA wastewater needs estimates from *Clean Watersheds Needs Survey 2000* (Washington, D.C.: EPA, 2003). Drinking water needs from EPA, SDWIS, database for 4th quarter, fiscal year 2003, frozen in January 2004; downloaded from www.epa.gov/OGWDW/data/pivottables.html and analyzed by UNCEFC. Average per-system needs estimates from data in *Drinking Water Infrastructure Needs Survey: Second Report to Congress* (Washington, D.C.: EPA, 2001).

Kentucky maintains one of the most comprehensive and ongoing systems for documenting needs at the state level. The Kentucky Infrastructure Authority maintains a GIS database of needs throughout the state. For extending water and wastewater service to unconnected households, the per capita needs in the Appalachian counties are much greater than the per capita needs in the rest of the state (see Table 4-7).

**Table 4-7. Twenty-Year Water and Sewer Extension Needs in Kentucky**

| | Needs to Extend Service | | | Per Capita Needs | |
|---|---|---|---|---|---|
| Type | State | App. Counties | Non-App. Counties | App. Counties | Non-App. Counties |
| Water | $1,573,683,000 | $878,311,000 | $695,372,000 | $769 | $240 |
| Sewer | 1,973,494,000 | 1,052,710,000 | 920,784,000 | 922 | 317 |

*Source* Kentucky Governor's Water Resource Development Commission, *Water Resource Development: A Strategic Plan* and *Water Resource Development: A Strategic Plan for Wastewater Treatment* (Frankfurt: the Commission, 1999, 2000). Population estimates from Census Bureau, Census 2000, Summary File 1, Table P1.

In summary, the needs surveys conducted by some Appalachian states may report county needs more accurately than national needs surveys do. Where discrepancies exist between them and the national surveys, such as in Tennessee, closer examination is necessary.

## Needs by Physiographic Region

The level of needs across physiographic regions would be expected to differ because of the contrasting topography, in terms of both the varying engineering designs and corresponding costs that are specific to certain topographies, and the necessity of supplying community water and wastewater services in areas where onsite systems still predominate, such as in the Blue Ridge province. Examination of EPA's community water system needs and documented wastewater and collection system needs by physiographic region supports this hypothesis (see Table 4-8).

**Table 4-8. Wastewater and Drinking Water Needs and Population Served per System, by Physiographic Region**

| Physiographic Region | Wastewater Population Served and Needs | | Community Water System Population Served and Needs | |
|---|---|---|---|---|
| | Population Receiving Wastewater Collection by Treatment Facility, per Facility | Documented Needs per Capita | Population Served per Community Water System | Drinking Water Needs per Population Served |
| Atlantic Plain | 3,549 | $128 | 2,880 | $320 |
| Piedmont | 7,135 | 244 | 6,010 | 198 |
| Interior Plains | 8,508 | 336 | 9,409 | 250 |
| Blue Ridge | 3,574 | 374 | 1,937 | 242 |
| Valley and Ridge | 7,166 | 494 | 3,983 | 302 |
| Appalachian Plateaus | 6,345 | 946 | 3,396 | 389 |

*Source* Environmental Protection Agency, Needs Report data for *Clean Watersheds Needs Survey 2000*, available at www.epa.gov/owm/mtb/cwns, downloaded and compiled by UNCEFC. Total headquarters-accepted Categories I–V needs are used in this analysis. Data from EPA, SDWIS, database for 4th quarter, fiscal year 2003, frozen in January 2004; downloaded from www.epa.gov/OGWDW/data/pivottables.html. Average per-system drinking water needs estimates from data in *Drinking Water Infrastructure Needs Survey: Second Report to Congress* (Washington, D.C.: EPA, 2001), compiled by UNCEFC. Population estimates from Census Bureau, Census 2000, Summary File 1, Table P1.

This analysis suggests an interesting correlation between needs levels and physiographic regions. However, the concerns about data quality outlined throughout this report limit the reliability of this analysis, and its results should be applied cautiously.

## Needs by County Economic Status

Every year, ARC classifies all the Appalachian counties into four economic levels. The levels are based on a comparison of the counties with national averages according to three economic indicators (see Table 4-9). The analysis in this report uses county economic status for 2004.

**Table 4-9. Criteria for Economic Status Classification of Appalachian Counties**

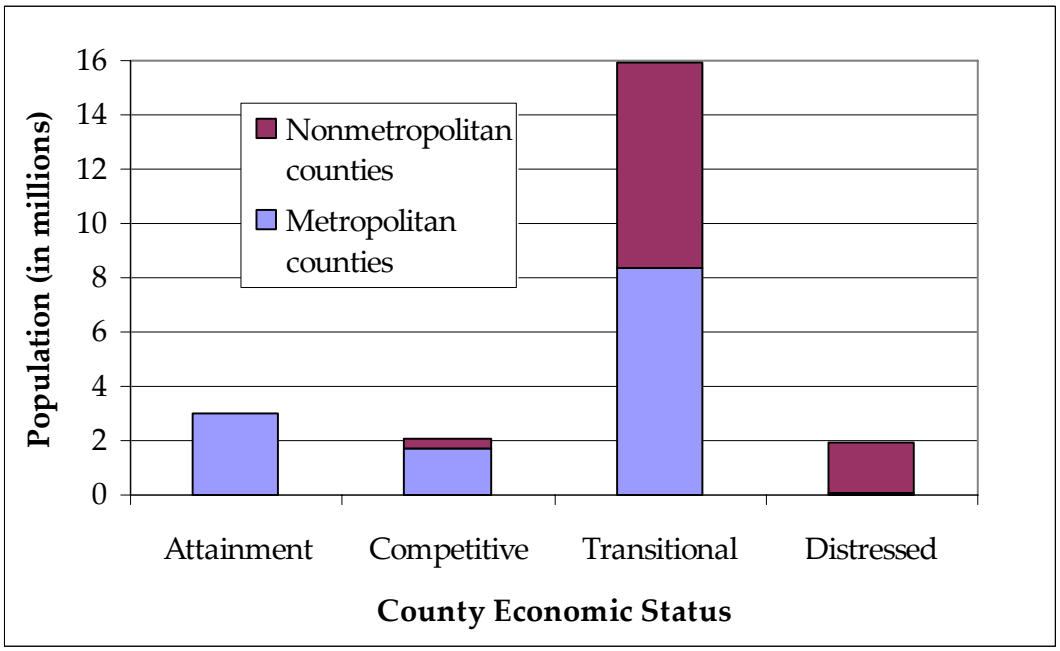
| Criterion | Economic Status Classification | | | |
|---|---|---|---|---|
| | **Attainment** | **Competitive** | **Transitional** | **Distressed** |
| Three-year Average Unemployment Rate | ≤ national average | ≤ national average | All counties not in other classes | ≥ 150% of national average |
| 2000 Per Capita Market Income | ≥ national average | 80%–100% of national average | All counties not in other classes | ≤ 67% of national average |
| 2000 Census Poverty Rate | ≤ national average | ≤ national average | All counties not in other classes | ≥ 150% of national average *or* ≥ 200% and county qualifies on one of other two criteria |

*Source.* Appalachian Regional Commission, Source and Methodology for the map *County Economic Status in Appalachia, FY 2004*, available at www.arc.gov/search/method/cty_econ.jsp.

In 2004 there were ninety-one distressed counties. Distressed counties are of particular interest because they have many fewer resources available to promote self-sufficiency for their populations than other Appalachian counties do, based on their lower per capita income levels, higher poverty and unemployment rates, and smaller population sizes, which amount to reduced labor forces. On average, distressed counties have a population size of 21,000, which is 38 percent of the average population size in all Appalachian counties (about 56,000).

On the whole, slightly less than 2 million people (8 percent) live in distressed counties, primarily in nonmetropolitan ones (see Figure 4-4). Carter County, Kentucky, and Lawrence County, Ohio, are the only two metropolitan counties in Appalachia that are distressed. On average, county population size is smaller for distressed counties than it is for counties with a higher economic status level (see Table 4-10).

**Figure 4-4. Population of Metropolitan and Nonmetropolitan Appalachian Counties, by County Economic Status**




*Source* County economic status from Appalachian Regional Commission, *County Economic Status in Appalachia, FY 2004* (available at www.arc.gov/index.do?nodeId=2146). Metropolitan status, as defined by the Office of Management and Budget in 2000, provided by the Appalachian Regional Commission (personal communication with authors, 4 November 2003). Population estimates from Census Bureau, Census 2000, Summary File 1, Table P1.

**Table 4-10. Population of Appalachian Counties, by County Economic Status**

| Economic status | Number of counties | Total population | Average county population |
|---|---|---|---|
| Attainment | 8 | 3,014,461 | 376,808 |
| Competitive | 22 | 2,046,604 | 93,027 |
| Transitional | 289 | 15,925,690 | 55,106 |
| Distressed | 91 | 1,907,262 | 20,959 |
| All | 410 | 22,894,017 | 55,839 |

*Source* Appalachian Regional Commission, 2004. Population estimates from Census Bureau, Census 2000, Summary File 1, Table P1.

Of the 4,110 treatment facilities and collection systems included in the 2000 CWNS, 567 (13.8 percent) are located in distressed counties. The wastewater infrastructure

needs per Appalachian facility documenting needs average more than $9 million, ranging from more than $4 million per facility in distressed counties to about $30 million per facility in attainment counties (see Table 4-11).

**Table 4-11. Wastewater Infrastructure Needs in Appalachia per Facility and per Capita, by County Economic Status**

| County Classification | Average Needs per Facility | Average Needs per Capita |
|---|---|---|
| Attainment | $29,843,766 | $634 |
| Competitive | 14,629,563 | 572 |
| Transitional | 8,725,997 | 644 |
| Distressed | 4,208,135 | 554 |
| All | $ 9,165,105 | $629 |

*Source* Environmental Protection Agency, Needs Report data for *Clean Watersheds Needs Survey 2000*, available at www.epa.gov/owm/mtb/cwns, downloaded and compiled by UNCEFC. Total headquarters-accepted Categories I–V needs are used in this analysis. Population estimates from Census Bureau, Census 2000, Summary File 1, Table P1. County economic status from Appalachian Regional Commission, 2004.

Per capita, however, there is no large difference between the needs of facilities in distressed counties and the needs of facilities in nondistressed counties, despite the fact that a much lower percentage of distressed county residents are actually served by (and pay sewer bills to) centralized facilities. In summary, distressed areas have per capita needs similar to those of nondistressed counties but fewer well-off rate payers, and fewer rate payers in general, to meet the burden.

Of the 5,234 Appalachian community water systems listed in the SDWIS database, 638 are located in distressed counties. On average, distressed counties have seven community water systems, which is half or less than half the number of systems in nondistressed counties (see Table 4-12). Furthermore, the populations served by these systems are smaller in size than those in nondistressed counties (see Table 4-13). Distressed counties' community water systems serve a population of nearly 8,000, on average.

**Table 4-12. Community Water Systems in Appalachia, by County Economic Status**

| County Classification | No. of CWSs | Population Served per CWS | Average No. of CWSs per County |
|---|---|---|---|
| Attainment | 132 | 119,368 | 17 |
| Competitive | 364 | 52,126 | 17 |
| Transitional | 4,100 | 20,574 | 14 |
| Distressed | 638 | 7,914 | 7 |
| All | 5,234 | 24,901 | 13 |

*Source:* Data from Environmental Protection Agency, SDWIS, database for 4th quarter, fiscal year 2003, frozen in January 2004; downloaded from www.epa.gov/OGWDW/data/pivottables.html and compiled by UNCEFC. County economic status from Appalachian Regional Commission, 2004

Note: CWS = community water system.

**Table 4-13. Drinking Water Infrastructure Needs in Appalachia per Community Water System and per Person Served, by County Economic Status**

| County Classification | Needs per CWS | Needs per Person Served |
|---|---|---|
| Attainment | $24,567,729 | $191 |
| Competitive | 19,082,612 | 326 |
| Transitional | 7,052,729 | 353 |
| Distressed | 3,864,707 | 497 |
| All | $ 7,989,679 | $316 |

*Source:* 1999 Drinking Water Needs Survey data, obtained by e-mail from Cadmus Group, 23 March 2004, compiled by UNCEFC.

Likewise, nonmetropolitan counties have fewer systems per county (11) and smaller community water systems (serving less than 12,000 people per system, on average) than metropolitan counties.[53]

On average, community water systems in Appalachia have $8 million in infrastructure needs. The needs grow according to the economic status of the county,

[53] Data from Environmental Protection Agency, SDWIS, database for 4th quarter, fiscal year 2003, frozen January 2004; downloaded from www.epa.gov/OGWDW/data/pivottables.html and compiled by UNCEFC.

from $4 million per system in distressed counties to about $25 million per system in attainment counties.

Again, though, on a per capita level, the trend is reversed. The average community water system's per capita needs increase as the economic status of the county decreases. Thus, on average, community water systems in distressed counties have greater needs per person served ($497) than systems in nondistressed counties ($191–$353). These findings imply that in Appalachia the burden of needs for drinking water infrastructure is greatest on those being served by community water systems in distressed counties or nonmetropolitan counties, where resources are fewer and incomes are lower but per capita needs are greater.

## Regulatory Needs as Water and Wastewater Funding Needs

Including regulatory needs in an assessment of the adequacy of funding for water and wastewater infrastructure may be unprecedented. However, without an adequate regulatory system, the quality of water and wastewater services will not be assured.

Anecdotal accounts and occasional published news reports suggest that regulators in the Appalachian states have unusually large needs—in other words, that their budgets, human resources, and levels of political support fall behind those in other regions of the country. For example, in 1998, citing EPA officials and a study from the magazine *Chemical and Engineering News*, Ken Ward of the *Charleston Gazette* reported that West Virginia's water-quality regulators were seriously underfunded.[54]

Confirming or refuting this suggestion of disproportionately low regulatory funding for water quality in Appalachia is difficult, if not impossible. The UNCEFC research team has attempted to assess it using three sources: data supplied directly to UNCEFC by the Environmental Council of the States (ECOS); a report, *State Environmental Expenditures and Innovations*, compiled by the National Association of State Budget Officers (NASBO) in May 2000; and an interim report by the Association of State and Interstate Water Pollution Control Administrators (ASIWPCA) in April 2002.[55] The data

[54] Ken Ward, "Regulators Lacking Funds: EPA Upset," *Charleston Gazette*, 25 January 1998.

[55] ECOS data from spreadsheet provided to Richard Whisnant, on file at UNCEFC; National Association of State Budget Officers, *State Environmental Expenditures and Innovations* (Washington, D.C.: the Association, May 2002), available at www.nasbo.org/publications/infobriefs/enviro_expend2000.pdf; Association of State and Interstate Water Pollution Control Administrators, *State Water Quality Management Resource Analysis: Interim Report on Results* (Washington, D.C.: the Association, April 1, 2002).

collection and presentation methods in these reports make disaggregating costs for Appalachia difficult.

The ECOS data provide the most insight into potential regulatory funding gaps. They suggest that there may be a significant difference between environmental budgets inside the region and environmental budgets outside it. Comparing per capita spending for all environmental programs in fiscal year 2003, the UNCEFC research team found that Appalachian states spent $53.17, while non-Appalachian states spent $79.97. This comparison includes West Virginia among the Appalachian states. In the ECOS data, West Virginia is an outlier for spending. If it is excluded from the comparison, the gap between Appalachia and the rest of the country widens further: $40.03 for the Appalachian states other than West Virginia, still $79.97 for the rest of the nation. (For a discussion of the methodology used for this analysis and for the complete results, see appendix H.)

## Application of Needs Estimates to the Policy Challenges Facing Appalachian Communities

Taken together, the EPA needs surveys indicate that communities in Appalachia have approximately $26 billion in water and wastewater infrastructure needs. However, there is ample evidence that communities will actually have to pay far more than this to ensure services that meet basic public health and environmental standards. Given the manner in which the surveys were carried out, it is impossible to estimate exactly how much more communities will have to pay, yet detailed needs extrapolations by others suggest that the number could easily be in the range of $35 billion–$40 billion. Once again, this number does not include the additional funds, certainly in the billions, needed to address the thousands of substandard and failing individual wells and onsite (septic systems to straight pipes) sanitation systems, nor does it include the funds that will be necessary to operate and maintain new facilities or facilities that have been neglected in the past.

In general, because so many state and federal funding policy decisions are justified under the rubric of responding to unmet capital needs, having a general estimate of capital needs is essential to an informed policy dialogue. The UNCEFC research team thinks that a range of $26 billion–$40 billion provides a realistic metric for understanding the challenges facing the region as a whole, especially for purposes of comparison with the public funding amounts presented in the next chapter. However, as large as these numbers are, they do not portray the full set of challenges facing individual states, counties, and communities. Any macro analysis of needs must be balanced by an examination of the challenges facing individual communities, such as those that have been profiled for this study (see appendix E).

# 5
# Sources of Funding for Water and Wastewater Infrastructure

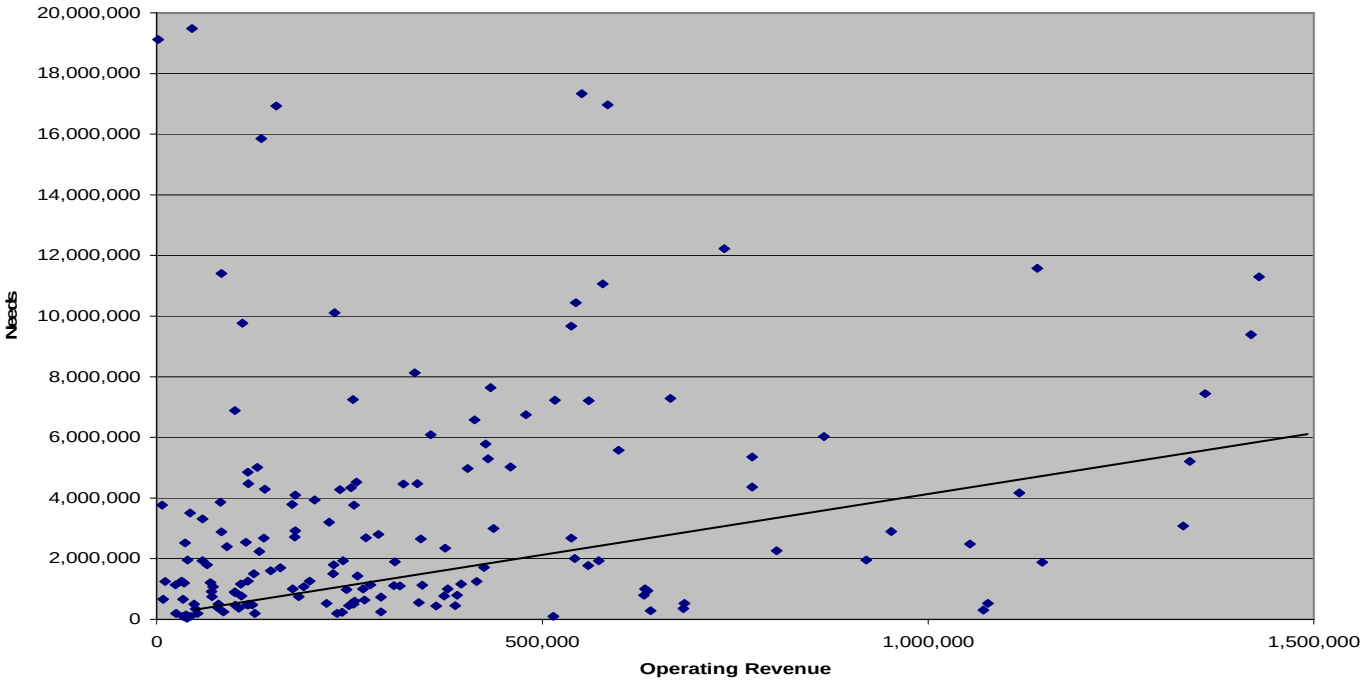
When communities write a check for a large infrastructure project, they normally find the funds in one of three places: their current revenues and reserve funds, the private capital market, or public funding programs. Some communities create innovative partnerships with other systems or private entities, but this source of funding is relatively uncommon, compared with the other three sources.

## Current Revenues and Reserve Funds

The use of current revenues and reserve funds to pay for capital improvements often is referred to as pay-as-you-go financing. Systems with large annual revenues and well-planned, staggered investments can occasionally cover large initial capital expenditures using revenues generated in the year in which the investment is made, but this is rare for all but the largest systems. For most systems, pay-as-you-go financing depends on proactive capital planning, which involves putting funds aside for future expenditures, sometimes for years. This type of planning is particularly difficult for small systems with limited revenues and elected boards that are reluctant to charge rates beyond what the systems require to meet current operating needs. The use of pay-as-you-go financing as a financial management strategy is discussed further in the next chapter.

Analysis of the documented needs for wastewater systems in West Virginia, versus current revenues, is instructive (see Figure 5-1). All the points above the diagonal line in Figure 5-1 represent communities where the documented needs are more than four times the annual revenues. If these systems could put 10 percent of their current revenues aside for future capital costs, it would take each of them at least forty years to accumulate enough savings to address today's needs, not to mention future needs. Even if systems did want to use pay-as-you-go financing, for many, the needs are so much higher than the revenues that it is difficult to imagine how they would generate extra revenues.

**Figure 5-1. Documented Needs for Wastewater Systems in West Virginia, versus Current Revenues**




*Source:* Data from West Virginia Public Service Commission, provided to UNCEFC by Dave Jarret, 19 May 2004 ; West Virginia Infrastructure and Jobs Development Council, *2002 Inventory and Needs Assessment Report* (Charleston: the Council, 2003), available at www.wvinfrastructure.com/reports/index.html.

Many state and federal programs that fund infrastructure require local matching (also called cost-sharing). For example, State and Tribal Assistance Grants require 45 percent cost-sharing (unless a different requirement is specified). The Capital Improvements Revolving Loan Program in Mississippi requires 50 percent cost-sharing. The North Carolina Clean Water Management Trust Fund provides communities with grants but requires cost-sharing of at least 20 percent.

Some communities have savings or cash on hand to cover these additional matching or cost-sharing requirements, but in many situations, communities turn to another funding program to obtain the additional funds. In the end, communities often can carry out multimillion-dollar projects with minimal local contributions up front. For example, Weaverville, North Carolina, combined $100,000 of its own funds with millions of dollars from other funding sources to pay the costs of a new water system (for a case study of Weaverville, see appendix E).

## The Private Capital Market

According to EPA, the private capital market is the single largest source of infrastructure capital funds.[56] However, use of this market varies significantly as a function of a community's creditworthiness, which in turn depends on a range of local factors. Relatively few communities in Appalachia, especially in economically distressed counties, have credit ratings for water and wastewater purposes from major rating agencies (for those with credit ratings from Moody's Investors Service, one of the nation's three major rating agencies, see Figure 5-2).

Some areas of Appalachia have regional rating agencies, such as the North Carolina Municipal Council. More than 40 percent of the cities and the counties in the Appalachian region of North Carolina either do not have a rating from the council or have a rating that indicates limited creditworthiness (less than 75). A review of outstanding private debt in certain areas in Appalachia indicates that in many of them, direct borrowing from the private capital market still is relatively rare Nevertheless, for larger and more economically advanced communities, such as Weaverville, North Carolina, the private debt market has been an important source of capital (see the sidebar below; also, for more detail about Weaverville, see the case study in appendix E).

Because of the difficulty many local communities have to accessing private capital, many states have realized that one of the most efficient methods of supporting infrastructure investment is to use a state's credit worthiness or bonding authority to develop pooled loan programs. This method of providing private capital to local communities has taken different forms in different states. For example, Virginia, Ohio, and West Virginia have developed traditional pooled loan programs in which state agencies serve as intermediaries to borrow money from the private capital market and lend it back to local governments through special state assistance programs. In some cases, states use the EPA SRF programs as their vehicle for providing local governments with access to private capital. Alabama has issued revenue bonds in order to contribute millions more than its required 20% state match to its EPA supported revolving loan programs. [57]

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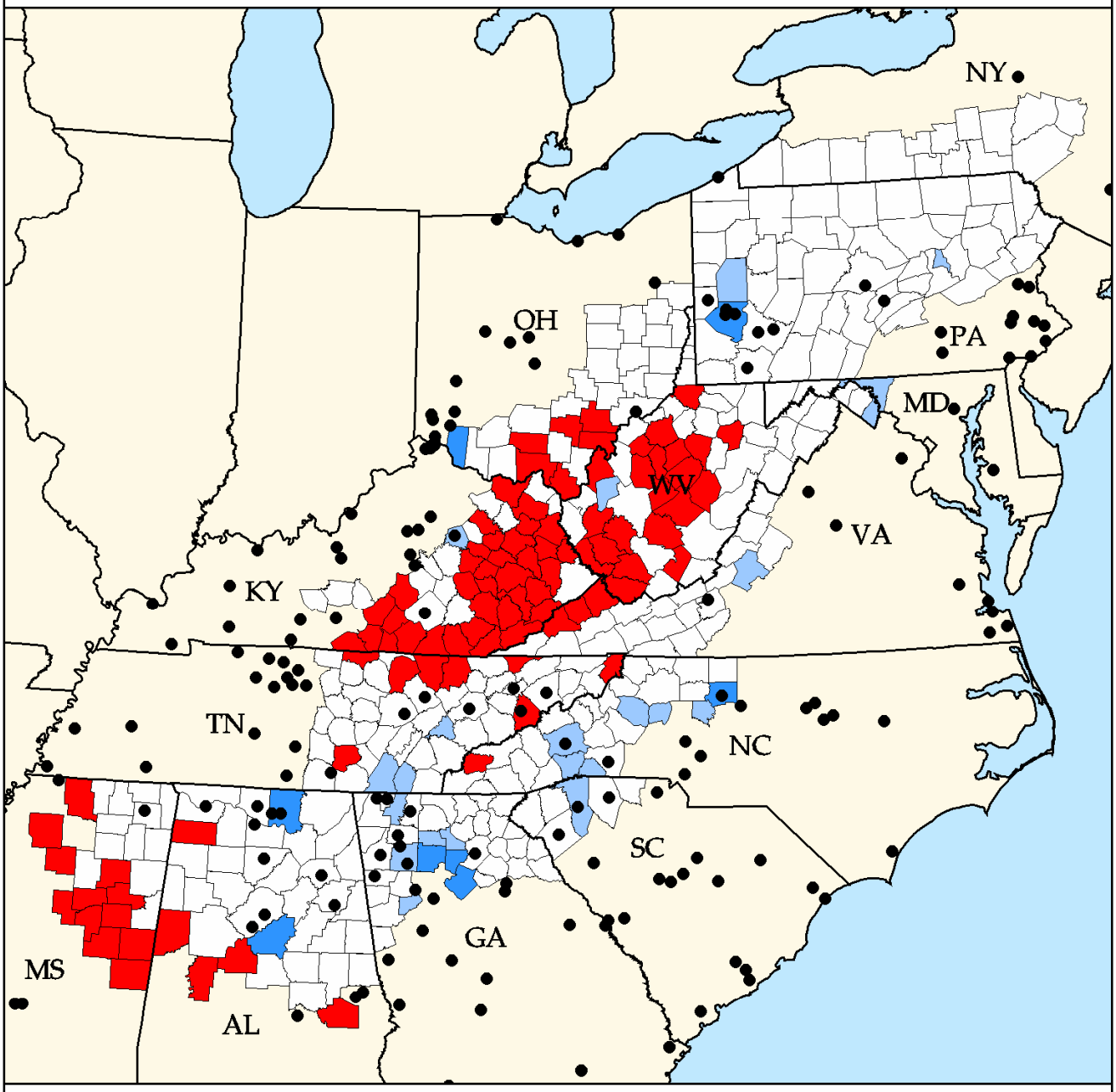
[56] Environmental Protection Agency, *2000 Community Water System Survey* (Washington, D.C.: EPA, 2002).

[57] Alabama Department of Environmental Management http://www.adem.state.al.us/WaterDivision/SRF/SRFMainInfo.htm, Web site accessed July 22, 2005.

**Figure 5-2. Communities in Appalachia with Credit Ratings from Moody's for Water and Sewer Purposes**




Data Sources:
2004 ARC Economic Status data
Credit Ratings: Moodys Investor Service, New York, NY, data received at UNCEFC in April 2004 from Ms. Rebecca Blackmon Joyner, Analyst

Community
Attainment
Competitive
Transitional
Distressed

**Sidebar 5-1**

**Sources of Capital: Weaverville, North Carolina**

Year: 1996

Purpose: expansion of drinking water source and protection of watershed

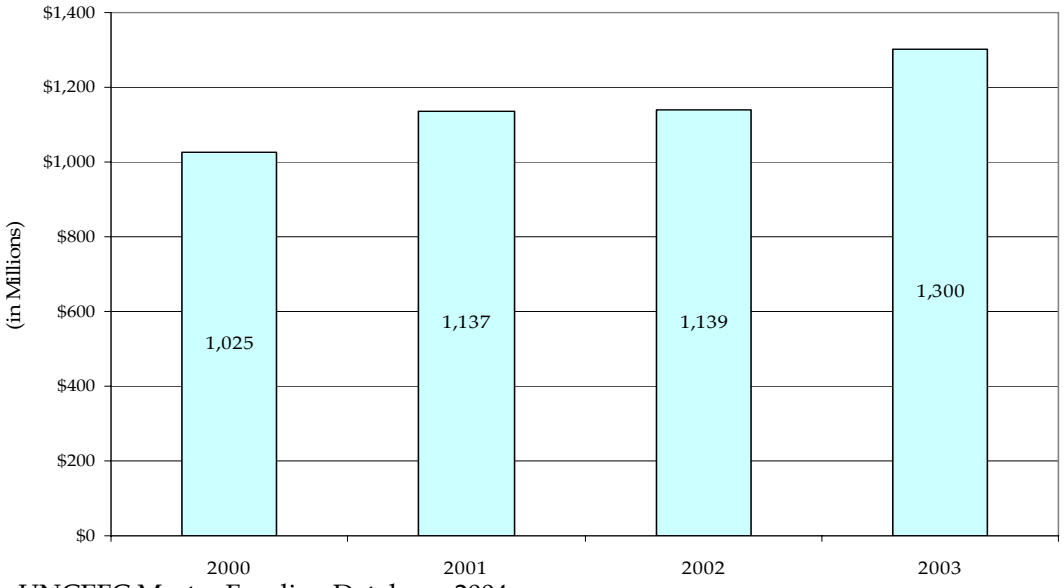
Funding Sources:

- $3.9 million general obligation bond
- $1.5 million grant from the Farmers Home Administration of the U.S. Department of Agriculture
- $200,000 grant from ARC
- $100,000 in local township funds

## Public Funding Programs

Communities with significant investment needs that do not have cash on hand or access to private capital invariably turn to the federal government or their state government for capital funds for water and wastewater infrastructure. Government programs disbursing such funds collectively account for a significant amount of capital investment in Appalachia. UNCEFC created a Master Funding Database as part of the present study (see appendix I). Data from that source indicate that between January 1, 2000, and December 31, 2003, government programs disbursed about $4.6 billion for water and wastewater infrastructure in Appalachia (see Figure 5-3). Funding programs include grants, subsidized loans, and pooled loans (bond bank programs).

**Figure 5-3. Disbursements in Appalachia by Federal and State Programs, 2000–2003**

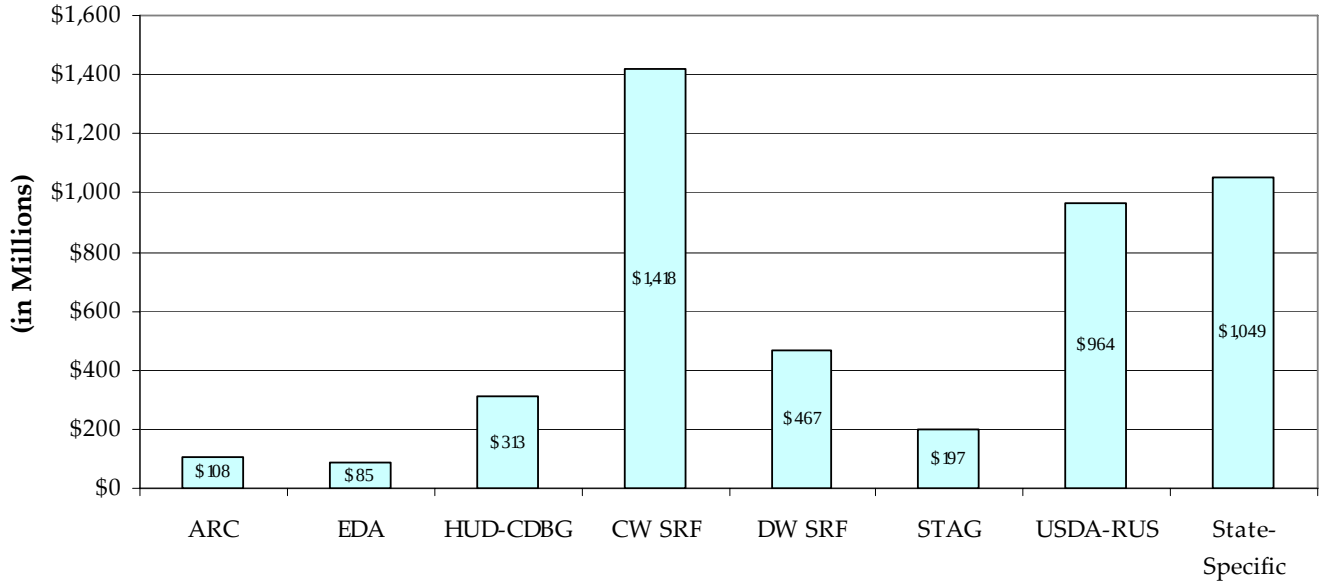



*Source:* UNCEFC Master Funding Database, 2004.

## Types of Funding Programs

Funding programs in Appalachia are directly administered by federal and state government agencies, independent authorities, and nonprofit programs. Some, such as ARC's programs, EPA's CWSRF and DWSRF, and the Community Development Block Grants program of the U.S. Department of Housing and Urban Development (HUD–CDBG), are primarily federal programs that are administered by state agencies. Federal funding programs do not rely exclusively on federal funds, for example the EPA SRF programs require states to contribute a 20 percent capital match. In other words, disbursements from federal assistance programs do not equate to federal funding levels. In other cases, state agencies and organizations manage pools of state-appropriated funds that are state-specific. (For the identities of major funding programs in Appalachia, see Figure 5-4.)

**Figure 5-4. Disbursements in Appalachia by Major Water and Wastewater Programs, 2000-2003**




*Source:* UNCEFC Master Funding Database, 2004.

The CWSRF is the single largest infrastructure program in the region, accounting for 30.8 percent of the water and wastewater investments by public programs from 2000 through 2003. Over this period, across the thirteen Appalachian states, the CWSRF provided an average of $354.4 million each year.[58]

[58] This report refers to the CWSRF as a federal funding program. However, CWSRF funds are disbursed by state-managed government programs. These programs also distribute state cost-sharing funds and proceeds from past loans.

The Water and Waste Disposal Loans and Grants Program of the U.S. Department of Agriculture, Rural Utilities Service (USDA–RUS), is the second-largest federal funding program in Appalachia, accounting for $964 million in water and sewer investments between 2000 and 2003. The funding criteria and procedures for USDA grants and loans are the same throughout the country, and the programs are administered by USDA offices located in each Appalachian state. (For a summary of the CWSRF, the USDA Water and Waste Disposal Loans and Grants Program, and other federal programs, see appendix J.)

Taken together, the special programs established by individual states accounted for 22.8 percent of the public program investments. The size of the programs varies significantly across states. The largest single state program is the West Virginia Infrastructure and Jobs Development Loan Program, with $215.4 million in funding from 2000 through 2003. (For the four-year funding totals for each major category of state funding program, see Table 5-1.)

Stand alone state specific programs have been important in some states and nonexistent in others. The data presented in Table 5-1 and throughout this chapter under the heading of "State Specific" refers to disbursements from state specific programs and does not include funds that states contribute to federal programs such as the EPA's SRF programs. SRF state matching funds are accounted for within the disbursements made through federal programs in this study. Alabama, while without any major stand alone state specific programs, is the only Appalachian State to have made significantly higher state capitalization matches (an average of 45 percent over 1988-2003) to its CWSRF program.[59]

**Table 5-1. Major Water and Wastewater Funding Programs in Appalachia and Percentage of Total Funding in Appalachia, 2000 –2003**

| Program Name | Total Funding | Percentage of Total Appalachian Program Funding |
|---|---|---|
| **Federal Programs** | | |
| SRF—Clean Water Program | $1,417,601,834 | 30.81 |
| USDA–RUS Water and Wastewater Disposal Loans and Grants | 964,322,220 | 20.96 |
| SRF—Drinking Water Program | 466,727,534 | 10.14 |
| HUD—Community Development Block Grants | 312,813,531 | 6.80 |

[59] *Clean Water SRF Program Information for the State of XXX* 2004, online at http://www.epa.gov/region5/water/cwsrf/pdf/*.*

| Program Name | Total Funding | Percentage of Total Appalachian Program Funding |
|---|---|---|
| State and Tribal Assistance Grants | 197,213,837 | 4.29 |
| ARC—Area Development, Economic Development, and Grant Programs | 107,840,761 | 2.34 |
| EDA—Public Works Program (about 5% of EDA funds were not used in this analysis) | 84,974,870 | 1.85 |
| **State-Specific Programs** | | |
| West Virginia Infrastructure and Jobs Development Loan Program | 215,387,425 | 4.68 |
| Pennsylvania State Revolving Fund (Clean Water and Drinking Water—State Source of funds, not Federal source of Funds) | 177,997,697 | 3.87 |
| West Virginia Water Development Authority | 75,267,433 | 1.64 |
| Georgia Fund Loan Program | 72,940,037 | 1.59 |
| West Virginia Infrastructure and Jobs Development Grant Program | 55,669,810 | 1.21 |
| Tennessee Municipal Bond Fund | 53,596,660 | 1.16 |
| Ohio Water Development Authority | 48,822,280 | 1.06 |
| Ohio Public Works Commission—State Capital Improvements Program | 41,404,787 | 0.90 |
| New York Clean Water/Clean Air Bond Act—Safe Drinking Water Portion | 37,654,156 | 0.82 |
| Kentucky Coal and Tobacco Development Fund Program | 33,110,783 | 0.72 |
| North Carolina Revolving Loan and Grant Program—High Unit Cost Grants, Clean Water | 31,723,316 | 0.69 |
| Kentucky Wastewater Construction | 28,008,669 | 0.61 |
| Kentucky 2020 Water Services Account Program | 24,476,650 | 0.53 |
| Kentucky Single County Coal Program | 20,482,894 | 0.45 |
| North Carolina Revolving Loan & Grant Program—High Unit Cost Fund, Drinking Water | 20,359,310 | 0.44 |
| Virginia Pooled Financing Program | 19,505,000 | 0.42 |
| Kentucky Coal Severance Tax Receipts—Kentucky Infrastructure Authority portion only | 12,686,958 | 0.28 |
| North Carolina Supplemental Grants Program | 11,728,130 | 0.25 |
| Kentucky Flexible Term Finance Program | 11,643,700 | 0.25 |
| North Carolina Unsewered Communities Grants Program | 9,942,907 | 0.22 |
| North Carolina Clean Water Management Trust Fund | 9,010,490 | 0.20 |
| South Carolina Water and Wastewater Infrastructure Fund | 7,790,473 | 0.17 |

| Program Name | Total Funding | Percentage of Total Appalachian Program Funding |
|---|---|---|
| Maryland Supplemental Assistance Program | 6,132,000 | 0.13 |
| Kentucky Infrastructure Revolving Loan—Fund B | 5,247,364 | 0.11 |
| Maryland Drinking Water Supply Assistance Program | 4,749,925 | 0.10 |
| South Carolina Budget and Control Board Grant Program | 3,620,184 | 0.08 |
| New York Financial Assistance to Business—Water Program | 3,162,628 | 0.07 |
| Mississippi Capital Improvements Revolving Loan Program | 2,019,534 | 0.04 |
| Georgia Equity Fund Program | 1,761,800 | 0.04 |
| U.S. Army Corps of Engineers (includes only selected records) | 1,510,000 | 0.03 |
| North Carolina Capacity Building Grants Program | 1,371,939 | 0.03 |
| Georgia Regional Assistance Program (2003 data not included) | 500,000 | 0.01 |

*Source:* UNCEFC Master Funding Database, 2004.

Sixty-eight percent of the public funding assistance to Appalachian communities from 2000 through 2003 came as loans. In total, $3.1 billion was loaned to communities. The largest single source of loans in the region was the CWSRF. The largest single source of grants was the Water and Waste Disposal Loans and Grants Program.

The terms of the loans varied significantly across programs. CWSRF loan terms are established by individual state programs. Typical terms from 2000 through 2003 were interest rates between 0 and 4.5 percent and loan periods of 15–20 years.[60] The Water and Waste Disposal Loans and Grants Program packages loans with grants. Most loans in the loan portion of the financing are made at 4 percent to 5 percent over 30–40 years.

State loan programs use various assistance strategies. One strategy is to offer loans at market rates but for periods (thirty years) longer than communities would qualify for in the private sector. The Ohio Water Development Authority is among the programs that employ this strategy. Another strategy is to offer discounted loan terms (for example, 0.0 percent). The Ohio Water Development Authority and Pennsylvania's State Funded State Revolving Fund (Clean Water and Drinking Water) are among the followers of this strategy.

[60] Some states extend DWSRF loans to disadvantaged communities for thirty years. West Virginia has received special permission to extend CWSRF loans for thirty years.

### Distribution of Funds

Public funding programs in Appalachia support different objectives and have different eligibility requirements, making geographic comparison difficult without taking into consideration the characteristics of systems in each area. On a per capita basis, Appalachian counties received $0–$649 annually from state-originated programs from 2000 through 2003, with a median of $36 and a mean of $58 (see Figure 5-5). As expected, the counties in the states with large state programs received significantly more funding than those in states without similar programs.

From 2000 through 2003, Appalachian communities received about 16.5 percent of the funds distributed by USDA's Water and Waste Disposal Loans and Grants Program and about 8.2 percent of the funds distributed nationally by the CWSRF.[61]

Analysis of the distribution of state-specific program investments in the Appalachian and non-Appalachian areas of the states offering the programs reveals that most of the programs are investing more per capita in the former areas than in the latter (see Table 5-2). This distribution is not surprising, given the distressed economic status of many Appalachian communities and the design of most funding programs to support low-income communities.

**Table 5-2. Total Funding per Capita by State-Specific Programs**

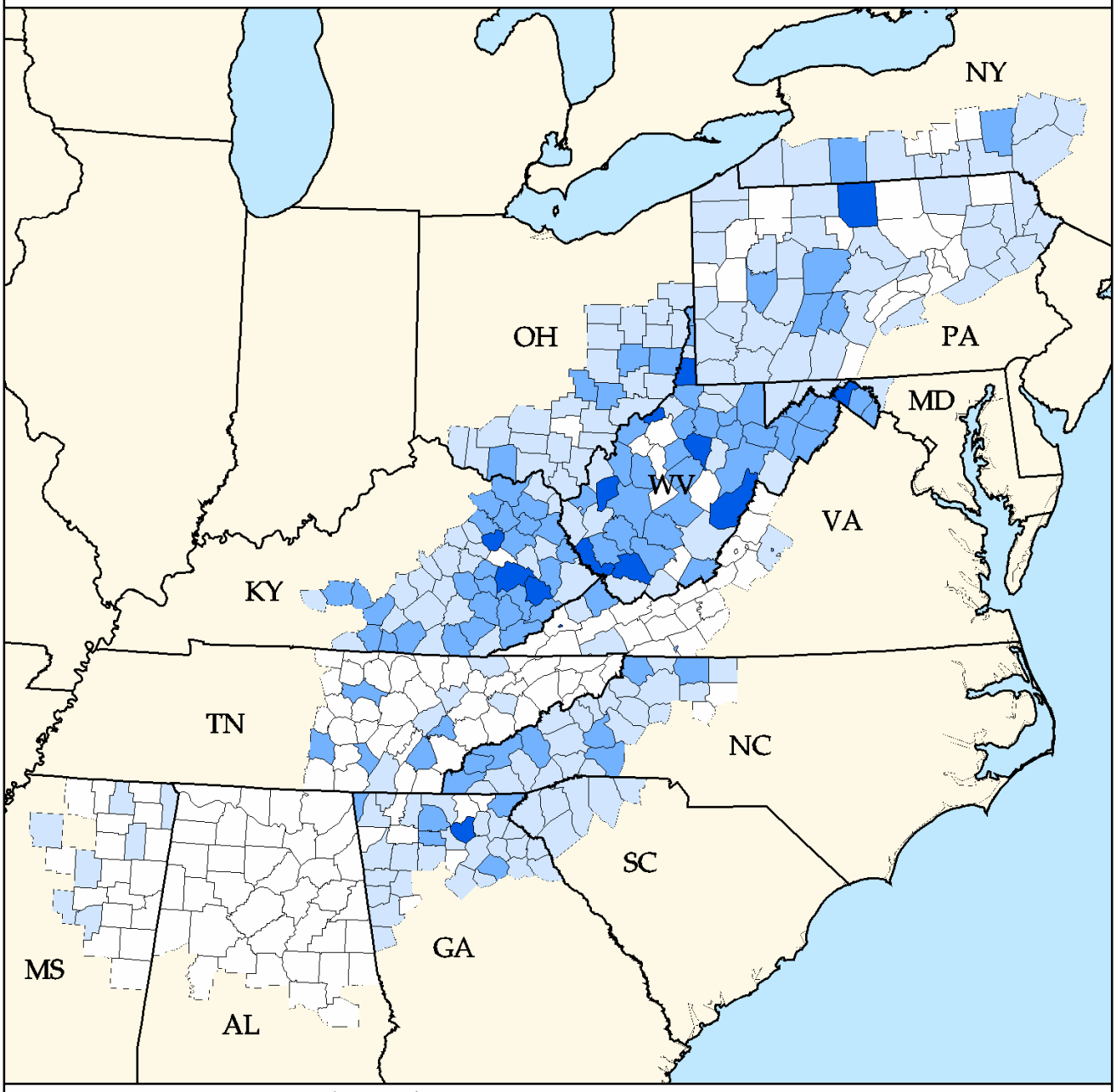
| | Region (per Capita) | | |
|---|---|---|---|
| **Program** | **Appalachian** | **Non-Appalachian** | **State** |
| West Virginia Infrastructure and Jobs Development Loan Program | $119.11 | NA | $119.11 |
| West Virginia Water Development Authority | 41.62 | NA | 41.62 |
| New York Clean Water/Clean Air Bond Act —Safe Drinking Water Portion | 35.10 | $28.85 | 29.21 |
| Ohio Water Development Authority | 33.55 | 29.35 | 29.89 |
| Georgia Fund Loan Program | 33.04 | 20.36 | 23.78 |
| West Virginia Infrastructure and Jobs Development Grant Program | 30.78 | NA | 30.78 |

[61] Data on USDA distributions from U.S. Department of Agriculture, Rural Utilities Service, *Annual Reports for Fiscal Years 2001, 2002, 2003* (Washington, D.C.: USDA, 2002, 2003, 2004), and UNCEFC Master Funding Database (see appendix I). Data on EPA distributions from Environmental Protection Agency, *Annual Report for 2003* (Washington D.C.: EPA, 2004), and UNCEFC Master Funding Database (see appendix I). In some cases these calculations were made by comparing calendar fiscal years with state or federal noncalendar fiscal years.

| Program | Region (per Capita) | | |
|---|---|---|---|
| | Appalachian | Non-Appalachian | State |
| Pennsylvania State Revolving Fund (Clean Water and Drinking Water—State Source) | 30.58 | 0.00 | 14.49 |
| Virginia Pooled Financing Program | 29.32 | 45.44 | 43.92 |
| Kentucky Coal and Tobacco Development Fund Program | 29.01 | 5.67 | 12.26 |
| Ohio Public Works Commission—State Capital Improvements Program | 28.45 | 16.21 | 17.78 |
| Maryland Supplemental Assistance Program | 25.91 | 2.31 | 3.37 |
| Kentucky Wastewater Construction | 24.54 | 0.00 | 6.93 |
| Tennessee Municipal Bond Fund | 21.62 | 13.07 | 16.79 |
| Kentucky 2020 Water Services Account Program | 21.44 | 7.65 | 11.55 |
| North Carolina Revolving Loan and Grant Program—High Unit Cost Grants, Clean Water | 20.79 | 16.83 | 17.58 |
| Maryland Drinking Water Supply Assistance Program | 20.07 | 0.76 | 1.63 |
| Kentucky Single County Coal Program | 17.94 | 2.37 | 6.77 |
| North Carolina Revolving Loan & Grant Program—High Unit Cost Fund, Drinking Water | 13.34 | 12.65 | 12.78 |
| Kentucky Coal Severance Tax Receipts—Kentucky Infrastructure Authority portion only | 11.11 | 1.50 | 4.22 |
| Kentucky Flexible Term Finance Program | 10.20 | 7.76 | 8.45 |
| North Carolina Supplemental Grants Program | 7.68 | 7.24 | 7.32 |
| South Carolina Water and Wastewater Infrastructure Fund | 7.57 | 23.96 | 19.76 |
| North Carolina Unsewered Communities Grants Program | 6.51 | 9.84 | 9.21 |
| North Carolina Clean Water Management Trust Fund | 5.90 | 4.00 | 4.36 |
| Kentucky Infrastructure Revolving Loan—Fund B | 4.60 | 3.14 | 3.55 |
| South Carolina Budget and Control Board Grant Program | 3.52 | 5.25 | 4.81 |
| Mississippi Capital Improvements Revolving Loan Program | 3.28 | 3.78 | 3.67 |
| New York Financial Assistance to Business—Water Program | 2.95 | 0.34 | 0.49 |
| North Carolina Capacity Building Grants Program | 0.90 | 0.92 | 0.92 |
| Georgia Equity Fund Program | 0.80 | 2.20 | 1.82 |
| Georgia Regional Assistance Program (2003 data not included) | 0.23 | 0.30 | 0.28 |

*Source:* UNCEFC Master Funding Database, 2004.

**Figure 5-5. Per Capita Disbursements for Water and Wastewater Projects from Stand Alone State Funding Programs**




Data Source: UNCEFC Master Funding Database, 2004

Note: Data from the 32 largest state specific programs of the 13 states are included.The data does not include funds that states contribute to federal programs such as the EPA's SRF programs. Alabama, while without any major stand alone state specific programs, is the only Appalachian State to have made significantly higher state capitalization matches (an average of 45 percent over 1988-2003) to its CWSRF program.

- No Public Funding or No Data
- Less than $25
- $25 through $100
- More than $100

### Sources of Funds

The terms "public funding program" and "government funding program" imply that the government provides the funds for community infrastructure. In reality, individuals (taxpayers, investors, etc.) are the source of funds for all public infrastructure investments. Governments just collect and distribute funds.

The public funding programs in Appalachia use different mechanisms to generate the capital funds they distribute. Some of these mechanisms are quite complicated, as in the case of the SRF programs, which involve combining state and federal appropriations with loan proceeds to create a pool of capital.

States have tapped into different revenue sources to support their public funding programs. The source of funds for programs may influence where the funds go, as in the Kentucky Coal and Tobacco Development Fund. Kentucky divides its counties by the principal commodity they export, coal or tobacco. The state used $5 million from coal severance taxes to secure $50 million in bonds that funded 103 water and wastewater projects specified by legislators in coal counties. Likewise, the state used $5 million from tobacco settlement money to finance more than $50 million in bonds to pay for 164 specified projects in tobacco counties.

### Relationship between Funding and County Needs

Any discussion of public funding invariably leads to this question: Did the funds go to those who needed it most? To attempt to answer the question, the UNCEFC research team carried out a series of analyses comparing the amount that counties received from different funding programs with various indicators of needs. Funding programs employ a wide variety of criteria to prioritize funding. The UNCEFC analysis was designed not to evaluate whether an individual program adhered to its criteria but to determine if there were general relationships between where funding went and what the public might commonly consider to be indicators of financial or environmental need (see Table 5-3)—for example, low median household incomes and a history of wastewater system violations. This section presents an overview of the analysis.[62]

[62] For a description of the methodology and a discussion of analysis results, see Matthew T. Richardson, "Examination of the Relationships between Public Funding for Water and Sewer Infrastructure and Indicators of Need in the Appalachian Region from 2000 through 2003" (master's thesis, University of North Carolina at Chapel Hill, 2005).

**Table 5-3. Sample Indicators of Need and Expected Relationships with Funding**

| | Indicator of Need | Abbre-viation | Hypothesized Relationship |
|---|---|---|---|
| 1 | Median household income | MHI | Negative—counties with lower income receive more funding |
| 2 | Total clean watershed needs per capita (from 2000 EPA CWNS) | CWNS | Positive—counties with more documented needs receive more funding |
| 3 | Septic system density (from 1990 Census) | Septic | Positive—counties with high septic system density receive more funding |
| 4 | Permitted combined-sewer-overflow systems | CSO | Positive—counties with more CSO permits receive more funding |
| 5 | Number of POTW NPDES violations per POTW NPDES permit issued | NPDES | Positive—counties with more NPDES violations receive more funding |
| 6 | SDWA violations per community water system (monitoring and reporting violations excluded) | SDWA | Positive—counties with more SDWA violations receive more funding |
| 7 | Waterborne disease outbreaks | WBD | Positive—counties with more disease outbreaks receive more funding |

*Note:* POTW = publicly owned treatment works (a facility). SDWA = Safe Drinking Water Act.

The analysis revealed that needs identified by the CWNS were statistically "significant" and positively related to the distribution of water and wastewater infrastructure funding in Appalachia. (A "significant" relationship is one that could not have occurred by chance, given a 0.01 percent probability.) The relationship between funding distributions and NPDES compliance violations were significant and positive. Likewise, the relationships between funding distributions and waterborne diseases were significant and positive. The relationship between septic system density and funding, although significant, was negative. In other words, on average, counties with higher densities of septic systems received less public funding than counties with lower densities of septic systems. This finding is likely attributable to a fundamental characteristic of infrastructure funding: funding from large programs tends to flow to communities with existing large public systems. In essence, septic system density also is an indicator of whether or not a county is likely to have centralized water and wastewater systems. (For a summary of the results, see Table 5-4.)

**Table 5-4. Regression Analysis: Relationship between County Funding Totals (All Funding Programs) and Indicators of Need**

| Independent Variable | Significance | Direction | Result |
|---|---|---|---|
| CWNS | High | Positive | An increase of one dollar per capita identified in CWNS is associated with an increase of 0.06 dollars per capita in funding. |
| NPDES | High | Positive | An increase of one NPDES violation from a POTW is associated with an increase of 54 dollars per capita in funding |
| Septic | High | Negative | An increase of one septic system per square mile is associated with a decrease of 2.7 dollars per capita in funding |
| WBD | High | Positive | An increase of one WBD case is associated with an increase of 1.3 dollars per capita in funding |

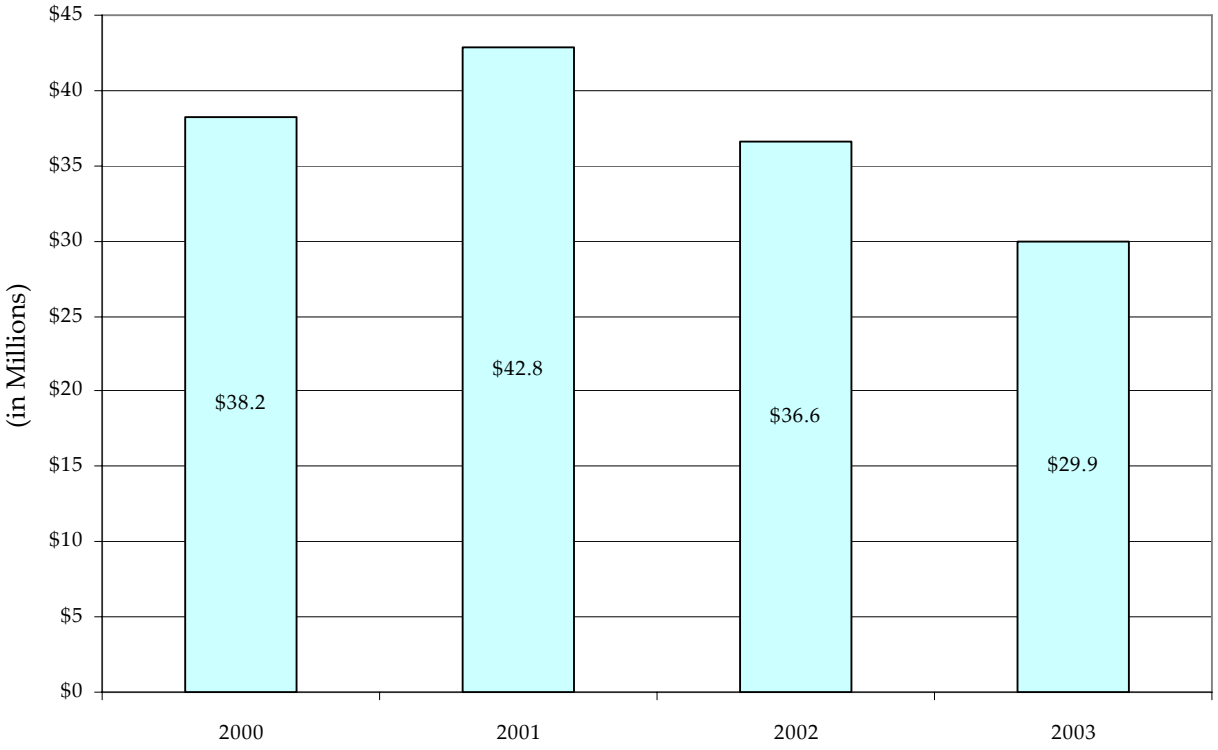
*Source:* Matthew T. Richardson, "Examination of the Relationships between Public Funding for Water and Sewer Infrastructure and Indicators of Need in the Appalachian Region from 2000 through 2003" (master's thesis, University of North Carolina at Chapel Hill, 2005)

The number of public funding programs and the amount of the public funding to upgrade existing wastewater systems in Appalachia or build new, decentralized ones are extremely limited. Consultations with public officials at the state and local levels suggest that some of these approaches promote sustainability and improved access to funds more than others do. States that have developed coordinated funding organizations have been able to improve communication and minimize the administrative hurdles. Other states, such as Ohio and West Virginia, have made difficult decisions regarding the eligibility of communities for funds and the types of funds to make available to communities. These states offer a large proportion of their funds as loans and pay careful attention to the fiscal capacity of communities before granting them. The measures have promoted consolidation and have kept some communities from investing funds in systems that may not be sustainable.

### Funding Stability over Time

Historical funding levels are not always good predictors of future funding, for the funds available to many programs, particularly those funded by state appropriations, can be highly variable over time. Over the study period, funding generally increased, but in some states, such as North Carolina, it decreased (see Figure 5-6). Many of the state programs in North Carolina that were most active from 2000 through 2003 have ceased distributing funds to communities because of depletion of a pool of bond funds approved in 1998.

**Figure 5-6. Disbursements of Federal and State Programs in the Appalachian Region of North Carolina, 2000–2003**




*Source:* UNCEFC Master Funding Database, 2004.

The amounts of federal funds that individual states have to administer also can change significantly over time. The USDA's Water and Waste Disposal Loans and Grants Program allocates funds to states on the basis of formulas that take rural population and incomes into consideration. In several Appalachian states, including New York and Pennsylvania, major demographic shifts between 1990 and 2000 have affected the number of Appalachian communities that are eligible for the funds. Congressional appropriations for the CWSRF program dropped significantly for the first time in several years in federal fiscal year 2004–05. Nationwide the appropriation dropped from $1.35 billion to $1.1 billion. (For the impact of this decrease on the capitalization funds that Appalachian states receive, see Table 5-5.) Additional decreases have been proposed in the fiscal year 2005–06 budget.

**Table 5-5. Decreases in Appropriations of Capitalization Funds for Appalachian States**

| State | CWSRF Appropriation FY 2003–04 (in millions) | CWSRF Appropriation FY 2004–05 (in millions) |
|---|---|---|
| Alabama | $15.0 | $12.1 |
| Georgia | 22.6 | 18.4 |
| Kentucky | 17.0 | 13.8 |
| Maryland | 32.4 | 26.3 |
| Mississippi | 12.1 | 9.8 |
| North Carolina | 24.2 | 19.6 |
| New York | 147.8 | 119.9 |
| Ohio | 75.4 | 61.2 |
| Pennsylvania | 53.0 | 43.0 |
| South Carolina | 13.7 | 11.1 |
| Tennessee | 19.4 | 15.8 |
| Virginia | 27.4 | 22.2 |
| West Virginia | 20.9 | 16.9 |
| All App. States | $480.8 | $390.0 |
| **U.S.** | **$1.35 billion** | **$1.09 billion** |

*Source* FY 2003–04 data from Environmental Protection Agency, *FY 2004 Clean Water State Revolving Fund Title VI Allotments* (February 17, 2004), available at www.epa.gov/owm/cwfinance/cwsrf/cwsrfallots.pdf. FY 2004–05 data from National Resource Defense Council, *Bush Budget Impacts on EPA Funding for Water Quality Programs* (Feb. 10, 2005) (last visited April 14, 2005), available at www.nrdc.org/media/docs/050211.pdf. National Resource Defense Council values for 2004–05 are based on formula calculations from the 2003–04 budgets.

In addition to seeing variation in the size of the funding pie, states may experience change in the relative size of their slice. CWSRF capitalization funds continue to be distributed to Appalachian states on the basis of percentages established about fifteen years ago. The allocation of funds has been a source of debate among states. Over the last few years, there have been several attempts to modify the allocation percentages in a way that could significantly affect several Appalachian states, including New York and Tennessee.[63] To date, these proposals for revised allocations have not been enacted. However, in the UNCEFC survey, several state needs coordinators indicated that they have begun investing more in carrying out their state's CWNS to ensure that if the change does occur, they will not be penalized by avoidable underreporting.

[63] "Perspectives on the CWSRF Allocation Formula" (paper presented at Council of Infrastructure Financing Authorities, Federal Policy Conference, May 2004).

In sum, whatever the true needs for water and wastewater services in Appalachia are, whether at the lower or the upper end of this study's $26 billion–$40 billion estimate, the $4.6 billion in total nonlocal public financing provided from 2000 through 2003 is only meeting part of the need. Unlike communities in more populous, higher-growth areas of the country, many communities in Appalachia have little or no access to private capital markets to make up the difference. These same communities cannot generate revenue to pay for capital improvements on a pay-as-you-go basis. State programs to help pay for water and wastewater capital problems have been an increasingly important share of the public funding effort, but the state commitments tend to wax and wane over fairly short cycles.

# 6
# Financial Management and Funding Strategies

The magnitude of the capital needs of Appalachian communities describes only part of the challenge facing them in regard to water and wastewater services. Even large gaps can be bridged with sufficient resources, and very small gaps can be insurmountable if a community lacks the capacity or the tools. Many recent policy reports offer suggestions and policy inventories for addressing infrastructure gaps at the national, state, and local level. Despite the region's recent gains, Appalachian communities remain some of the most fiscally stressed in the country.

Many of the strategies that seem feasible in other parts of the United States cannot readily be applied in Appalachia. Furthermore, given the diversity of the Appalachian communities and the water and wastewater challenges they face, no single strategy or measure will work throughout the region. So what financial management and funding strategies are likely to have the biggest impact on service in the region? This chapter assesses different strategies, policies, and tools that have been prescribed in national studies or implemented by states and communities in the region. To assess the applicability of these tools, the UNCEFC research team analyzed the fiscal, managerial, environmental, and technical capacity of Appalachian communities in comparison with the capacity required by these strategies.

## Major Funding Challenges and Gaps

Like the country as a whole, Appalachia faces several types of interrelated water and wastewater financing challenges, including capital requirement gaps; annual cash-flow shortages; marginal utility/system fiscal capacity; diminishing household ability to pay; and diverse management-oriented needs. Despite the numerous capital funding programs in the region, a backlog of project funding requests exists in many areas. In other parts of the country, the private capital market provides a large pool of capital funds to supplement limited public capital funds. Although some communities in Appalachia have access to private capital, it is out of reach for the majority of communities in distressed areas.

At the system level, many small utilities have insufficient revenues to cover future cash-flow requirements, once debt repayments and increased operating costs linked to new facilities are taken into account. These utilities are characterized by small and often shrinking customer bases. In some cases, even if grants for capital were available, the utilities would be unable to meet the operating costs associated with their facilities.

Concern about affordability and ability to pay exists in almost every system in the country. Even the nation's wealthiest areas have small pockets of poverty. However, in comparison with the nation as a whole, households in many Appalachian counties are paying a much higher proportion of their income for water and wastewater services, so high in several areas for large numbers of households that asking them to pay more for improved service is infeasible. This household affordability gap has become the critical challenge for many utilities.

Management shortfalls in the region range from small systems that are unable to support trained and educated staff, to large systems that have yet to shift from a reaction-oriented paradigm characterized by high maintenance costs and continual capital stock crises, to a more proactive approach that includes asset management systems, proactive investments, and continual staff training.

## Regionalization and Local Partnerships

Increasing the number of regional water and wastewater systems (or decreasing the number of small providers) is one of the few measures that almost all national advocacy organizations and state and federal government agencies endorse as a strategy for improving service and reducing cost. This strategy is described in detail in EPA's *Gap Analysis* and commonly appears among the suggestions made by regional EPA offices.[64] More than 90 percent of the state and federal funding program managers who responded to the UNCEFC survey thought that consolidation could have at least a moderate impact on the funding of water and wastewater services in Appalachia.

The average size of community water systems and the number of such systems vary significantly from state to state (including adjoining states) in Appalachia (for the number per county in selected Appalachian states, see Figure 6-1). This suggests that technology and topography are not the only determinants of the ease with which this strategy can be applied. Kentucky, which has made reducing the number of small systems a priority, tends to have fewer systems per county than most other Appalachian states. New York, North Carolina, and Pennsylvania have an abundance of small systems.

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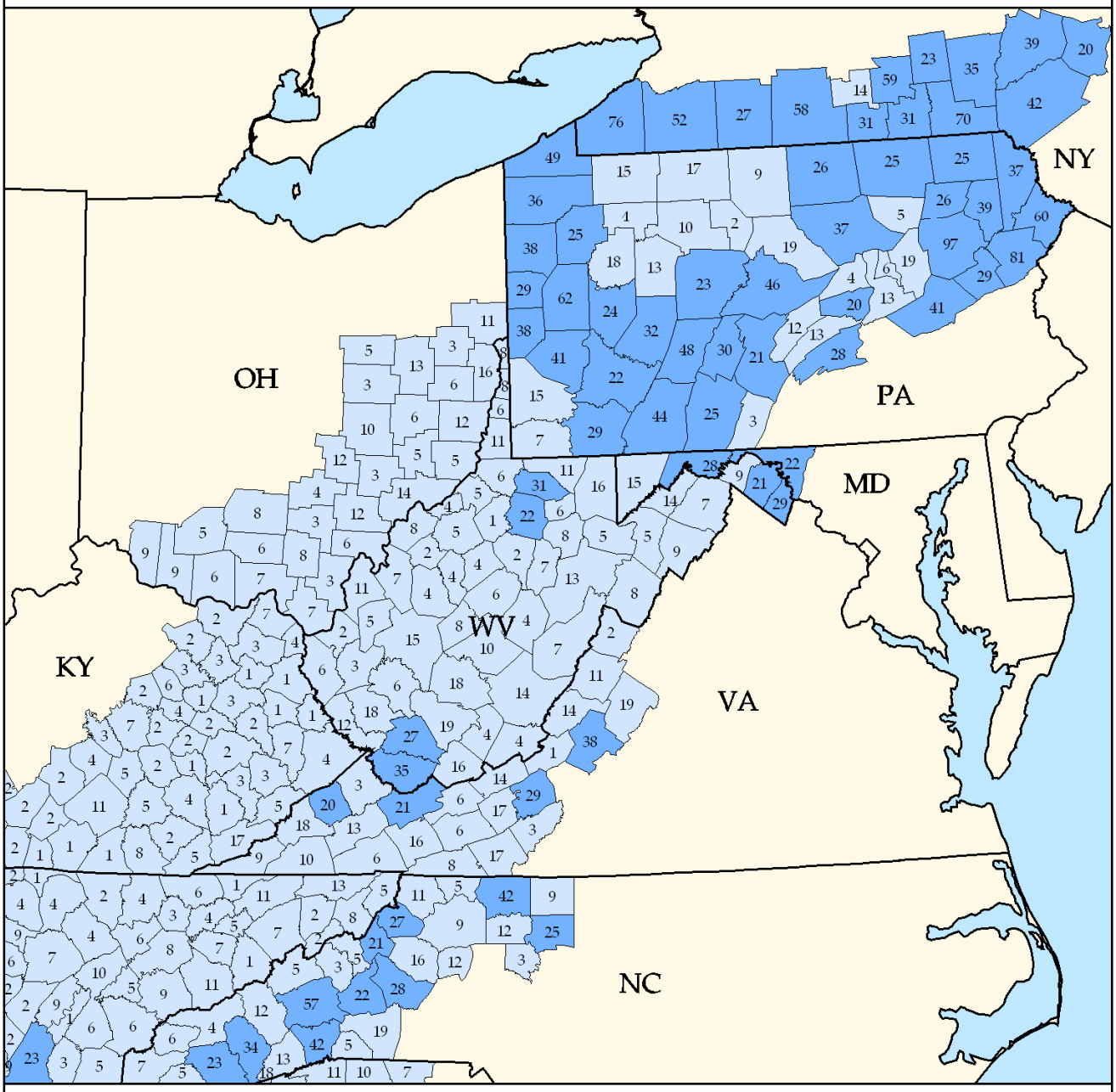
[64] Environmental Protection Agency, *The Clean Water and Drinking Water Infrastructure Gap Analysis* (Washington, D.C.: EPA, 2002); Environmental Protection Agency, *Mid-Atlantic States, Water Infrastructure Financial Assistance* (last visited April 17, 2005), available at www.epa.gov/reg3wapd/water_infrastructure.

**Fig 6-1. Community Water Systems per County in Selected Appalachian States**




Data Source: Environmental Protection Agency, Safe Drinking Water Information System database for 4th quarter fiscal year 2003 frozen in January 2004, downloaded from www.epa.gov/OGWDW/data/pivottables.html and compiled by UNCEFC. Noncommunity water systems are excluded. There were 5,234 community water systems in Appalachia in January 2004

Fewer than 20

20 or more

In addition to recent state efforts to promote consolidation, some states, such as Kentucky and West Virginia, have a history of regional entities and have institutional and regulatory frameworks favorable to regional systems. In other states a go-it-alone culture and a historic model of a single provider prevalent in their system of government make larger, multiple-jurisdiction systems much less common. For example, in North Carolina, municipalities make up a much higher percentage of government-owned systems than they do in West Virginia (see Table 6-1).

**Table 6-1. Government-Owned Utilities in North Carolina and West Virginia**

| Government Unit | North Carolina | West Virginia |
|---|---|---|
| Municipal systems | 402 | 175 |
| County systems, regional authorities, and other district models | 105 | 161 |

*Source:* Data from the North Carolina Local Government Commission and the West Virginia Public Utilities Commission, collected through e-mail communication (June 2004 and July 2004 respectively) and compiled by UNCEFC.

In many cases, communities that are part of large regional drinking-water systems maintain independent wastewater systems. One of the obvious reasons for this distinction is that moving drinking water long distances up and down mountains is normally easier and cheaper than moving sewage is. For example, in West Virginia, municipalities are the primary provider of wastewater services, despite the growing number of regional water providers.

Finding the right incentives to overcome the political and cultural attraction of single-jurisdiction systems is a key to making multiple-jurisdiction systems work. Many public funding agencies now incorporate regionalization into their evaluation criteria. About 75 percent of the respondents to the UNCEFC funding survey indicated that they had programs that included incentives for regionalization.

Local governments often put pride or political factors before cost in making decisions about infrastructure, a practice not commonly shared by for-profit companies. The private sector's drive for profits has proven to be very effective in reducing the number of small systems and facilities in certain parts of Appalachia. West Virginia–American Water has built a successful company by paying careful attention to cost, and it has been instrumental in water system consolidations throughout West Virginia (for a case study of this utility, see appendix E). The water company's efforts to build larger, more cost-efficient regional systems has led to a statewide network of eight large water treatment plants that serve or will serve more than fifty communities and districts. According to the company's president, one of the company's fundamental business

tenets is to minimize the number of treatment plants it has in operation, even if doing so requires extensive investments in water distribution lines.[65]

Another factor that encourages West Virginia–American Water and other private companies to invest capital to expand their systems relates to how rates are approved. West Virginia–American Water's rates are regulated by the West Virginia Public Utilities Commission, and the company is allowed to include a rate of return on its capital investment. If West Virginia–American Water invests in capital to acquire more systems, it can be assured of getting a return on that investment. Government utilities that have their rates approved by their governing board are under political pressure to keep rates low and are less assured of getting a return on capital investments in the system. This makes capital-intensive system expansions riskier. One of the likely reasons why West Virginia's public service districts have been able to play the role of regional provider is that, although they are government owned, their rates are approved by the West Virginia Public Utilities Commission rather than by elected boards. This arrangement removes some local political pressures from the decision-making process.

Municipal systems in many states also are reluctant to extend their systems beyond their boundaries, especially for low-income or expensive-to-serve customers, because they think that they have no legal or financial obligation to serve "non-voters." States like North Carolina that have a history of municipal provider models continue to have many areas outside city boundaries without access to centralized water systems. Regional models and options often are considered when a single jurisdiction faces significant system and investment needs. For example, when Weaverville, North Carolina, was planning a new water treatment plant, it considered regional models and partnerships. However, in the end, each of the three cooperating communities decided to proceed independently. (For a case study of Weaverville, see appendix E.)

In some cases, maintaining partnerships can be as difficult as creating them. The future of a regional model that has served a large area of western North Carolina for several years is currently in question. The situation in Asheville illustrates the importance of having regional models in which the multiple participating governments see themselves as equals. The Regional Water Authority, made up of Asheville, Buncombe County, and Henderson County, is an institutional body responsible for water allocation and financial decisions for a water system and treatment plant that is

[65] Chris Jarret, West Virginia–American Water, interview with authors, Charleston, June 2004. President.

owned and operated by Asheville. Asheville recently announced its decision to withdraw from the authority.[66]

A single large regional provider is not the only regionalization model in Appalachia. Thanks to incentives provided by funding agencies, small systems in some areas have been able to partner as equals and share ownership in new facilities.

Consolidation and regionalization of water and wastewater systems everywhere faces the problem of "us versus them"—that is, the perception that outside influence over matters as vital as water and wastewater services will come at a cost to a community. The loss of autonomy in connecting to another system is quite widely viewed as a cost in itself, often the most substantial perceived cost. This nearly universal human feeling about loss of control over vital services is compounded in many parts of Appalachia by the long, strong cultural opposition to outside influence, even when the outsiders are people of the same cultural, ethnic, and economic background who live just over the ridge. For funders and policy makers to bemoan this fact of the human and Appalachian condition is futile. Instead, they must minimize the other costs and barriers to consolidation and regionalization and develop good information about the economies to be gained from consolidation by each system considering it. Further, they must make these economies clear and understandable, in terms that are meaningful to the layperson, such as improvements in property values and reductions in rates as a result of combined operations. After all, as happened in War, West Virginia, the motivation of an individual community to maintain its autonomy can itself be a source of resources and support for a system by mobilizing leaders to search for external funding sources (for more detail, see the case study of McDowell County, West Virginia, and Letcher County, Kentucky, in appendix E). Nevertheless, the collective good of consolidation will not occur automatically.

## Full-Cost Pricing

"Full-cost pricing" is the practice of setting water and wastewater rates at a level that generates sufficient revenues to cover all the capital and operating costs of providing service. From the private sector's financial perspective, the term almost seems absurd. What company would intentionally price its product or service at a level at which it could not cover its costs? Full-cost pricing and less-than-full-cost pricing remain important issues for water and wastewater companies for several important reasons. First, many water and wastewater entities are not institutionally independent. Rather, they are part of larger government units, such as counties and municipalities. In many states, government entities are legally able to transfer funds between water and

[66] Jonathan Bernard, "More Surprises—Peterson, Dunn Vote against Water Authority Budget," *Mountain Xpress* (Asheville, N.C.), 9 June 2004.

wastewater units and other government accounts. The revenues from these transfers, often originating from general tax revenues of the host government, allow many water and wastewater companies to continue operations with artificially low prices. Records from the North Carolina State Treasurer indicate that this practice is common in North Carolina (see Table 6-2).

**Table 6-2. Average Financial Results of Municipal Water and Sewer Systems for the Fiscal Year Ended June 30, 2003**

| Population Groupings | Number of Units* | Average Operating Revenues | As Percentage of Operating Revenues | | |
|---|---|---|---|---|---|
| | | | Operating Margin | Operating Transfers In (Out) | Net Income |
| Statewide—All Units | 400 | $ 2,852,113 | 9.2 | (1.1) | 24.9 |
| Units with Electric Systems: | | | | | |
| All | 67 | 4,987,826 | 13.6 | (1.7) | 18.5 |
| 10,000 and above | 25 | 11,409,210 | 15.8 | (0.6) | 18.6 |
| 2,500–9,999 | 19 | 2,065,670 | 5.2 | (8.9) | 13.6 |
| 2,499 and below | 23 | 422,015 | (14.8) | (2.6) | 34.8 |
| Units without Electric Systems: | | | | | |
| All | 333 | 2,422,405 | 7.3 | (0.7) | 28.3 |
| 50,000 and above | 9 | 46,957,840 | 7.2 | (0.6) | 25.2 |
| 10,000–49,999 | 19 | 7,967,978 | 13.6 | (1.4) | 26.4 |
| 2,500–9,999 | 83 | 1,789,826 | 6.6 | (2.2) | 23.9 |
| 1,000–2,499 | 88 | 652,770 | 1.6 | 2.5 | 54.4 |
| 500–999 | 64 | 269,662 | (10.7) | 0.6 | 33.2 |
| 499 and below | 70 | 134,159 | (12.1) | (1.8) | 42.3 |

*Source:* North Carolina Department of State Treasurer, *Memorandum #1017, Statistical Information on Water and Sewer Operations* (Raleigh, NC: N.C. State Treasurer, 28 April 2004), available at www.treasurer.state.nc.us/NR/rdonlyres/4ED70521-087E-47F4-B61E-E0CFAC8BB47A/0/Memo1017.pdf.

* Number of units with water and wastewater systems that submitted audit reports by April 20, 2004.

Another reason for the widespread disconnection between prices and costs is that annual budgets and short-term cash-flow requirements, rather than financial statements, are the primary drivers of financial decisions made by government-owned water systems. Budget and cash-flow needs frequently mask the need for capital investment, allowing local governments to charge rates that cover basic operating costs but do not contribute sufficiently to capital stock investments and upkeep. Needed repairs often are deferred until the whole system breaks, requiring a capital infusion. In North Carolina the 134 smallest systems in Appalachian municipalities that do not run electric utilities had more than a negative 10 percent operating margin in 2003.

Nationally the EPA found that smaller systems are much more likely than larger systems to operate at a loss.[67]

Full-cost pricing is one of EPA's four pillars of sustainable infrastructure.[68] It also is strongly supported by professional organizations like AWWA.[69] High-profile national policy studies include assumptions about price increases to demonstrate the ability of local communities to meet their infrastructure needs.[70] When asked in the UNCEFC survey about the potential of full-cost pricing to help communities meet their infrastructure needs, funding program managers were split. Thirty percent of the managers responding to the survey thought that it would have a major impact, 29 percent a moderate impact, and 36 percent a small or no impact.

During interviews and discussions, local, state, and federal officials all reported that in many areas of the country, income constraints were a significant barrier to systems charging full-cost prices. In 1999 in Appalachia, 67 percent of the households paid a water and sewer bill directly, 10 percent had their bills included in the rent, and 23 percent reported not having to pay for water and sewer services (probably because the households were not connected to centralized systems) (for an explanation of the methodology used to generate these data, see appendix K). Of the 67 percent that paid directly for water and sewer services, the average household expenditure for those services was $403, equivalent to an average proportion of income spent on these services of 1.65 percent.

For Appalachian households that pay directly for water and sewer services, their average expenditures in absolute terms ($403) are lower than the national average ($476). However, this statistic may be misleading since the expenditures that were reported by the households include bundled water and wastewater services, and a smaller proportion of Appalachian households are connected to centralized wastewater services than the rest of the country on average. In other words, if water and wastewater average expenditure information was collected and shown separately, it is likely that Appalachian households would pay the same if not more for comparable

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[67] Environmental Protection Agency, *2000 Community Water System Survey* (Washington, D.C.: EPA, 2002), app. 2.

[68] Environmental Protection Agency, *Sustainable Water Infrastructure for the 21st Century* (last visited 17 April 2005), available at www.epa.gov/water/infrastructure/.

[69] See *AWWA E-Mainstream*, 28 September 2004.

[70] EPA, *Gap Analysis*; Water Infrastructure Network, *Clean and Safe Water for the 21st Century: A Renewed National Commitment to Water and Wastewater Infrastructure* (Washington, D.C.: the Network, 2000).

services. Os a percentage of income, Appalachian families spend a greater percentage of their income on water and wastewater services (1.65 percent) than the rest of the country on average (1.51 percent).[71]

The difference in expenditures in some areas is striking. West Virginia households spend, on average, the greatest percentage of their income (2.22%) on water and wastewater services than households of any other state in the United States[72]. In fact, West Virginia is the only state where the average percentage of income spent on water and wastewater services exceeds 2% (see Figure 6-2).

At the county level, the average household expenditure on water and wastewater services in Appalachia varied from $232 in Gordon, Murray, and Whitfield counties in Georgia to $622 in Lackawanna County in Pennsylvania. The average proportion of household income spent on water and wastewater services also varied widely, from 0.75 percent in Forsyth County in North Carolina to 2.75 percent in Dickenson, Lee, Russell, and Wise counties in Virginia.

Households in West Virginia, eastern Kentucky, and parts of Alabama and Pennsylvania already pay relatively high percentages of their income for water and wastewater services. Raising the price in these areas would be more difficult than doing so in areas in Georgia, South Carolina, and southern New York. Most of the distressed counties in Appalachia are among the areas where households pay the highest amounts and the greatest percentages of their incomes for water and wastewater services. Twenty-nine percent of households in Fayette, Greenbrier, Nicholas, Pocahontas, and Webster counties in West Virginia pay more than 2.5 percent of their income for water and wastewater services, whereas only 4 percent of households in Gwinnett County in Georgia do. In 1999 in Appalachia, 15 percent of all the households that paid directly for water and wastewater services paid more than 2.5 percent of their income for those services, and 5 percent paid more than 5 percent of their income.

A comparison of what utilities inside and outside the Appalachian region of Ohio charge their customers shows that on a statewide basis, Appalachian customers are charged more for water both in absolute terms and as a percentage of median household income. Based on a statewide monthly average consumption rate of 7,756 gallons per customer, about 50 percent of utilities in the Appalachian region of Ohio charge customers at least $30 per month. Approximately 30 percent of the utilities in the

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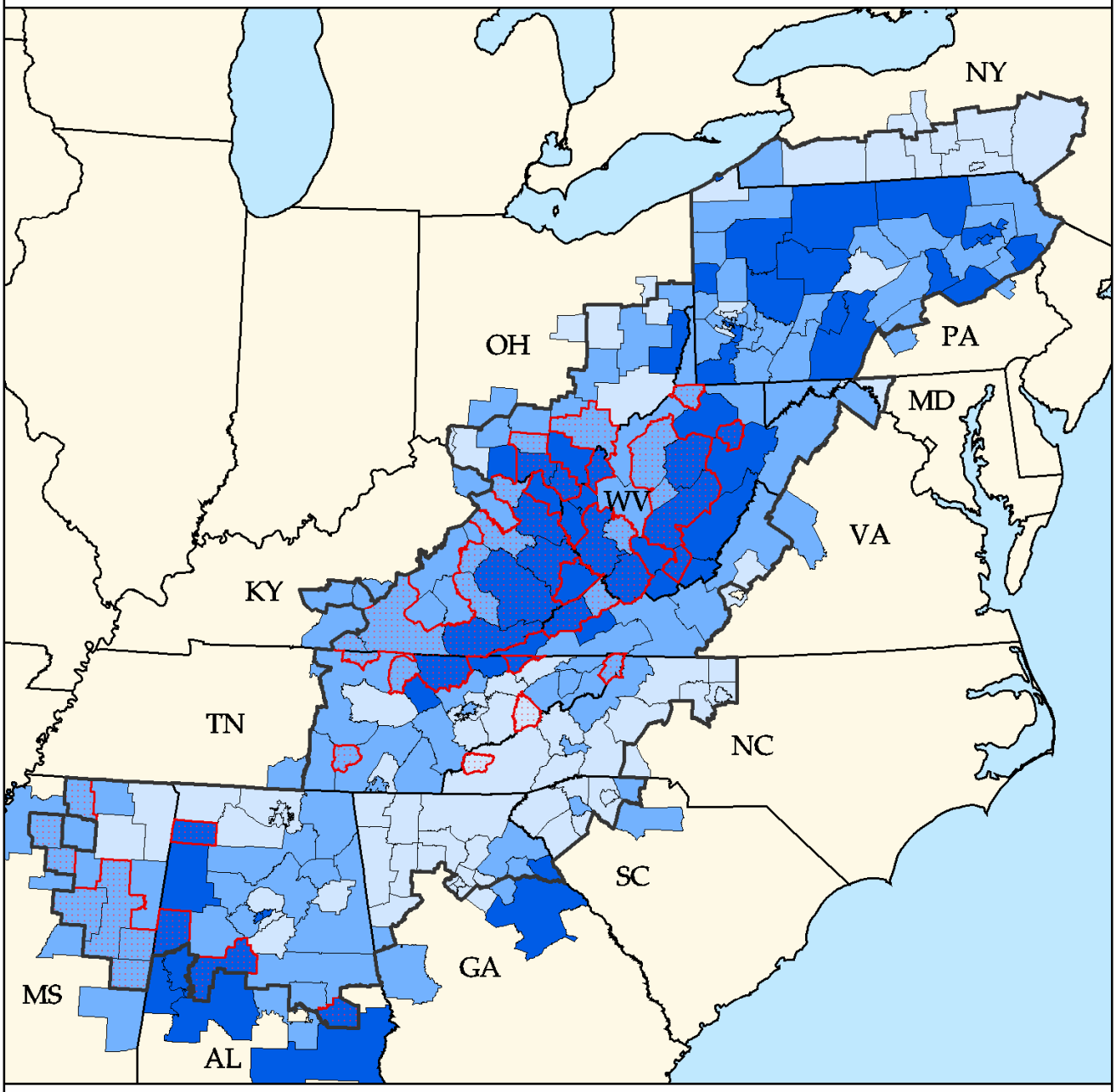
[71] U.S. Census Bureau, Public Use Microdata Sample 5-Percent Files, available on ftp://ftp2.census.gov/census_2000/datasets/PUMS/FivePercent. Data downloaded and compiled by UNCEFC, using HWEIGHT, WATER and HINC.

[72] Scott Rubin (2003), *The Cost of Water and Wastewater Service in the United States.* Available at www.publicutilityhome.com/speeches/Cost%20of%20Water.pdf. Table 8.

**Fig 6-2. Average Percentage of Household Income Spent on Water and Wastewater Services in Appalachia, in 1999**




Data Source: U.S. Census Bureau, Public Use Microdata Sample 5-Percent Files, available on ftp://ftp2.census.gov/census_2000/datasets/PUMS/FivePercent/. Data downloaded and compiled by UNCEFC, using HWEIGHT, WATER and HINC. Map shows distressed counties from 2004 ARC Economic Status data.
Note: Individual household weights were used to extrapolate results to the population. Only households paying a system directly for water and sewer service and with at least $1,000 in annual income in 1999 are included in this analysis.

- Less than 1.5%
- 1.5 through 2.0%
- More than 2.0%
- Distressed Counties

non-Appalachian region charge more than $30 currently. The customer cost of water exceeds 2 percent of the median household income for approximately 18 percent of the utilities in Appalachia and less than 1 percent of the utilities in the non-Appalachian region.[73] The same trend was observed in other states. In his response to the UNCEFC survey, an official working for Virginia's Community Development Block Grants program said he thought that the Appalachian communities in Virginia had the highest rates in the state, to the point that they had "maxed out" their potential to incur debt.

While funding and regulatory programs often employ universal metrics to determine whether water is affordable or not, at the local level, full-cost pricing becomes an issue of willingness to pay that is difficult to estimate without understanding local conditions. Communities in parts of Appalachia that currently pay a lot for their services or have bad service, have demonstrated a willingness-to-pay-more that appears to be much higher than in other areas. For example, given the choice of high rates and service, or low rates and no service, many residents of McDowell County, West Virginia, one of the poorest counties in the United States, have chosen high rates. Customers now pay as much as $9 per 1,000 gallons, a rate that many leaders in far wealthier areas of the country would consider infeasible.

The relationship between public funding programs and local initiatives for full-cost pricing is complicated. One could argue that by providing utilities with grant assistance, public funding programs send the message that less-than-full-cost pricing is acceptable. Many funding program managers interviewed and surveyed for this report acknowledged this relationship. They indicated that they use their grants only as a last resort for communities able to demonstrate that their residents cannot afford to pay the full cost of service. Half of the funding survey respondents indicated that they manage programs that include funding incentives for communities willing to move toward full-cost pricing. Indeed, 52 percent of the funding programs have conditions that require community rates to be at a certain level or to be increased to obtain funds. The definition of "affordable rates" used as a trigger by funding agencies varies widely across programs and states.

Accident, in Garrett County, Maryland, illustrates the challenge of full-cost pricing facing many small communities in Appalachia. Accident is quite poor, with a median household income of $22,500, compared with $52,868 for all of Maryland, and an unemployment rate of 6.8 percent.[74] In 1999 a family with average consumption (4,000

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[73] Ohio Environmental Protection Agency, Office of Fiscal Administration, *2002 Sewer and Water Rate Survey* (Columbus: OEPA, 2004), available at www.epa.state.oh.us/ofa/sw02/02report.pdf July 2004.

[74] Data on income from Census Bureau, Census 2000, Summary File 3, Table P53; data on unemployment calculated by UNCEFC from Census Bureau, Census 2000, Summary File 3, Table P43.

gallons per month, according to billing records) was charged $196 a year for wastewater services and $138 for water services. Together these payments represent about 1.5 percent of the median household income of Accident—a percentage that is high but still lower than the proportion in many other parts of the region.

Accident recently completed a series of major investments to improve and upgrade its wastewater collection and treatment facilities. The improvements were necessary to meet the requirements of a consent decree and to correct severe public health and environmental problems. The investment upgrades cost about $3 million and were funded primarily by grants. However, as part of the funding package, the town had to borrow $480,000 from USDA at a rate of 4.5 percent over forty years. The debt service for this loan will cost each of Accident's 197 customers about $130. If the town had borrowed the full amount from USDA, the cost per household would have risen to more than $800 per customer. If Accident had not received the substantial grants and if customers had been asked to pay the full cost of service, their annual payment for water and wastewater service would have been about $1,000 per year, or 4.4 percent of their median household income—an amount that far exceeds what any county in Appalachia currently pays.

Overall, Appalachia is one of the best "laboratories" in the country for demonstrating the potential and the limitations of full-cost pricing. Appalachian communities are an example of the willingness of people to make financial sacrifices in order to guarantee sustainable, high-quality water and wastewater services. At the same time, many of these communities continue to have substantial needs. A time comes when price increases reach their limits.

The region also shows that funding agencies play different roles in promoting full-cost pricing, with some carefully incorporating it into their decisions. The bottom line: Appalachia has demonstrated that many communities can contribute to meeting their needs but many communities cannot generate adequate revenue to meet future needs with price increases.

## Rate-Making Strategies for Low-Income Customers

Like many other organizations, EPA often suggests that utilities use "lifeline rates" or other special strategies to ensure that low-income customers are insulated from the impacts of full-cost pricing. Utilities can lower rates for low-income customers directly by establishing rate structures that take income levels or other economic indicators into consideration. According to West Virginia–American Water staff, American Water's subsidiaries in Pennsylvania have used this approach for years. West Virginia–American Water has proposed using a similar rate structure for its customers. Again according to the utility's staff, under the proposal, customers whose income is below

the federal poverty level would receive a 25 percent discount on their minimum-allowance charge.

This type of strategy is infeasible where state law prohibits governments from establishing different rate structures for different income classes. For example, North Carolina law does not give municipal water and sewer enterprises the authority to develop classes of customers based solely on income or to have two separate rate structures based on the household income of customers. In other words, a system cannot charge a low-income customer who uses 5,000 gallons per month less than it charges a wealthier customer who consumes 5,000 gallons per month.

Utilities can consider household income, though, in developing rate structures applied to all customers. For example, in some areas, customers living in larger houses have been shown to have higher base-consumption amounts than customers living in smaller houses. The former type of customer may use 8,000 gallons per month, and the latter 3,000 gallons. Rate structures can be designed so that the price per gallon for the first 3,000 gallons is significantly lower than the price per gallon for 3,000–8,000 gallons. This approach often can be supported by cost considerations. Serving large users of water, especially those who consume a lot more in the summer than in the winter, can usually be shown to be more costly than serving customers who use a more modest, consistent amount.

### Targeted Assistance for Low-Income Customers

In most cases the primary objective of reducing the price that low-income customers pay for water and wastewater services is to ensure that they have sufficient funds to meet other basic needs. Providing direct funding assistance to low-income water and wastewater customers, rather than trying to reduce their rates, can achieve the same objective. The National Drinking Water Advisory Council has recommended that EPA create a Low Income Water Assistance Program (LIWAP) modeled after the Low Income Heating Assistance Program (LIHEAP).[75]

This type of targeted assistance also can be established at the state or local level. For example, the Orange Water and Sewer Authority in North Carolina runs a Taste of Hope program, under which water customers are urged to round up their bills when they make payments. The extra funds generated by this rounding are transferred to a

[75] National Drinking Water Advisory Council, *Recommendations of the National Drinking Water Advisory Council to U.S. EPA on Its National Small Systems Affordability Criteria*, July 2003, available at www.epa.gov/safewater/ndwac/pdfs/report_ndwac_affordabilitywg_final_.08-08-03.pdf.

local nonprofit social service agency that provides direct financial assistance to low-income water customers who are unable to pay their bills.

CBO has been critical of many public funding programs that distort prices by using federal grant funds to pay for projects and thus reducing prices below the true cost of water. CBO has recommended that federal funds be more targeted toward disadvantaged communities and low-income households.[76]

### Asset Management

"Asset management" is widely used to refer to a collection of proactive policies, procedures, and strategies seeking to ensure that capital assets provide high-quality services in a cost-effective manner. Improved asset management has long provided substantial benefits to communities in Australia and offers potential to many U.S. communities. Some asset management systems are so basic as to be in reach of even the smallest community and can and should be promoted in Appalachia. Some larger communities in Appalachia, such as Asheville, North Carolina, have developed advanced asset management systems that are beginning to provide cost benefits. Such systems often require significant up-front planning investments, political commitment, and skilled staff to ensure proper implementation. All of these are in short supply in the most economically distressed communities in Appalachia. More data and research are needed to determine the full potential of asset management systems in small rural communities, but in the short term, there are enough obstacles to implementing these systems that this strategy alone is unlikely to have a major impact on Appalachian water and wastewater funding needs.

### Improvement of Water Efficiency

Improving water efficiency is the third pillar of EPA's sustainable infrastructure program.[77] It includes everything from installing water-efficient fixtures to reducing distribution-system leaks. This measure can have varying financial impacts on local utilities, depending on the size and the type of system.

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[76] Congressional Budget Office, *Future Investment in Drinking Water and Wastewater Infrastructure* (Washington, D.C.: CBO, November 2002), available at www.cbo.gov/showdoc.cfm?index=3983&sequence=0.

[77] Environmental Protection Agency, *Sustainable Water Infrastructure for the 21st Century* (last visited April 17, 2005), available at www.epa.gov/water/infrastructure/.

The most direct financial benefits accrue to communities that currently have large, unaccounted-for water losses and are purchasing treated water from other systems to resell, or paying other systems to treat their wastewater. (There are 1,260 community water systems that purchase water from others; see Figures 2-4 and 2-5.) As more small systems begin relying on larger regional facilities for treatment, the incentives for reducing water losses will likely increase.

Improved water efficiency can have unexpected consequences. In West Virginia, for example, efficiency improvements and conservation have had such a major impact across the state that the average water consumption per connection has dropped from 4,500 to 4,000 gallons per month. According to state officials, many communities designed and financed facilities using water-demand and cash-flow models with the higher estimate and are now experiencing revenue shortfalls.

Improving efficiency does appear to be one area in which federal, state, and local agencies are providing significant assistance to communities. The Rural Water Association, the Rural Communities Assistance Project, and state capacity development staff offer water audits and other technical assessment programs to help small utilities improve their efficiency.

### Planning Grants and Assistance

Many of the funding program managers whom UNCEFC surveyed thought that the lack of planning and the lack of financial assistance for planning made developing sustainable, well-conceived water and wastewater systems difficult for communities. Although public funding programs have provided billions of dollars in funds for water and wastewater systems, only a small percentage of those funds have gone toward preliminary planning efforts. When public funding programs do support such efforts, normally they do so only after an overall project has been approved and constructed.

Some state programs have recognized this problem and created special planning or administrative funding programs. North Carolina's Capacity Grants Program provides up to $40,000 for system feasibility studies. In many states, funds distributed by ARC are among the few that can be used to study and plan a project.

Local officials in Jasper, New York, think that the planning funds the town received through ARC's local development district were essential in developing community support for its project to construct a centralized wastewater system in the town. (For more detail, see the case study of Jasper in appendix E.)

### Improved Access to the Private Capital Market

As noted in chapter 5, relatively few communities in Appalachia have ratings from Moody's Investors Service for bonds with a designated water or wastewater purpose (see Figure 5-2). The figure does not include bond issues that were used for multiple projects that may have included water and wastewater components. Nor does it give an indication of communities that have worked with local banks to finance infrastructure projects through other credit means, such as lease installment purchases or certificates of participation. Nevertheless, the figure does demonstrate a commonly held view by public officials throughout the region that private capital has played a less important role in infrastructure development in Appalachia than in other areas of the country.

In the UNCEFC survey, only 5 percent of public funding program managers responding thought that improving access to commercial credit would have a significant impact on water and wastewater services in the region. Sixty-six percent thought that improved access would have a small impact or no impact at all, and 29 percent thought that improved access would have a moderate impact. Of course, to stay in business, many of these public funding programs depend on communities with poor credit.

Despite the limitations of this funding strategy in Appalachia, in some Appalachian communities, it has been instrumental in improving services. Weaverville, North Carolina, with its growing population of affluent retirees and Asheville commuters, used a general obligation bond to finance a new water system (for a case study of Weaverville, see appendix E).

### Offering of Attractive Loan Terms

For many communities with marginal fiscal capacity, careful manipulation of funding terms may offer the best hope for stretching limited public dollars. In some situations, long-term loans can make a capital project feasible for a community. USDA, the Ohio Water Development Authority, and West Virginia's CWSRF are examples of programs that offer thirty- and forty-year loans under special conditions to disadvantaged communities. These loans should be made only after careful evaluation of a project. Generally accepted accounting principles dictate that loan terms not exceed the useful life of a facility.

In the UNCEFC survey, several CWSRF fund managers indicated that the inability of states to offer EPA–capitalized SRF program loans beyond terms of twenty years made the programs less attractive to communities. Although federal restrictions influence the ability of SRF programs to offer extended loans for drinking water and clean water projects, some states have successfully crafted longer-term SRF packages for

disadvantage and distressed communities. Georgia and South Carolina are among the states that have chosen to implement optional disadvantaged community programs. Under the DWSRF disadvantaged community programs, states must develop their own criteria for identifying disadvantaged communities and then can offer thirty-year loans and principal forgiveness to these communities. (All other DWSRF loans must be for no longer than twenty years.)

At least one Appalachian state, West Virginia, has gone a step farther. It has used a special provision of the Clean Water Act to develop and gain EPA approval for a thirty-year extended wastewater loan program that relies on CWSRF funding.

### Establishment of State Funding Sources

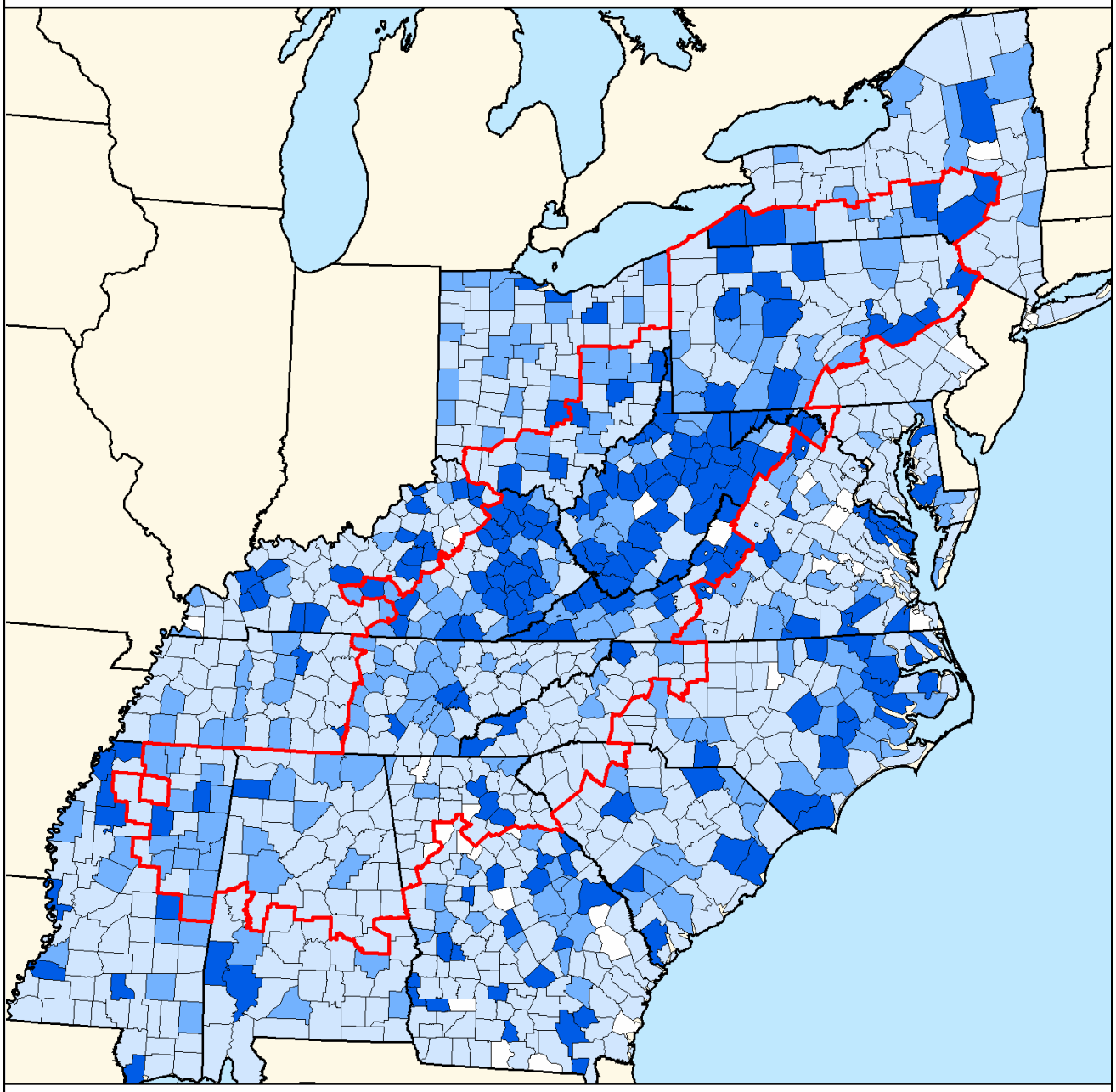
One of the most basic steps that a state can take to help its communities is to create a funding program that relies on revenues collected or pooled by the state. Twelve of the 13 states in Appalachia have at least one major state funding program that has invested funds in the region. In total, the twelve states have created thirty-two programs that are distinct from federal programs (see chapter 5 for more details). (For per capita funding levels for state and federal programs from 2000 through 2003, see Figure 6-3. The data include both the Appalachian and the non-Appalachian region of each state.) State funding for water and wastewater projects varies considerably in the region, with West Virginia state programs disbursing capital funds (loans and grants) totaling $175 per capita, compared with other states disbursing less than $10 per capita.

### Pooled-Loan Programs

The private capital market in the United States has proven to be an essential component of infrastructure. However, it still is a tool beyond the reach of many communities in Appalachia. Many states have developed innovative methods of pooling loans for small, credit-risky communities to reduce their risk. These pooled-loan programs often operate under the name "bond bank." They follow several designs, but the common approach is to use a combination of state administrative capacity and creditworthiness to obtain private capital at more favorable terms than individual communities could obtain. Across the country, bond banks have provided billions of dollars of funding for water and wastewater infrastructure by offering a range of programs and services.

Several states in Appalachia currently operate pooled-loan programs. They follow several models. The West Virginia Infrastructure and Jobs Development Council operates the largest program, having provided more than $215 million dollars in loans to communities from 2000 through 2003. The council was created in 1994 by the Infrastructure and Jobs Development Act. The act also authorizes the state to issue $300

**Figure 6-3. Per Capita Disbursements for Water and Wastewater Projects from Federal and State-Originated Programs**



Data Source: UNCEFC Master Funding Database, 2004

Note: Data from the 48 largest programs of the 13 states are included. Data do not include approximately 5% of all Community Development Block Grants for Non-Entitlement Cities, awarded across the 13 states.

No Public Funding or No Data
Less than $50
$50 through $100
More than $100
ARC Boundary

million in general obligation bonds for infrastructure.[78] The act was modified in 1998 to allow the council to sell revenue bonds to provide additional funds to communities. The general obligation and revenue bond proceeds are made available to local communities as grants (about 20 percent of the funds) and as loans at 0, 1, and 2 percent interest for twenty years. The state uses coal severance taxes to retire the original general obligation bond issue and established community (as opposed to new) loans to retire the revenue bonds.[79]

The Ohio Water Development Authority invested almost $50 million in water and wastewater infrastructure in Appalachia from 2000 through 2003 in the form of thirty-year market-rate loans, as part of its commitment to Appalachian communities. The authority's borrowers benefit from its superior credit rating and obtain loans for longer terms and at lower interest rates than they would on their own, but the program does not include any other embedded subsidies. Although these interest rates are higher than the SRF interest rates in Ohio (for loans also managed by the authority), many communities favor the loans for their reduced administrative requirements and longer loan terms.[80]

Virginia maintains one of the oldest pooled-loan programs in the region. The Virginia Resources Authority issues revenue bonds that have several layers of security, including local government loan repayments that provide a 1.4 debt-service coverage and a state aid program that indirectly backs the bonds with the moral obligation of the state. The last Senior Series bond issue in June 2004 carried Moody's highest rating, Aaa.[81] The Virginia pooled-loan program invested more than $20 million dollars in Appalachia from 2000 through 2003.

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[78] West Virginia Infrastructure and Jobs Development Council, *2002 Inventory and Needs Assessment Report* (Charleston: the Council, 2003), available at www.wvinfrastructure.com/reports/index.html.

[79] Katy Mallory, West Virginia Infrastructure and Jobs Development Council, telephone conversation with authors, October 2004.

[80] Steve Grossman, Ohio Water Development Authority, telephone conversation with authors, October 2004.

[81] Moody's Investors Service, Moody's Issue Rating Infrastructure Revenue Bonds, Senior Series 2004A (Non–AMT) (June 2004).

### Streamlining of, Coordination of, and Cooperation among Funding Programs

Capital funding comes from a wide variety of sources, making planning and management of applications, and timing of grants, loans, and matches a significant challenge for communities. "Too many hoops to jump through" is how one state SRF administrator put it in describing Appalachian communities' challenges in developing projects. Many of the local and state officials interviewed and surveyed for this project thought that administrative and timing issues of different public programs were the key challenge for local governments in carrying through with a project. At the time this report was being drafted, Jasper, New York, was struggling to meet the deadlines of one of its four project funders. Although this funder provided a relatively small part of the total project cost, the loss of it would have killed the entire project (for a case study of Jasper, see appendix E). More often than not, communities require multiple funding sources to complete a project successfully. Combining local, state, and federal grants and loans, each with their own requirements and deadlines, can be a challenge for even the most savvy local government and can be insurmountable for communities that lack administrative capacity.

In the UNCEFC survey, the research team asked funding program managers several questions related to collaboration among programs. Managers who were responsible for multiple programs tended to feel strongly that there should be more collaboration, whereas those who were responsible for only one program were more evenly split. (For the percentages of funding program managers who rely on the different coordination methods, see Table 6-3.)

**Table 6-3. Funding Coordination Methods Used by Funding Program Managers in Appalachia**

| Method | % Using |
|---|---|
| Informal discussions | 94 |
| Shared databases or information | 56 |
| Part of infrastructure coordination organization | 53 |
| Shared application forms | 18 |

*Source:* UNCEFC *Program Managers Funding Survey* (Chapel Hill: UNCEFC, 2004) (see appendix D).

The states in Appalachia have different types of coordinating organizations. They range from a legislative infrastructure council that has not met in more than two years (North Carolina), to an ad hoc funders group that meets regularly to evaluate projects (Ohio), to a staffed infrastructure development council that maintains elaborate project databases and makes recommendations for funding packages for each identified major project need in the state (West Virginia).

## The Role of Private Service Providers

Opinions about private service providers in the United States and Appalachia are as varied and confusing as the terminology and the models associated with them. EPA categorizes all water systems in which the assets are not owned by a government jurisdiction as private, including systems that are run by nonprofit entities or trailer parks whose water business is a secondary part of their operation. Most of the debate about privatization, though, centers on the subgroup of private service providers that are truly for-profit enterprises, with profit-oriented goals and management strategies that cannot be separated from their service goals.

For-profit water companies, and to a lesser extent for-profit wastewater companies, already play an important and growing role in many Appalachian communities. Privatization offers some communities a way to attain the economies of scale that regionalization brings, as well as access to greater technical and managerial capacity than is likely in a go-it-alone approach. Equally important, large multiple-jurisdiction for-profit providers offer rate-setting and institutional options not readily available to isolated single-jurisdiction systems.

Numerous state officials interviewed for this study were quick to point out that in some areas of Appalachia, for-profit companies have made important public health water investments in their service areas, well beyond what local-government-controlled utilities have made in their service areas. State officials also are quick to point out that these investments have come at a significant cost and that in many cases, customers served by for-profit companies are paying significantly more for water service than customers served by government utilities are paying. For example, of the 420 public and private water utilities monitored by the West Virginia Public Services Commission, West Virginia–American Water was ranked 14th in amount charged in 2003.[82]

For those in favor of for-profit company involvement, the higher cost is normally attributed to the cost associated with better, more modern facilities and is justified as necessary to meet public health needs. Private-sector advocates with whom the research team spoke stressed that their operational strategies, such as shared management and technical expertise, larger facilities, and bulk purchasing of chemicals, all lead to important cost efficiencies. Those wary of for-profit involvement attribute the higher charges primarily to return on capital (a form of profit), taxes, and higher costs of capital acquisition (because the tax-free municipal bond market and many government funding programs are out of reach to many for-profit companies).

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[82] American Water Works Association, *Dawn of the Replacement Era: Reinvesting in Drinking Water Infrastructure* (Denver: the Association, 2001).

At the local level, officials in communities like Mercer County, West Virginia, which has seen millions of dollars in infrastructure investment from for-profit companies, voiced support for their nongovernment service providers. Other local officials to whom the research team spoke, who have succeeded in creating large government regional water providers, such as the Public Service District in Putnam County, West Virginia, felt strongly that more government options still need to be developed that have incentives for capital investments without the cost items that for-profit providers add.

In the end, most state officials to whom the UNCEFC research team spoke admitted that given the choice between higher costs and more proactive capital investment, they would choose higher costs. However, both they and the private-sector managers to whom the research team spoke stressed that there are communities in which "the numbers don't work" and that are unlikely to benefit from for-profit investments.

Further, private systems will not reach the most remote and difficult-to-serve communities in Appalachia. Private providers will seek to serve the systems with relatively low costs and high revenues. In addition, for-profit providers' higher cost of obtaining capital, their profit needs, and their tax burdens inevitably influence the price their customers pay for water. The trade-offs between the benefits of consolidated private systems and the extra revenue requirements must be evaluated case by case throughout the region.

### A National Trust Fund

Although many state and federal officials suggested that more federal funding assistance was required to meet all the needs in the region, no one specifically mentioned or described a new national trust fund similar to the existing one for national highway improvement. However, several advocacy organizations, including the Association of Metropolitan Sewerage Agencies (AMSA), AWWA, and WIN, have called for the establishment of such a fund as a possible method of helping Appalachian communities.[83] AMSA has been one of the most vocal advocates of the fund and has published multiple papers and reports outlining potential structures and funding sources for it.

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[83] *Ibid.*; Association of Metropolitan Sewerage Agencies, *The Cost of Clean* (Washington, D.C.: the Association, 1999), available at www.amsa-cleanwater.org/pubs/cost/coc.pdf; Water Infrastructure Network, *Clean and Safe Water for the 21st Century: A Renewed National Commitment to Water and Wastewater Infrastructure* (Washington, D.C.: the Network, 2000), available at www.amwawater.org/features/win/win. html#report.

## Optimization of Grant Programs

Although opinions were mixed on the impact that most measures would have on assisting Appalachian communities, almost all the funding program managers whom the UNCEFC research team surveyed thought that grants would have major impacts. When asked to estimate the impact that different measures would have in helping communities meet their needs, 81 percent of the respondents indicated a large impact for grants. Similarly, almost 50 percent of the funding program managers responding felt that the inability of specific programs to offer grants was a major obstacle in the programs' helping distressed communities.

Most high-profile policy reports include conclusions and recommendations regarding grant funds. Dozens of separate programs, most of which are state based, offer grants to Appalachian communities. The sources of funds for these programs range from current-year appropriations to state bonds backed by general taxes.

Determining which communities receive grants can be a major challenge. Although most funders seem to agree that grant funds should go to communities "most in need," some argue that grants made to the most fiscally distressed communities may be counterproductive in supporting communities that do not have the managerial and financial capacity to maintain a viable system and, in the worst case, do not have the funds to operate the system the grant supported. Some states have used grants as an opportunity to encourage or force communities to address their shortcomings in fiscal capacity by partnering with other communities. For such strings to have an impact, a comprehensive funding strategy must be in place. Otherwise, as many officials reported, communities will play funders off each other and go to the funder that requires the least and provides the most. The West Virginia Infrastructure and Jobs Development Council's system of reviewing project requests to multiple programs and recommending a comprehensive package has allowed it to distribute grants in a much more planned and focused manner.

## Summary

In conclusion, no single strategy offers a way out of the problem of water and wastewater funding shortfalls in Appalachia, but there are many interrelated actions that federal and state policy makers and local communities can take to have a positive impact on water and wastewater capital funding. For most communities, particularly those that are economically distressed, addressing the shortfalls in a sustainable manner requires external support combined with local initiatives. Communities without access to external funding in many cases are unable to meet their needs. However, outside capital alone is not sufficient to guarantee sustainable services. Local communities without an understanding of how to tie together different funding programs are

unlikely to be able to assemble a funding package with sufficient resources to meet their needs. Funding sources like ARC that can provide planning grants and other up-front money can help communities stitch together the funding patchwork that has become the norm since the passing of the major federal construction grants program of the 1970s. Strategies such as full-cost pricing and asset management are more likely to help meet the capital gap facing larger communities with existing infrastructure investments to manage and with large customer bases, than they are likely to help smaller communities. However, communities unwilling to charge their customers higher rates for water and wastewater services may be unable to maintain new capital infrastructure even if they do succeed in attracting outside funding assistance.

For large-scale policy-making purposes, understanding the immensity of the needs facing the region as a whole is important. Ultimately, though, understanding the needs of individual communities may provide more guidance. The prototypical Appalachian community has a relatively small customer base and a need for what may be its first central treatment plant and distribution network. But it has no meaningful access to the private capital market in the absence of a state pooled-loan arrangement, and no cost-effective way to hook up to a nearby system that lies over a mountain ridge. It is going to need outside capital funding help from state or federal grants to address its water and wastewater capital needs. The challenge to federal and state funding agencies is not only to provide assistance but to do so in a way that is sustainable. Designing funding programs and packages that encourage local sustainable management practices should be an essential component of any external funding assistance.