UNC ENVIRONMENTAL FINANCE CENTER

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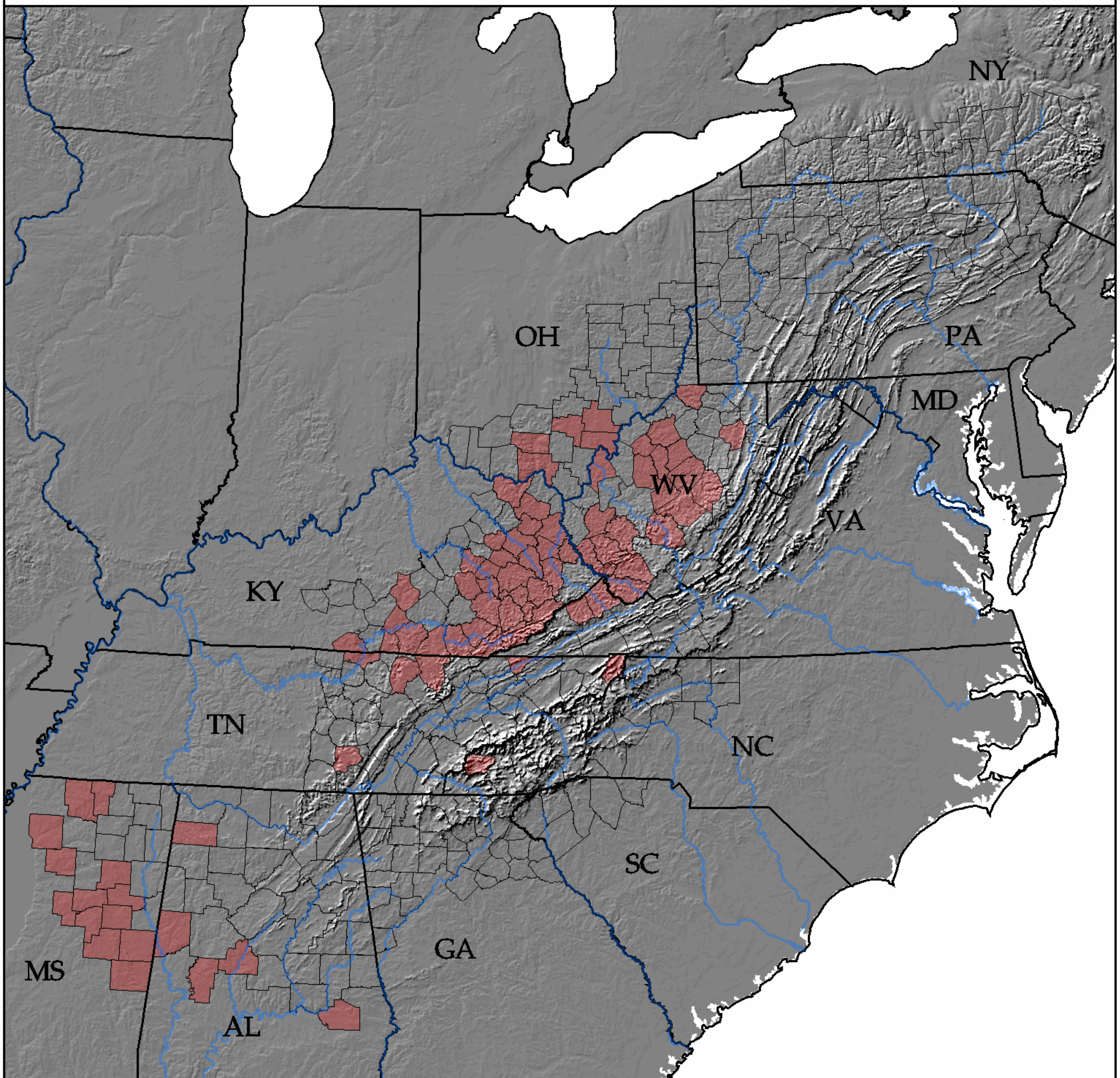
[2] For ARC purposes, "Appalachia" has a precise definition. See the section in this chapter headed Background on the Appalachian Regional Commission.

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

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[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**

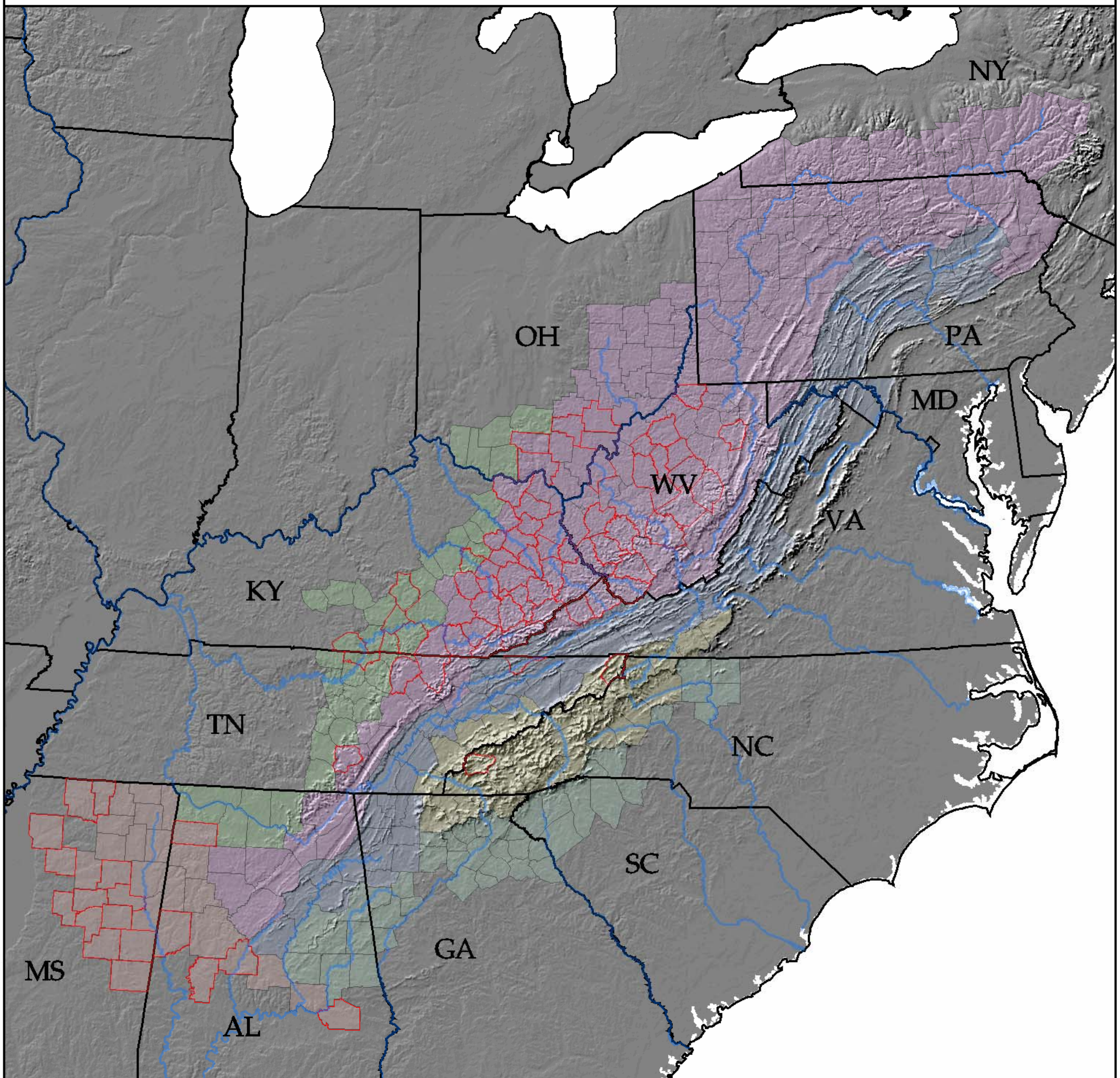
Source: Data from Census Bureau, Census 2000, Summary File 1, Table GCT-PH1-R. Population, Housing Units, Area, and Density: 2000 (last visited 12 May 2005), available at http://factfinder.census.gov/.

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):

Appalachian Highlands	Interior Plains	Atlantic Plain
Appalachian Plateaus	Interior Low Plateaus	Coastal Plain
Valley and Ridge	Central Lowland	
Blue Ridge		
Piedmont		

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

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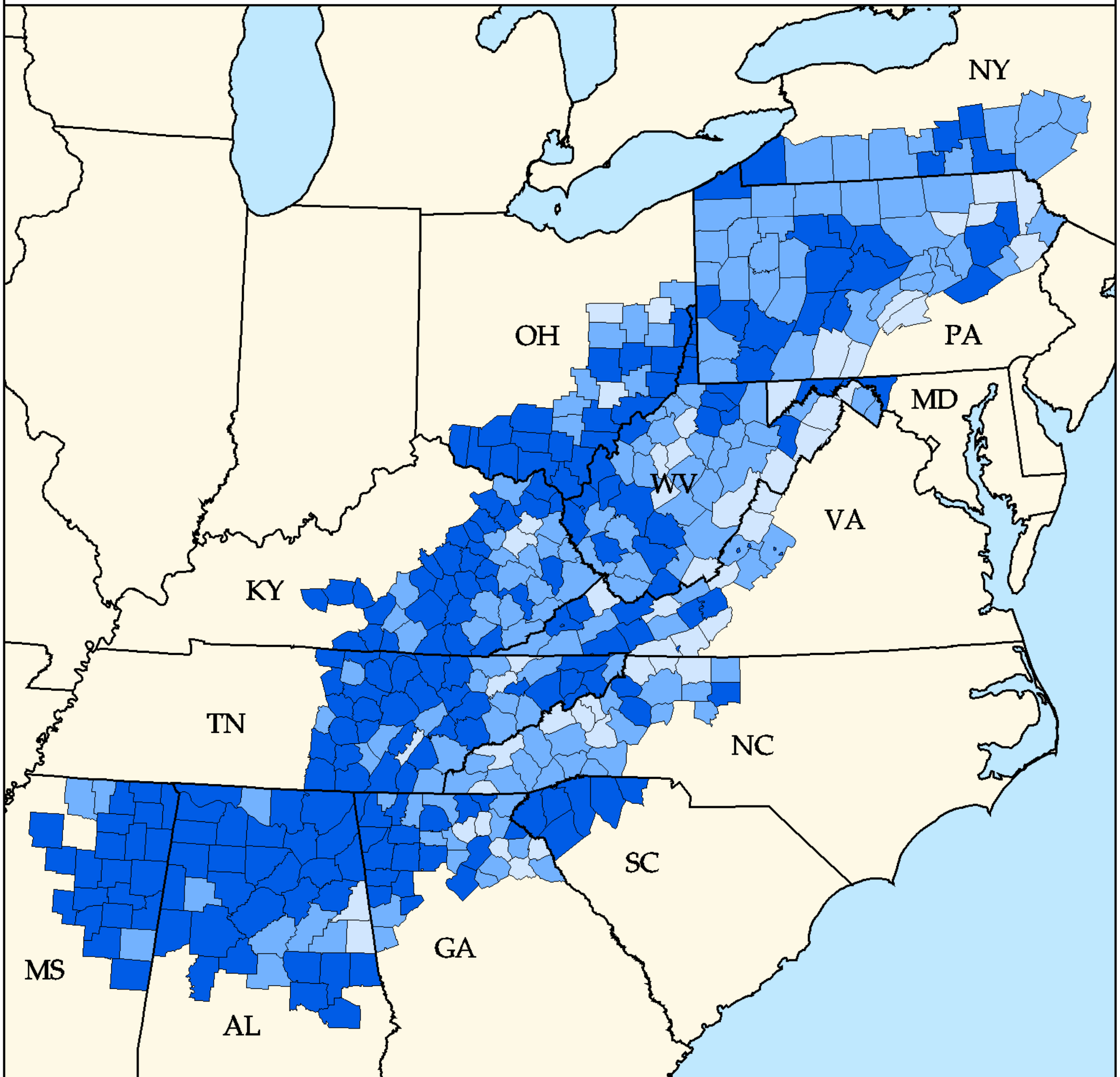
[16] Census Bureau, Census 2000, Summary File 3, Table H47.

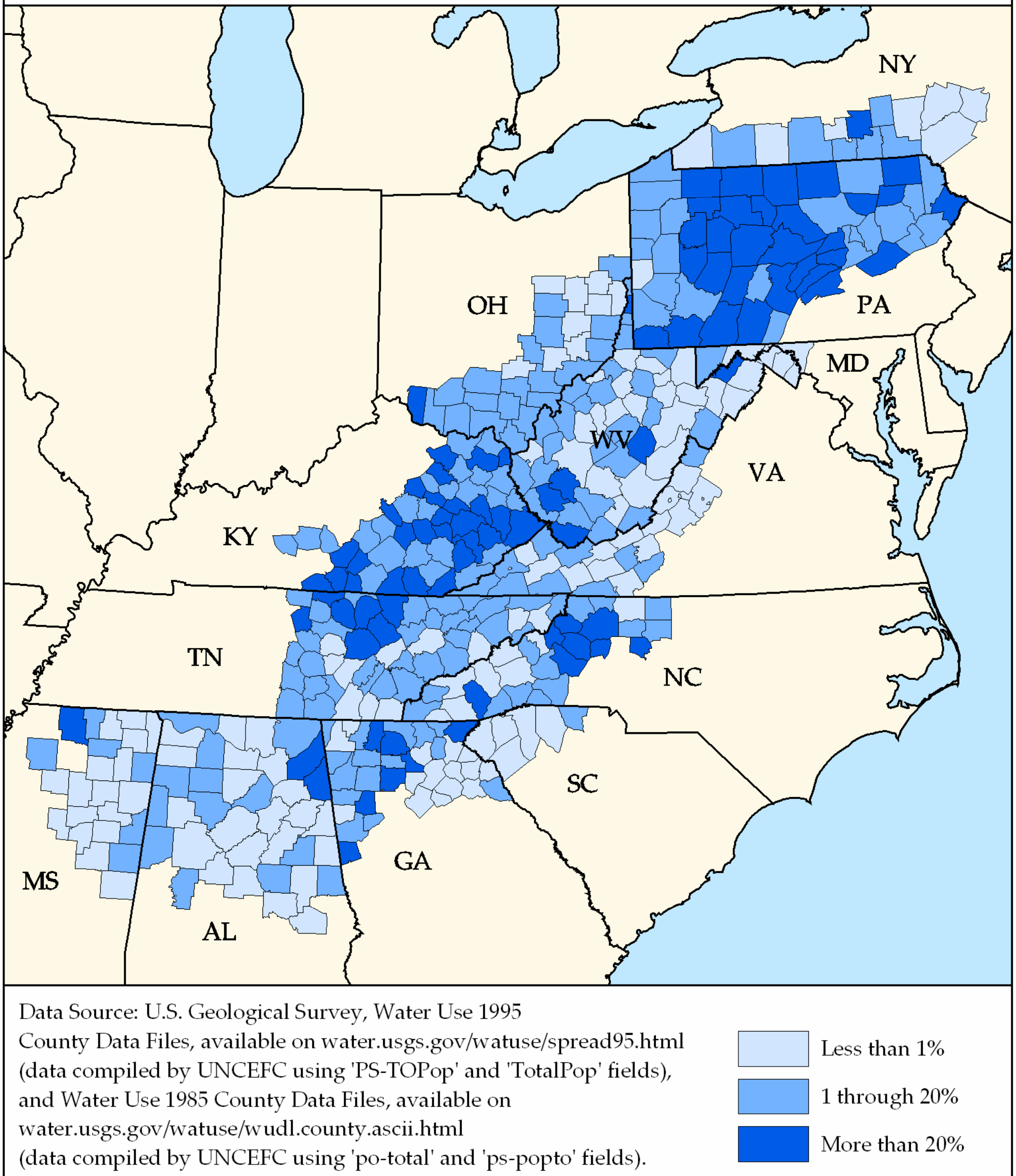
[17] U.S. Geological Survey, Water Use Data 2000, county-level data, available at water.usgs.gov/watuse/data/2000/index.html.

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.

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).

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.

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[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

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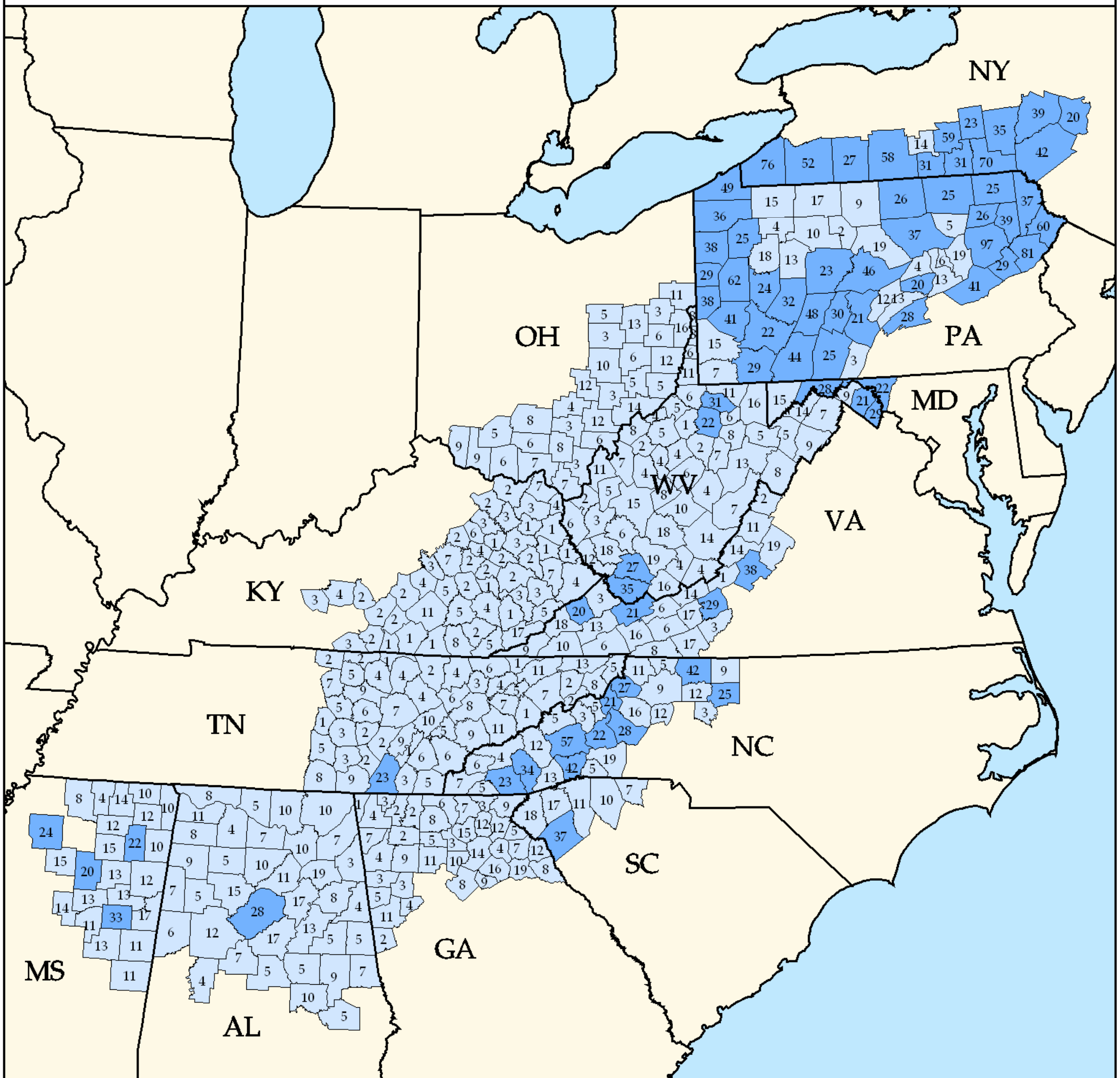
[20] Staff of Kentucky Infrastructure Authority, telephone conversations with authors, Fall 2004.

[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



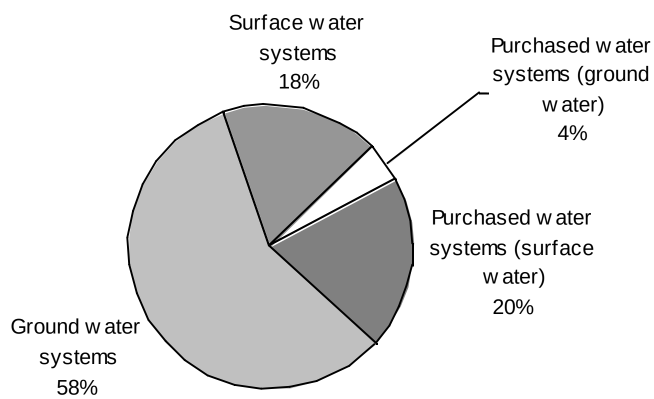
Data Source: Environmental Protection Agency,
Safe Drinking Water Information System database
for 4th quarter fiscal year 2003 frozen in January 2004,
downloaded from www.epa.gov/OGWDW/data/pivottables.html
and compiled by UNCEFC. Noncommunity water systems are
excluded. There were 5,234 community water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

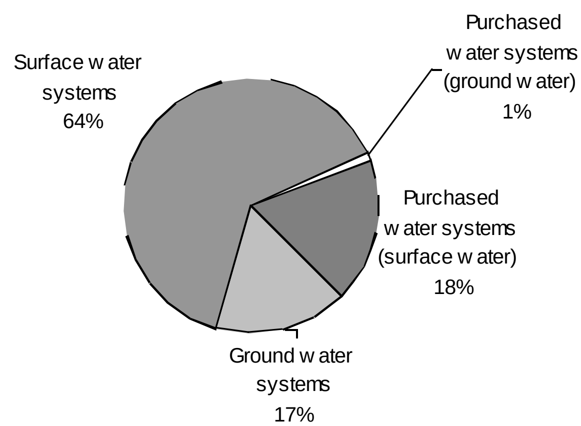


Source: Data from Environmental Protection Agency, SDWIS, database for 4th quarter, fiscal year 2003, frozen in January 2004; downloaded from www.epa.gov/ OGWDW/data/pivottables.html and compiled by UNCEFC. Noncommunity water systems are excluded. There were 5,234 community water systems in Appalachia 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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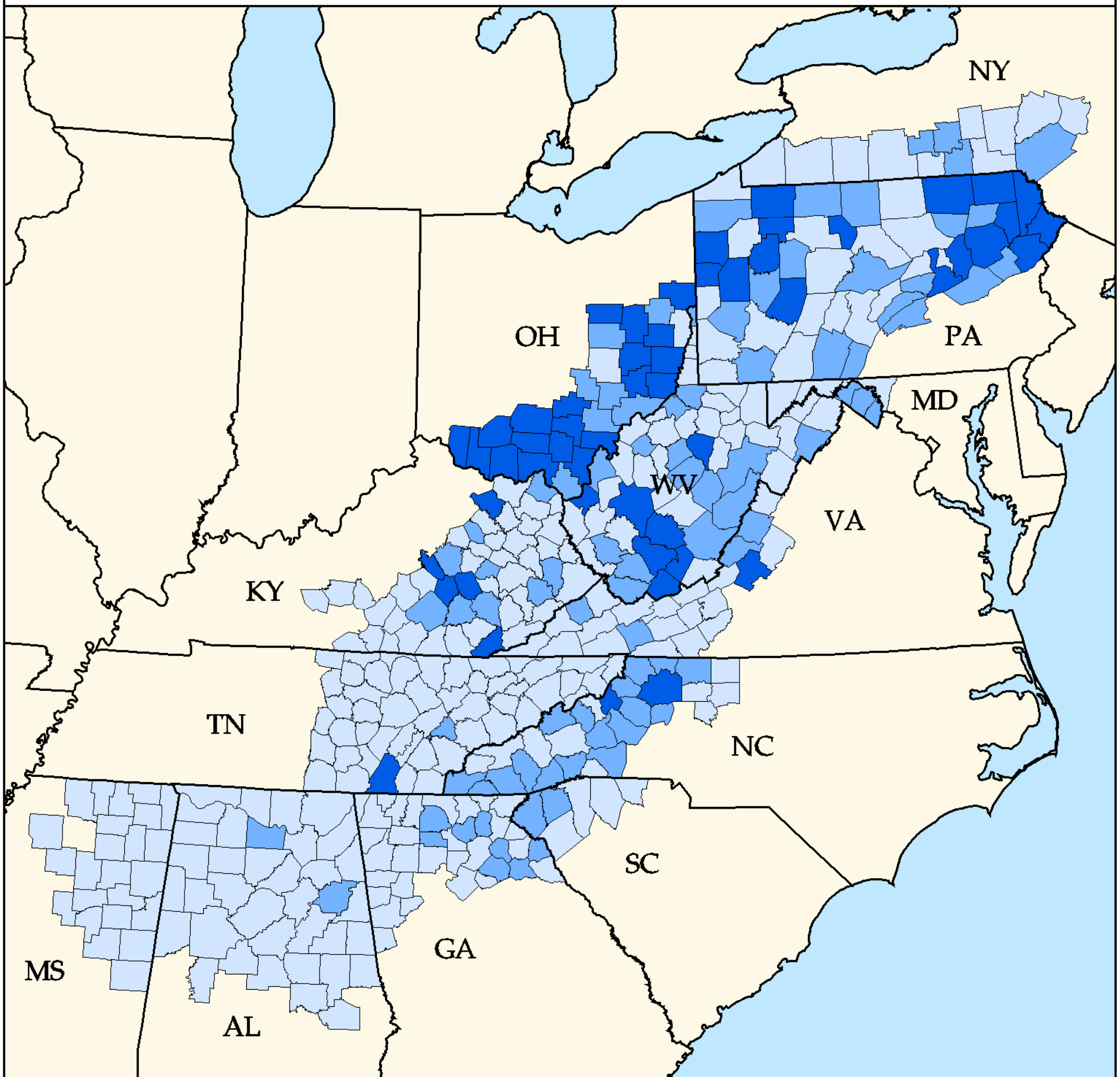
[22] Safe Drinking Water Act Amendments of 1996, 42 U.S.C. § 300j-12(a)(2).

[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,

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[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]

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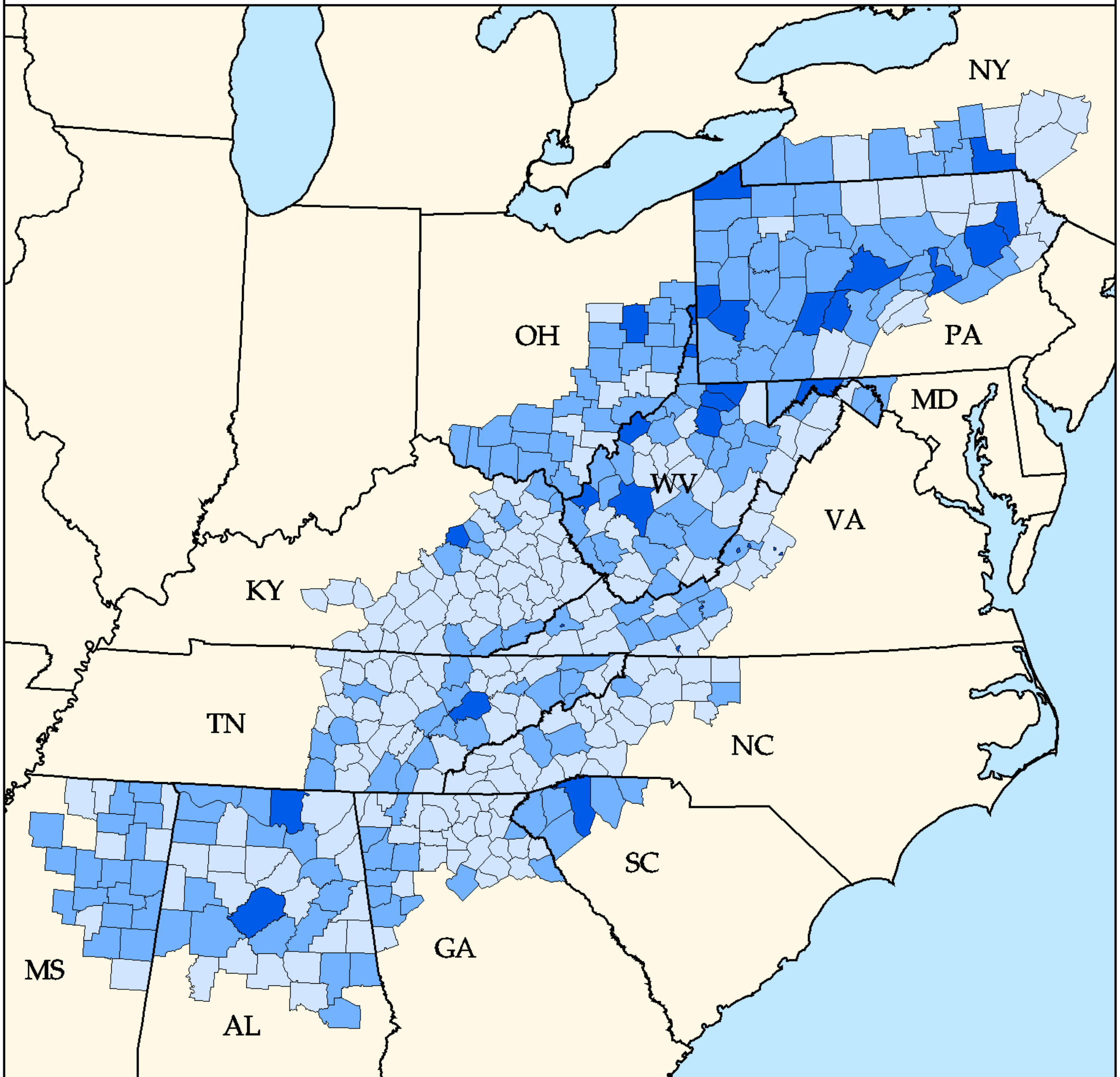
[25] Craig Lindell, Decentralized Wastewater Management, *Public Management* 87:6, 33-35 (July 2005).

[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.

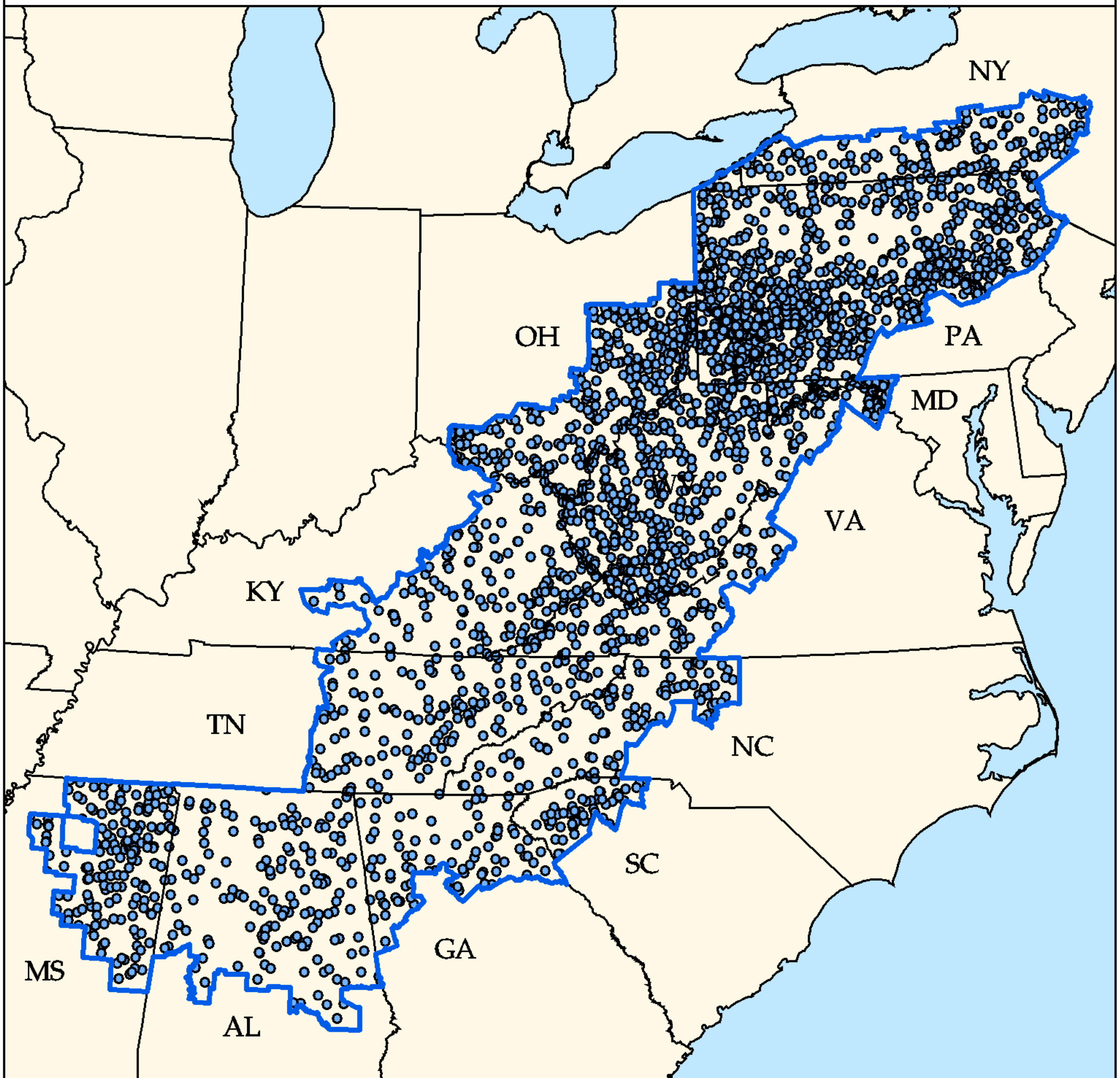
Note: MGD = millions of gallons per day.

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

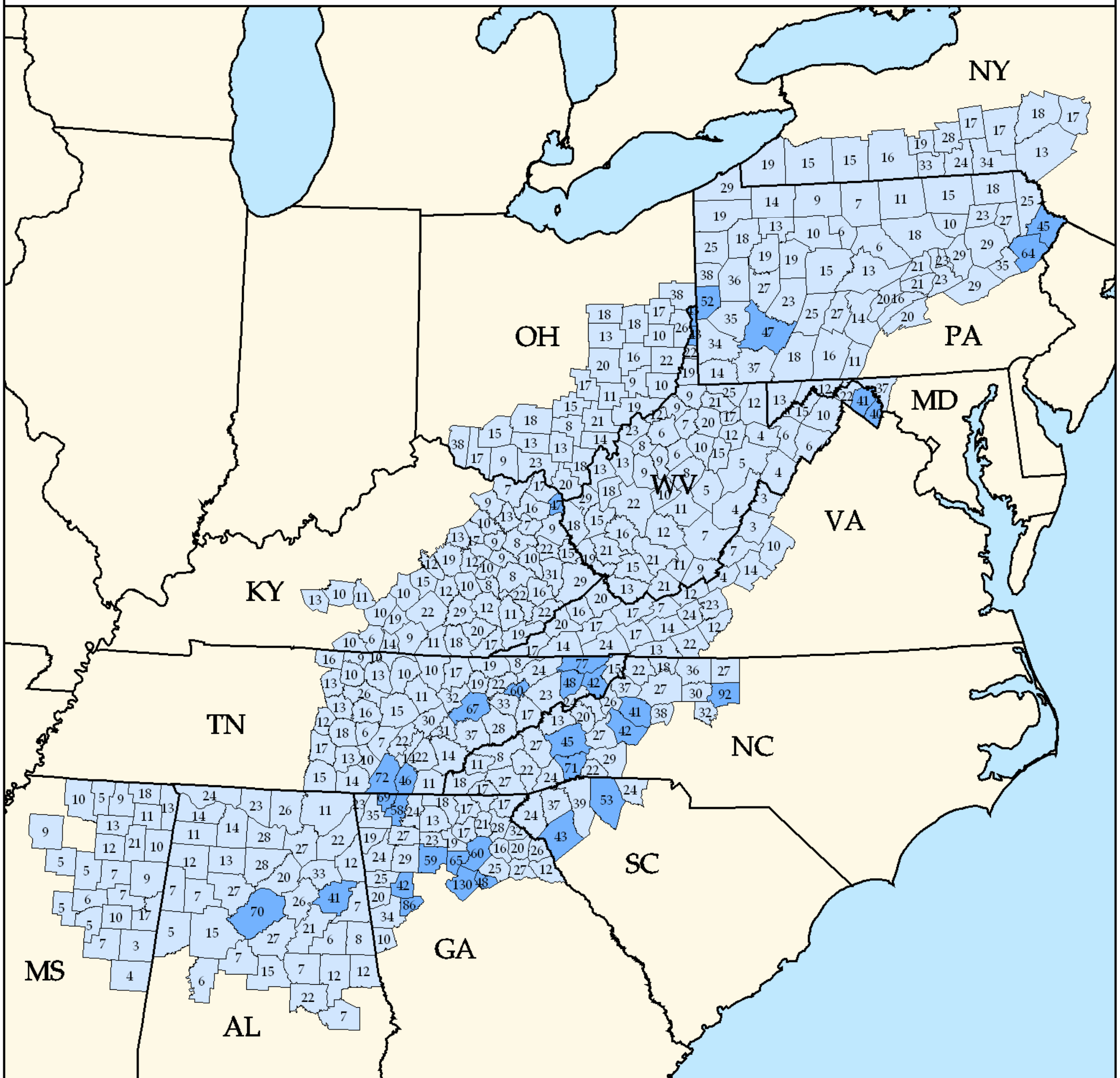


Data Source: Longitude and latitude data and mapping of wastewater systems from Clean Watersheds Needs Survey 2000 (Washington, D.C.: EPA, 2003), provided by email to the author from the Environmental Protection Agency on October 20, 2004. Data available on Enviromapper at maps.epa.gov/enviromapper/

Facility/Collection System

ARC Boundary

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

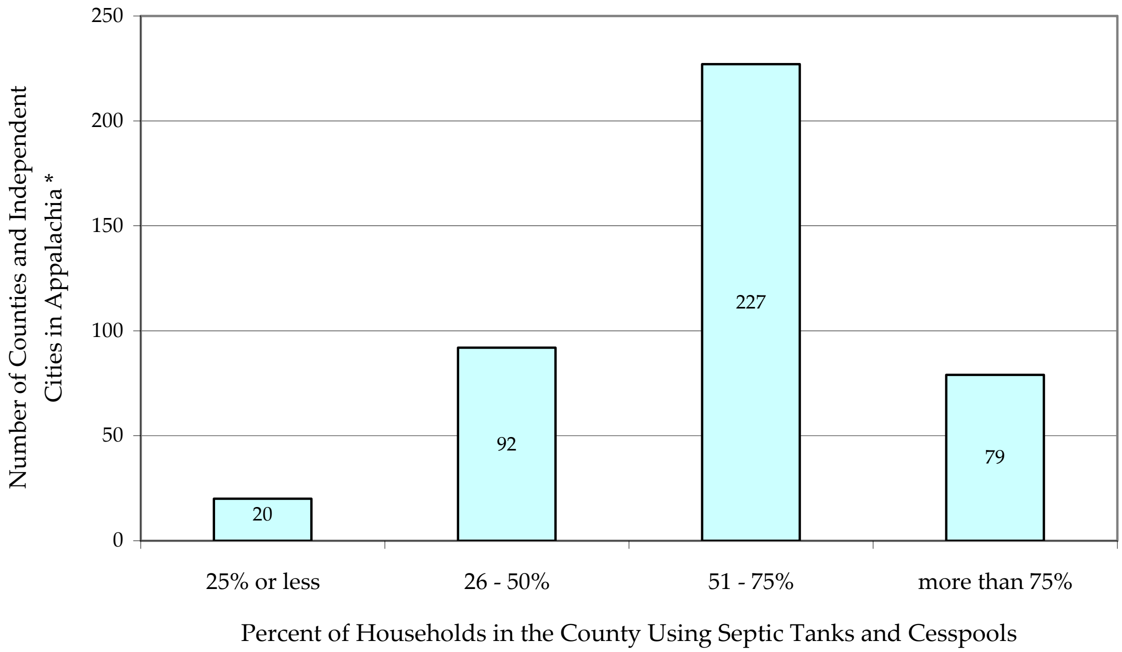


Data Source: Census 1990 Summary Tape File 3
Tables H23, H24

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.

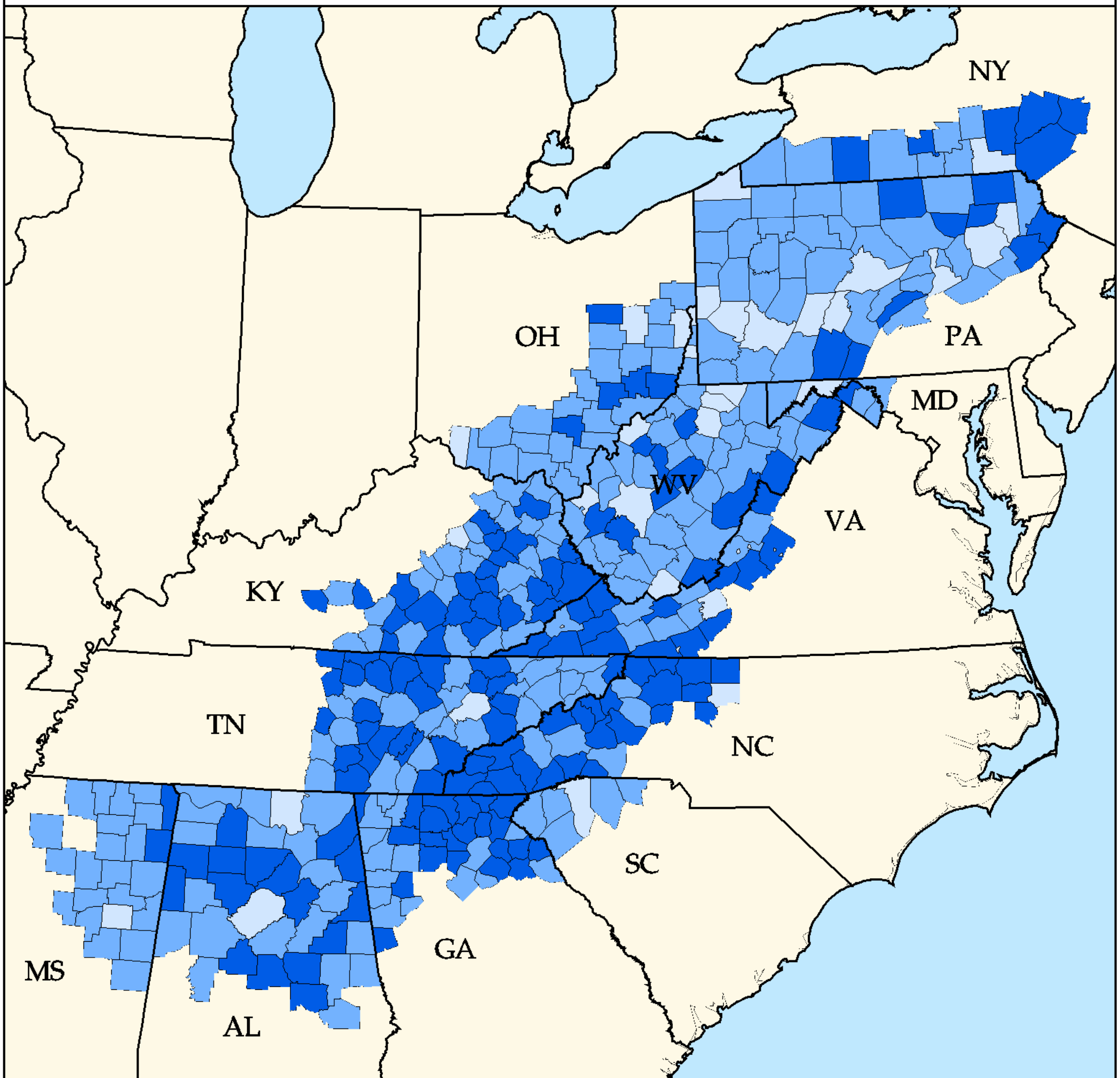
* Eight Virginia Independent Cities are analyzed separately, totaling to 418 counties and independent cities in Appalachia.

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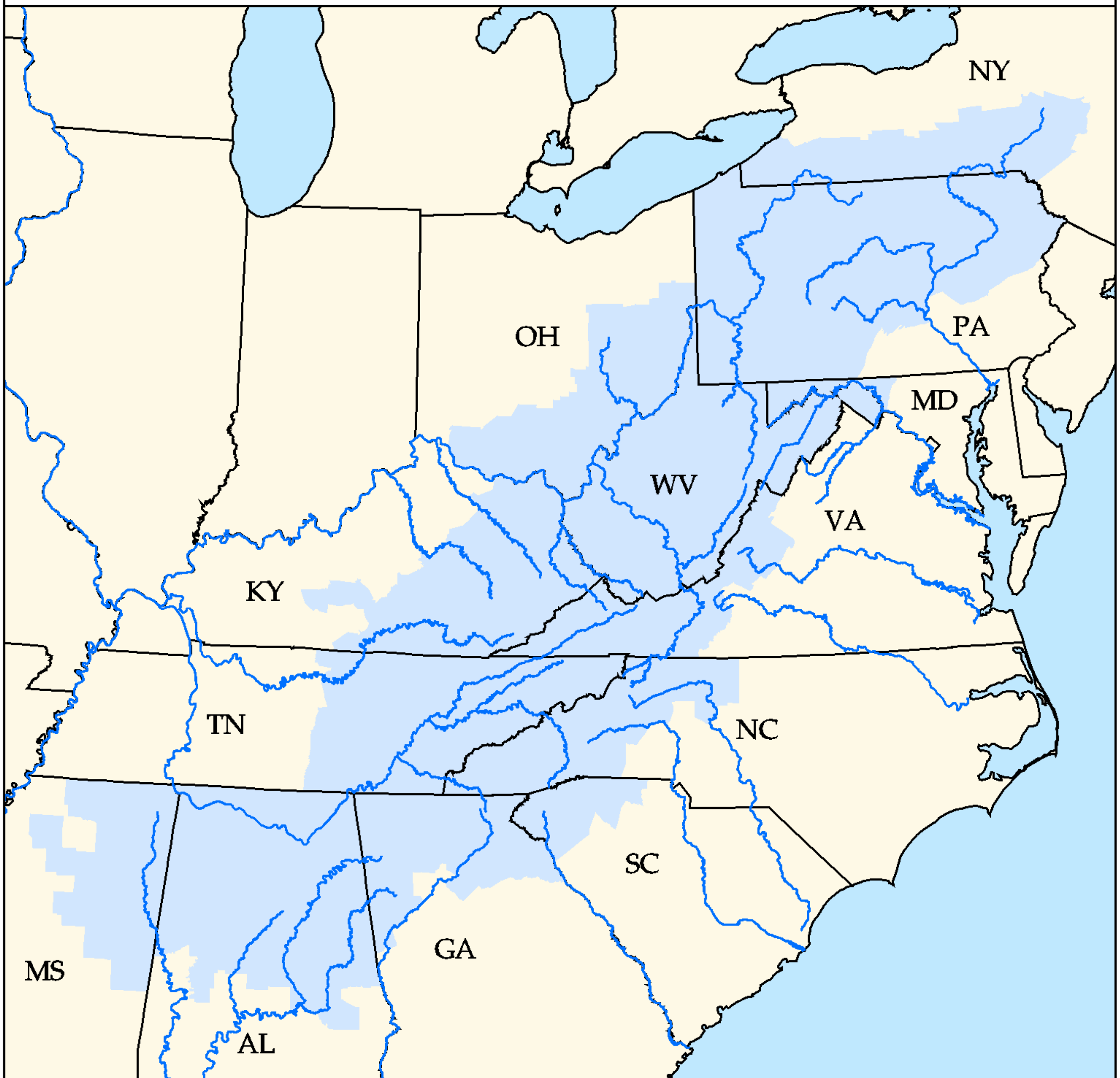
[28] Peter White et al., *Environments of the Southeast* (Delray Beach, Fla.: St. Lucie Press, n.d.), available at biology.usgs.gov/s+t/SNT/noframe/se130.htm.

[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 infrastructure 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).

[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

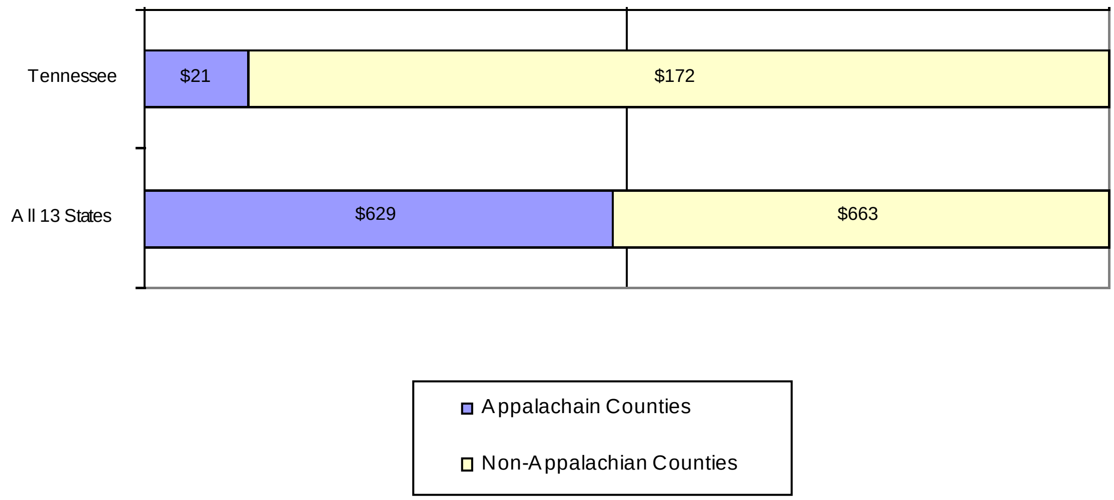
Source: Reprinted from Environmental Protection Agency, *The Clean Water and Drinking Water Infrastructure Gap Analysis* (Washington, D.C.: EPA, 2002), 31.

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	Cate-gories 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).

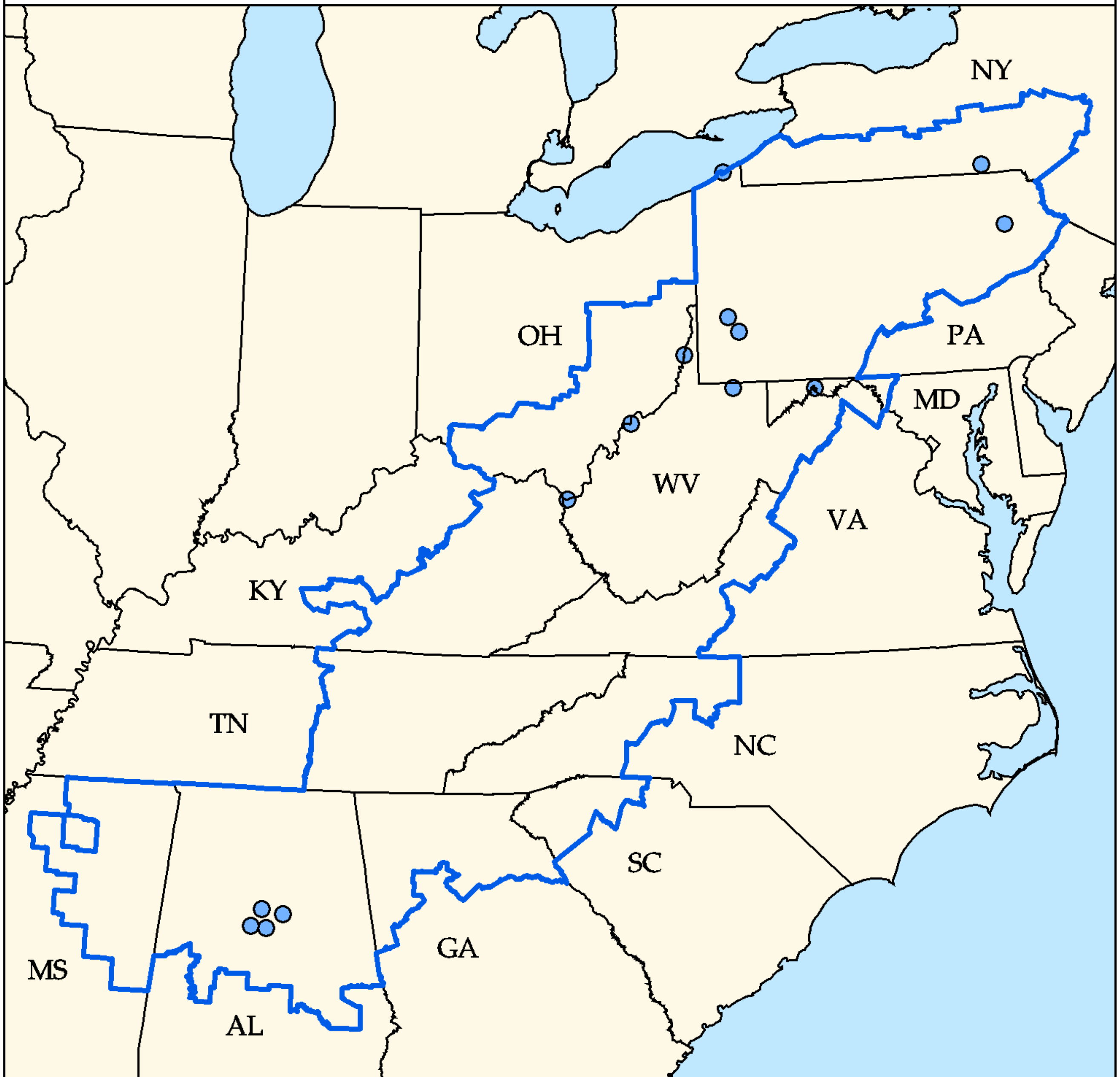
The documented needs for categories I–V for all of Appalachia account for $14.4 billion of the national documented needs of $162 billion, or close to 9 percent. In each of the categories, the total Appalachian needs range from 5.1 percent to 9.9 percent of the national needs, with the exception of category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

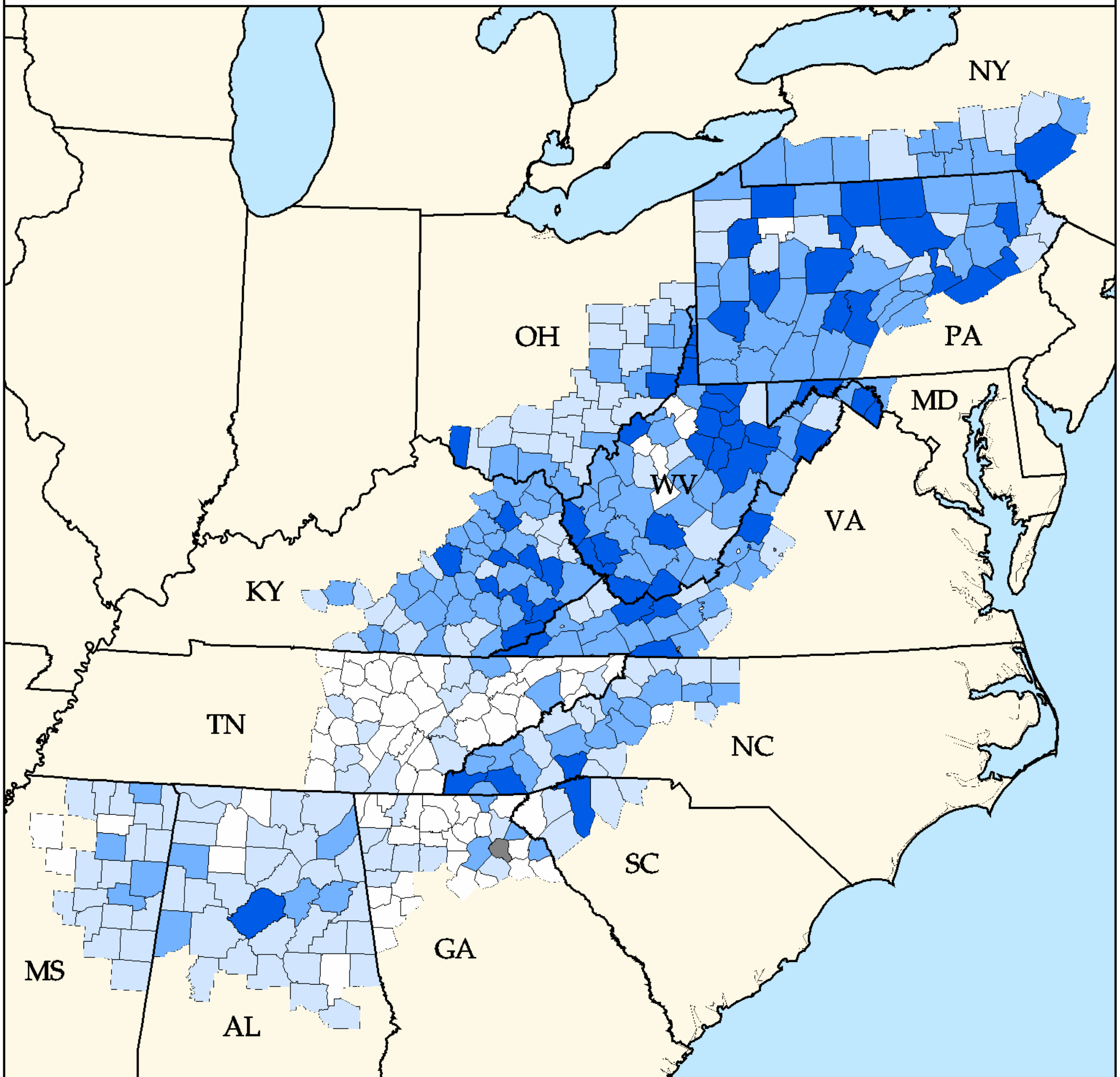


Data Source: Environmental Protection Agency,
Needs Report data for Clean Watersheds Needs Survey 2000,
available on www.epa.gov/owm/mtb/cwns, downloaded and
compiled by UNCEFC. Total headquarters-accepted
Categories I-V needs are used in this analysis.

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.

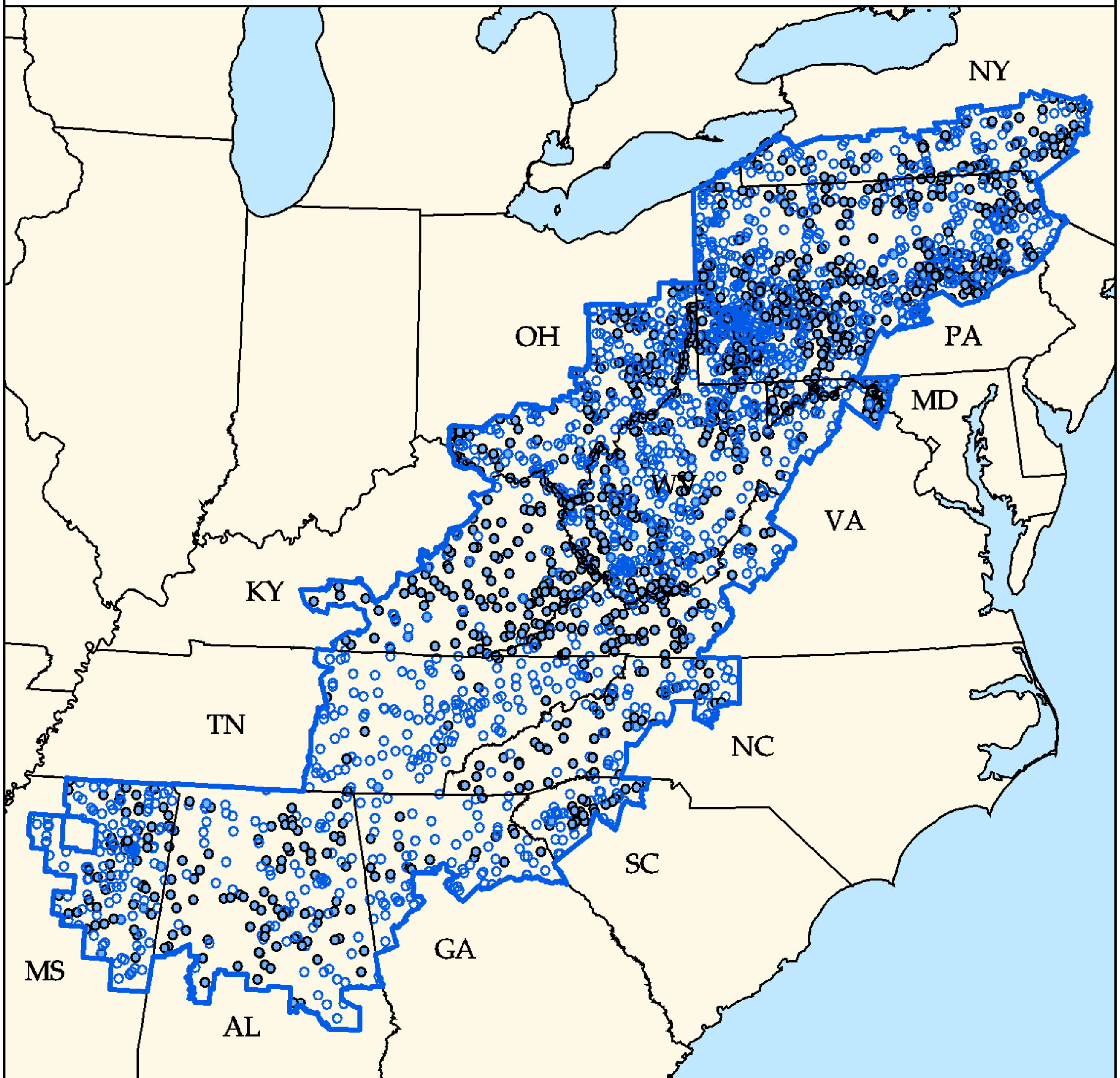
Table 4-3. Facilities with No Documented Needs in Categories I–V

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 Water	456,779,424 415,387,782	599,341,000 733,688,883
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 Water	3,104,717,185 692,455,713	2,530,259,000 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

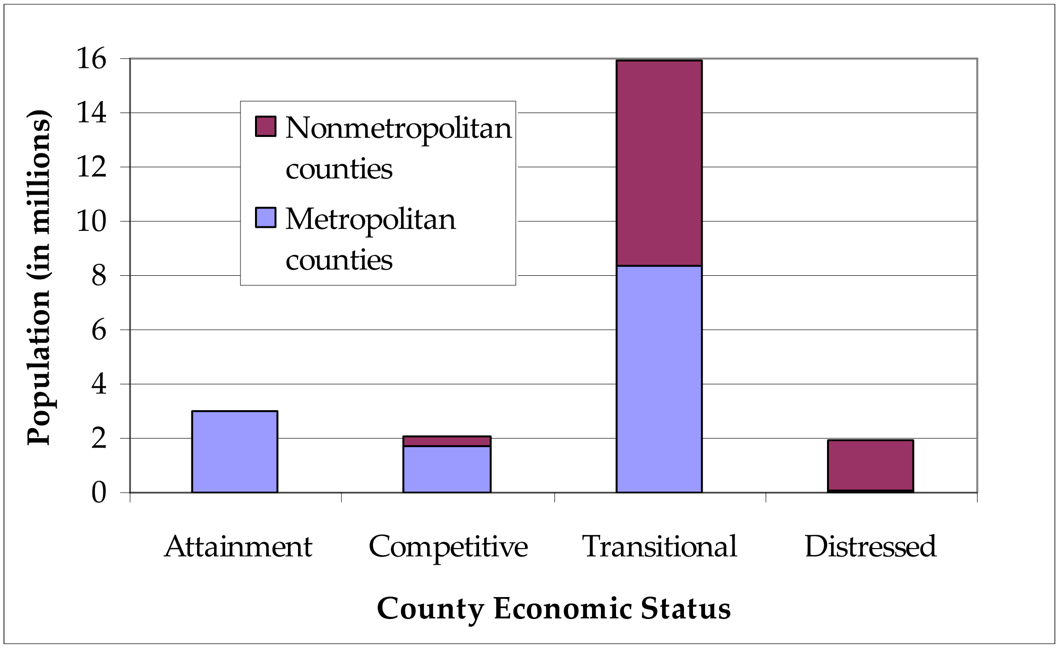
Criterion	Economic Status Classification			
	Attainment	**Competitive**	**Transitional**	**Distressed**
Three-year Average Unemployment Rate	≤ national average	≤ national average	All counties not in other classes	≥ 150% of national average
2000 Per Capita Market Income	≥ national average	80%–100% of 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

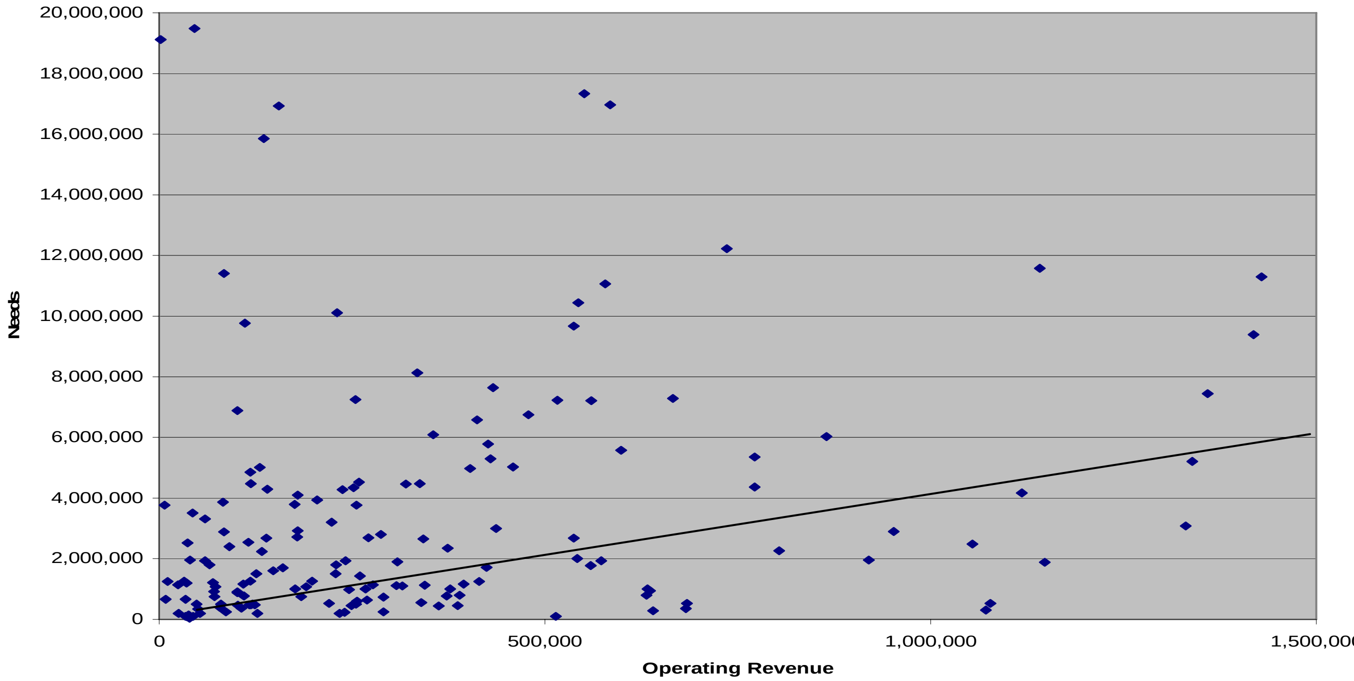
When communities write a check for a large infrastructure project, they normally find the funds in one of three places: their current revenues and reserve funds, the private capital market, or public funding programs. Some communities create innovative partnerships with other systems or private entities, 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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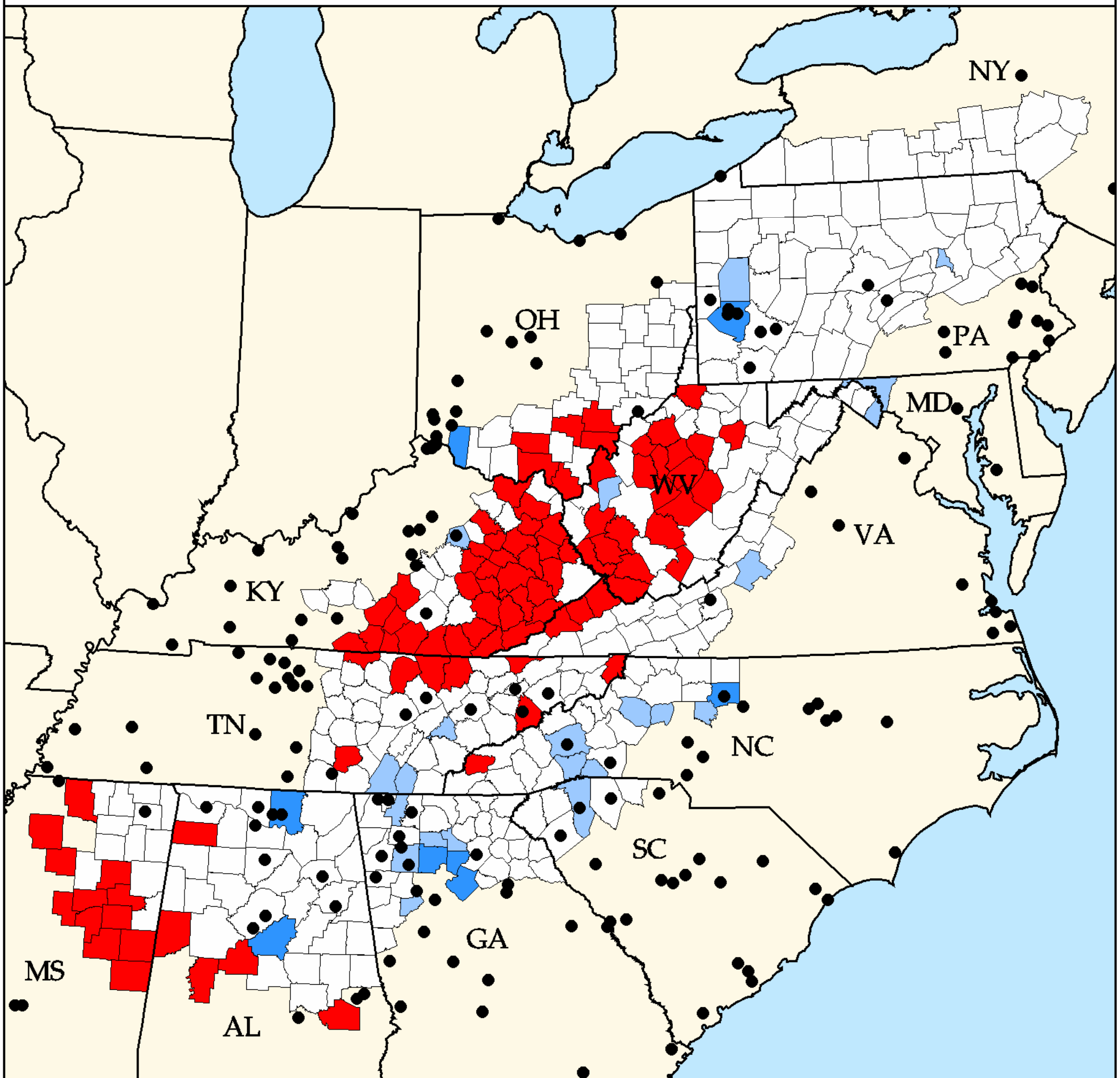
[56] Environmental Protection Agency, *2000 Community Water System Survey* (Washington, D.C.: EPA, 2002).

[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

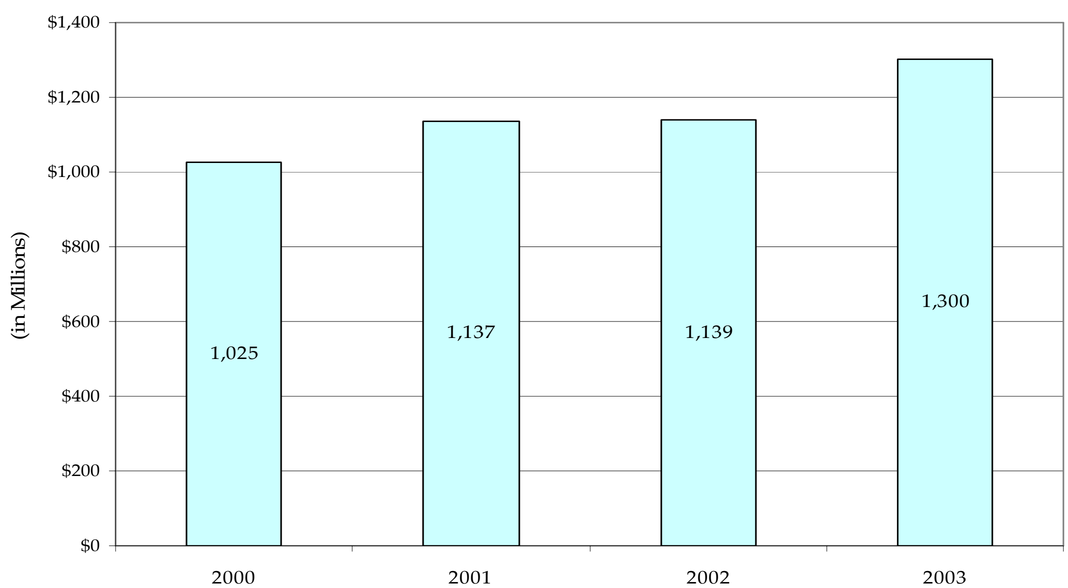
Funding Sources:

- $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

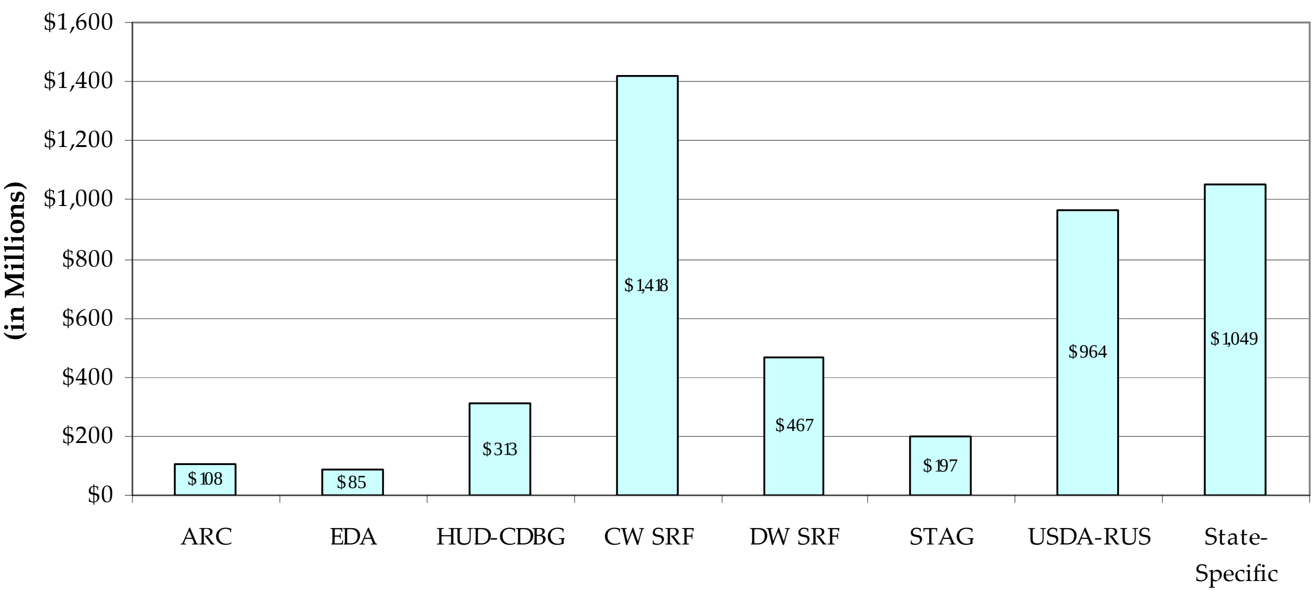


Source: UNCEFC Master Funding Database, 2004.

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

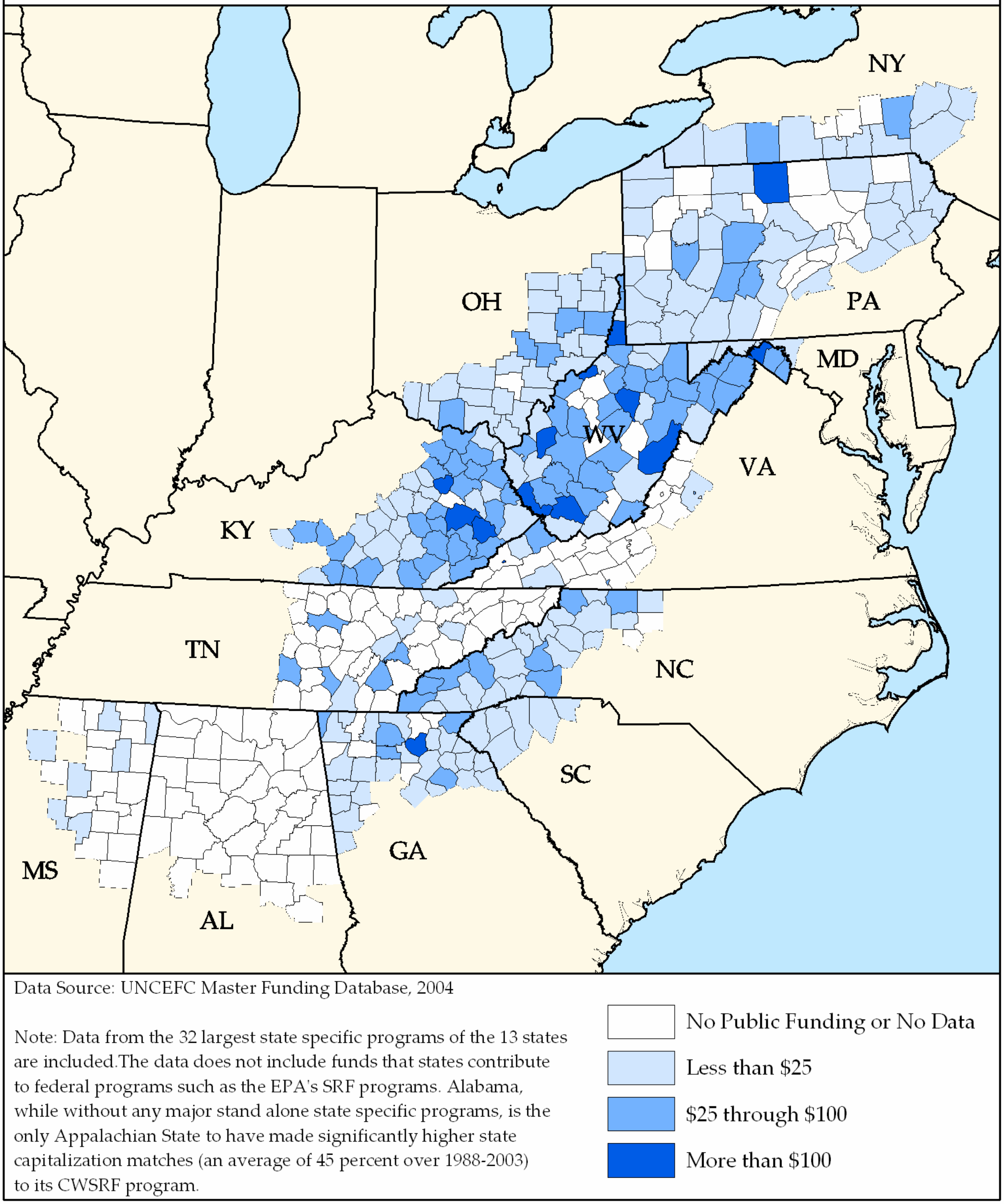
	Region (per Capita)		
Program	**Appalachian**	**Non-Appalachian**	**State**
West Virginia Infrastructure and Jobs Development Loan Program	$119.11	NA	$119.11
West Virginia Water Development Authority	41.62	NA	41.62
New York Clean Water/Clean Air Bond Act —Safe Drinking Water Portion	35.10	$28.85	29.21
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.

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]

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[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

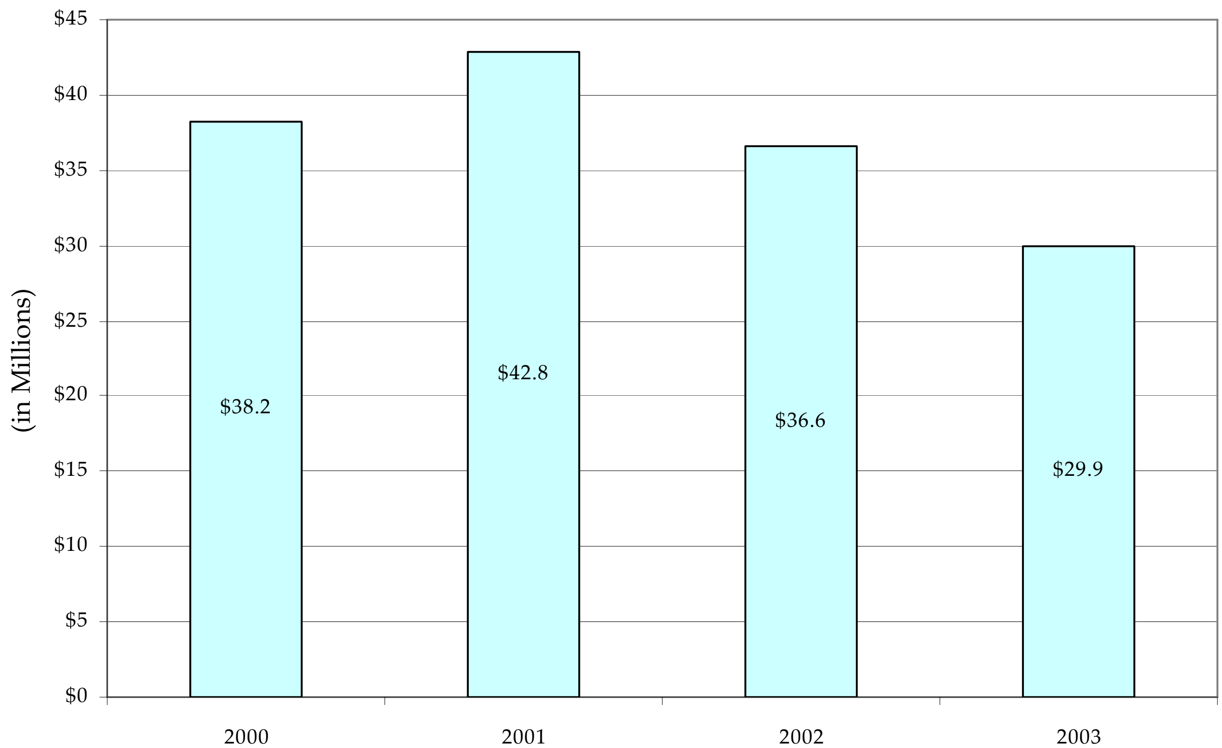
Source: Matthew T. Richardson, "Examination of the Relationships between Public Funding for Water and Sewer Infrastructure and Indicators of Need in the Appalachian Region from 2000 through 2003" (master's thesis, University of North Carolina at Chapel Hill, 2005)

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.

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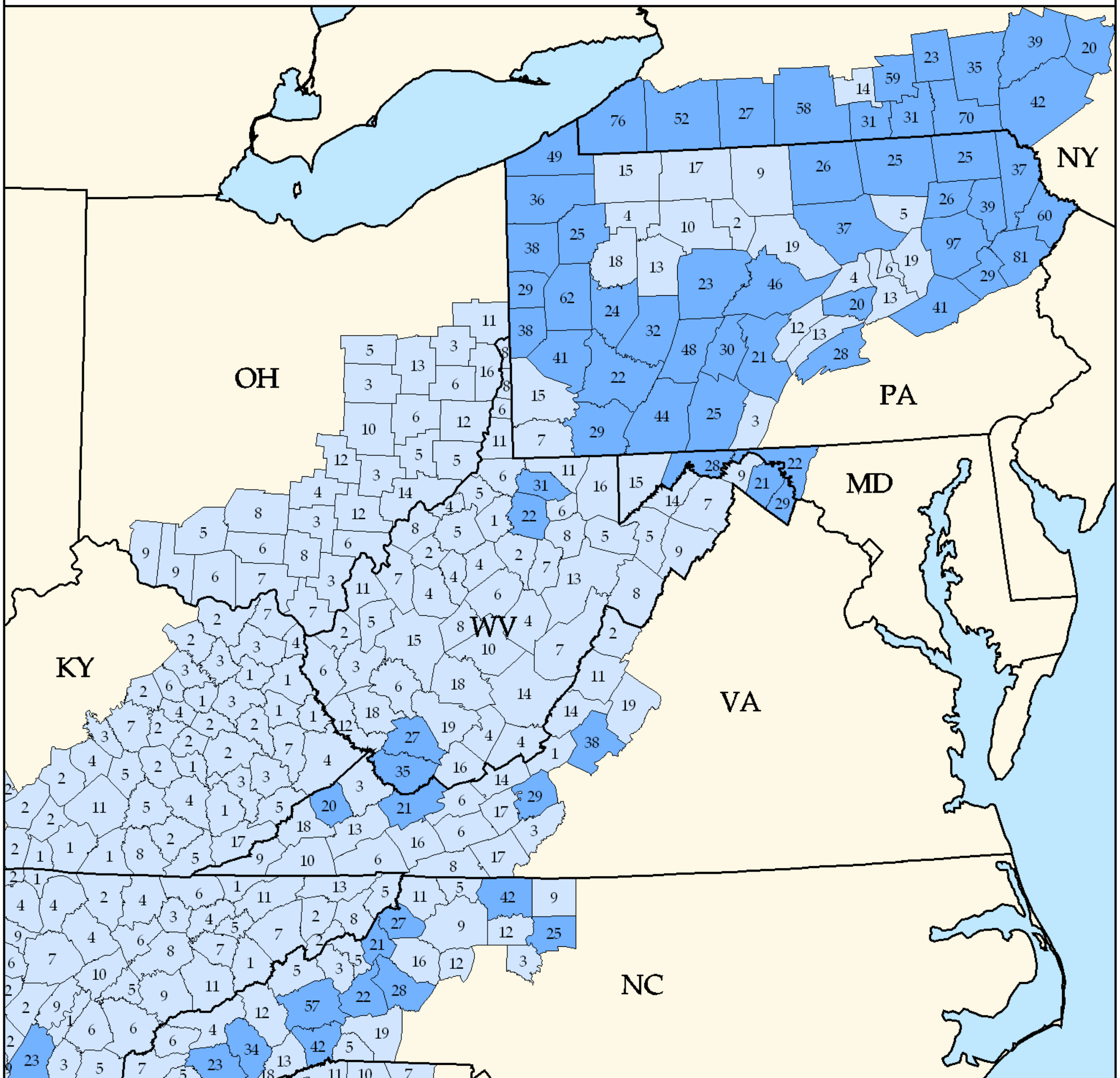
[64] Environmental Protection Agency, *The Clean Water and Drinking Water Infrastructure Gap Analysis* (Washington, D.C.: EPA, 2002); Environmental Protection Agency, *Mid-Atlantic States, Water Infrastructure Financial Assistance* (last visited April 17, 2005), available at www.epa.gov/reg3wapd/water_infrastructure.

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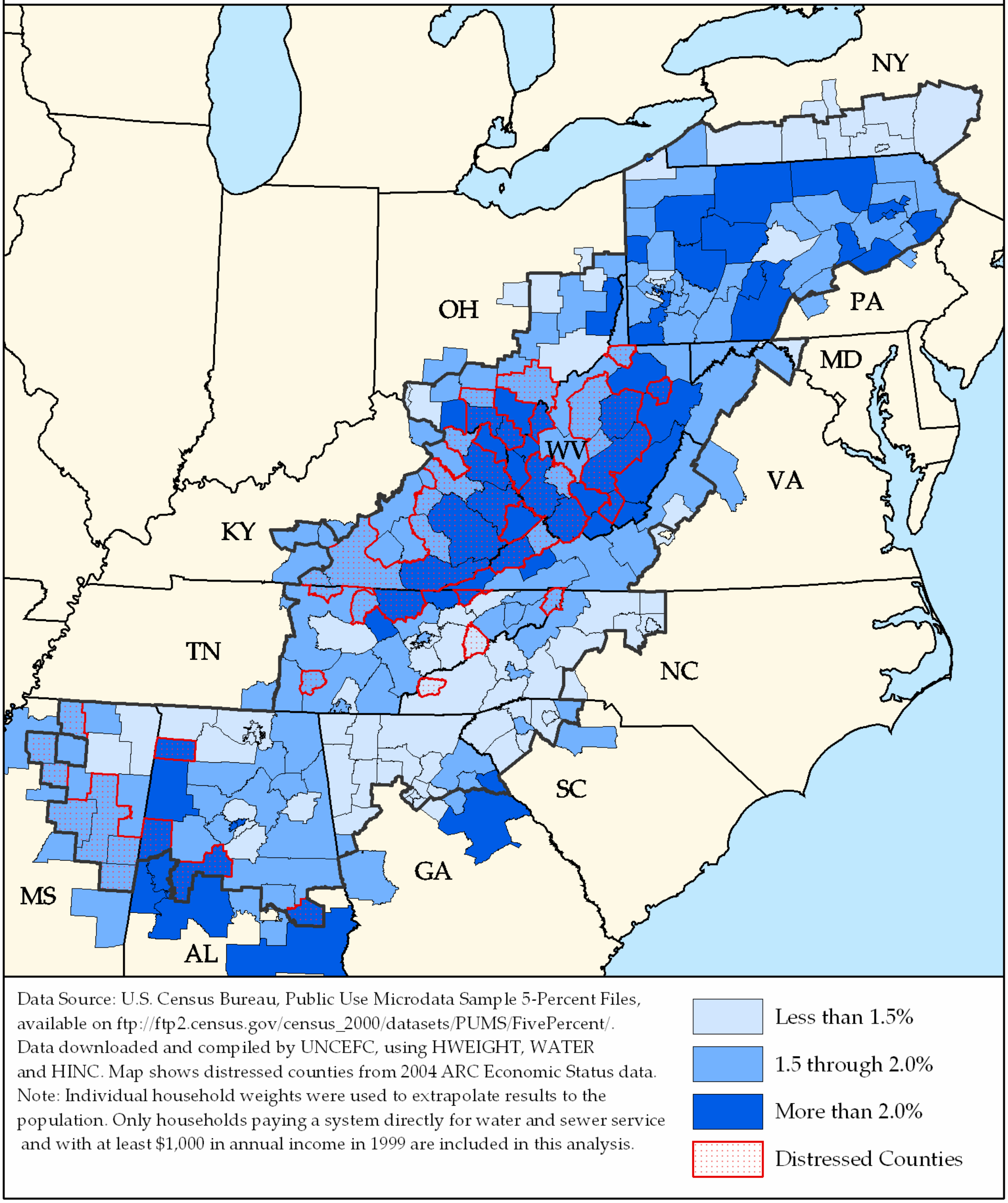
[71] U.S. Census Bureau, Public Use Microdata Sample 5-Percent Files, available on ftp://ftp2.census.gov/census_2000/datasets/PUMS/FivePercent. Data downloaded and compiled by UNCEFC, using HWEIGHT, WATER and HINC.

[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.

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

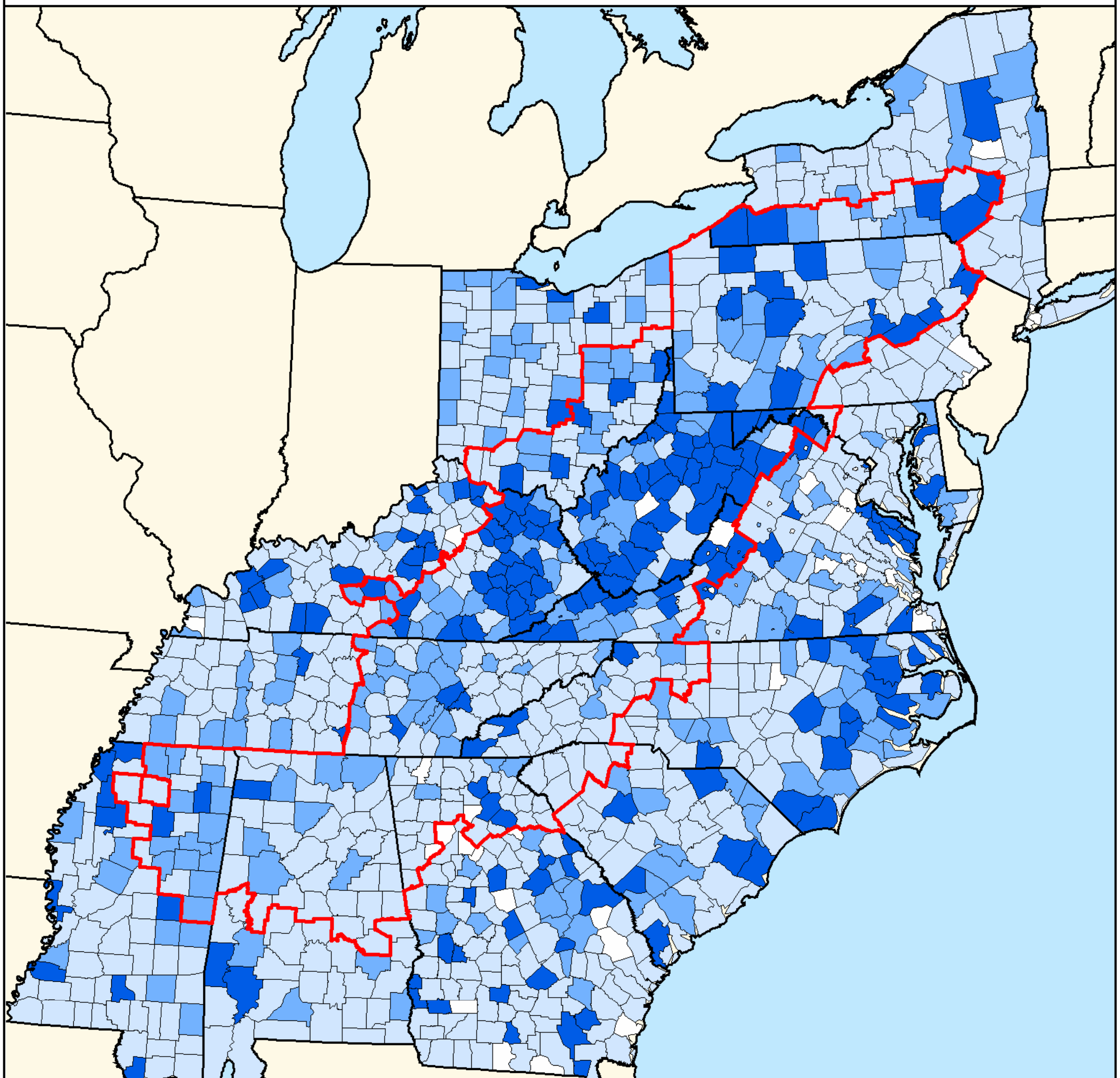
One of the most basic steps that a state can take to help its communities is to create a funding program that relies on revenues collected or pooled by the state. Twelve of the 13 states in Appalachia have at least one major state funding program that has invested funds in the region. In total, the twelve 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.

Drinking Water and Wastewater Infrastructure in Appalachia

An Analysis of Capital Funding and Funding Gaps

APPENDICES

The UNC Environmental Finance Center
School of Government
The University of North Carolina at Chapel Hill

July 2005

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Contents

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APPENDIX A

Clean Water Needs per Appalachian County, 2000

County Name (ARC Counties)	State	Wastewater Capital Needs CWNS (Cat. I–V)	Wastewater Capital Needs State Survey*	Wastewater Needs per Capita** CWNS (Cat. I–V)	Wastewater Needs per Capita** State Survey
Bibb	AL	$ 364,000	No data	$ 17	No data
Blount	AL	625,000	No data	12	No data
Calhoun	AL	93,164,000	No data	830	No data
Chambers	AL	458,000	No data	13	No data
Cherokee	AL	780,000	No data	33	No data
Chilton	AL	3,439,000	No data	87	No data
Clay	AL	1,265,000	No data	89	No data
Cleburne	AL	205,000	No data	15	No data
Colbert	AL	5,115,000	No data	93	No data
Coosa	AL	261,000	No data	21	No data
Cullman	AL	1,595,000	No data	21	No data
De Kalb	AL	27,279,000	No data	423	No data
Elmore	AL	6,363,000	No data	97	No data
Etowah	AL	2,224,000	No data	21	No data
Fayette	AL	591,000	No data	32	No data
Franklin	AL	1,044,000	No data	33	No data
Hale	AL	2,959,000	No data	172	No data
Jackson	AL	472,000	No data	9	No data
Jefferson	AL	2,233,335,000	No data	3,373	No data
Lamar	AL	1,496,000	No data	94	No data
Lauderdale	AL	1,283,000	No data	15	No data
Lawrence	AL	0	No data	0	No data
Limestone	AL	0	No data	0	No data
Macon	AL	1,231,000	No data	51	No data
Madison	AL	55,597,000	No data	201	No data
Marion	AL	11,883,000	No data	381	No data
Marshall	AL	8,498,000	No data	103	No data
Morgan	AL	24,774,000	No data	223	No data
Pickens	AL	8,034,000	No data	384	No data
Randolph	AL	984,000	No data	44	No data
St. Clair	AL	23,667,000	No data	366	No data
Shelby	AL	10,684,000	No data	75	No data
Talladega	AL	9,850,000	No data	123	No data
Tallapoosa	AL	0	No data	0	No data
Tuscaloosa	AL	3,890,000	No data	24	No data
Walker	AL	7,565,000	No data	107	No data
Winston	AL	0	No data	0	No data
Alabama ARC Counties		**$2,550,974,000**		**$899**	

County Name (ARC Counties)	State	Wastewater Capital Needs		Wastewater Needs per Capita**	
		CWNS (Cat. I–V)	State Survey*	CWNS (Cat. I–V)	State Survey
Banks	GA	No data	No data	No data	No data
Barrow	GA	0	No data	0	No data
Bartow	GA	$ 3,461,000	No data	$ 46	No data
Carroll	GA	0	No data	0	No data
Catoosa	GA	0	No data	0	No data
Chattooga	GA	936,000	No data	37	No data
Cherokee	GA	23,155,000	No data	163	No data
Dade	GA	0	No data	0	No data
Dawson	GA	0	No data	0	No data
Douglas	GA	0	No data	0	No data
Elbert	GA	0	No data	0	No data
Fannin	GA	0	No data	0	No data
Floyd	GA	3,013,000	No data	33	No data
Forsyth	GA	0	No data	0	No data
Franklin	GA	0	No data	0	No data
Gilmer	GA	0	No data	0	No data
Gordon	GA	0	No data	0	No data
Gwinnett	GA	0	No data	0	No data
Habersham	GA	1,655,000	No data	46	No data
Hall	GA	118,145,000	No data	848	No data
Haralson	GA	0	No data	0	No data
Hart	GA	6,619,000	No data	288	No data
Heard	GA	0	No data	0	No data
Jackson	GA	1,655,000	No data	40	No data
Lumpkin	GA	0	No data	0	No data
Madison	GA	0	No data	0	No data
Murray	GA	0	No data	0	No data
Paulding	GA	0	No data	0	No data
Pickens	GA	0	No data	0	No data
Polk	GA	4,622,000	No data	121	No data
Rabun	GA	0	No data	0	No data
Stephens	GA	6,618,000	No data	260	No data
Towns	GA	4,138,000	No data	444	No data
Union	GA	0	No data	0	No data
Walker	GA	0	No data	0	No data
White	GA	0	No data	0	No data
Whitfield	GA	14,342,000	No data	172	No data
Georgia ARC Counties		**$188,359,000**		**$85**	
Adair	KY	$ 936,000	$ 7,500,000	$ 54	$ 435
Bath	KY	5,091,000	24,900,000	459	2,246
Bell	KY	19,985,000	44,063,000	665	1,466
Boyd	KY	18,189,000	63,400,000	366	1,274
Breathitt	KY	14,567,000	2,500,000	905	155
Carter	KY	7,568,000	3,411,000	281	127
Casey	KY	7,729,000	1,997,000	500	129

County Name (ARC Counties)	State	Wastewater Capital Needs		Wastewater Needs per Capita**	
		CWNS (Cat. I–V)	State Survey*	CWNS (Cat. I–V)	State Survey
Clark	KY	20,499,000	26,500,000	618	800
Clay	KY	21,131,000	41,579,000	861	1,693
Clinton	KY	3,075,000	8,727,000	319	906
Cumberland	KY	3,300,000	0	462	0
Edmonson	KY	434,000	125,000	37	11
Elliott	KY	682,000	0	101	0
Estill	KY	9,122,000	7,015,000	596	458
Fleming	KY	9,840,000	1,732,000	713	126
Floyd	KY	67,344,000	62,500,000	1,587	1,473
Garrard	KY	1,407,000	2,750,000	95	186
Green	KY	1,877,000	167,000	163	14
Greenup	KY	19,554,000	29,690,000	530	805
Harlan	KY	35,977,000	48,990,000	1,084	1,476
Hart	KY	10,235,000	8,882,000	587	509
Jackson	KY	6,316,000	6,838,000	468	507
Johnson	KY	4,633,000	21,100,000	198	900
Knott	KY	7,999,000	12,000,000	453	680
Knox	KY	7,278,000	25,805,000	229	812
Laurel	KY	37,577,000	47,292,000	713	897
Lawrence	KY	1,434,000	3,600,000	92	231
Lee	KY	1,543,000	500,000	195	63
Leslie	KY	3,942,000	5,600,000	318	452
Letcher	KY	39,897,000	42,021,000	1,578	1,662
Lewis	KY	4,026,000	3,422,000	286	243
Lincoln	KY	9,795,000	17,754,000	419	760
McCreary	KY	16,798,000	28,612,000	983	1,675
Madison	KY	97,328,000	52,922,000	1,373	747
Magoffin	KY	14,188,000	18,300,000	1,064	1,373
Martin	KY	728,000	14,000,000	58	1,113
Menifee	KY	2,410,000	18,600,000	368	2,837
Monroe	KY	1,046,000	806,000	89	69
Montgomery	KY	20,687,000	16,800,000	917	745
Morgan	KY	8,949,000	8,100,000	642	581
Owsley	KY	10,837,000	11,700,000	2,231	2,408
Perry	KY	36,066,000	24,348,000	1,227	828
Pike	KY	66,305,000	109,300,000	965	1,590
Powell	KY	4,108,000	6,350,000	310	480
Pulaski	KY	33,684,000	46,512,000	599	827
Rockcastle	KY	4,236,000	41,389,000	255	2,496
Rowan	KY	26,559,000	14,700,000	1,202	665
Russell	KY	1,693,000	6,024,000	104	369
Wayne	KY	3,955,000	1,787,000	199	90
Whitley	KY	6,400,000	57,000,000	178	1,589
Wolfe	KY	7,883,000	3,100,000	1,116	439
Kentucky ARC Counties		**$766,842,000**	**$1,052,710,000**	**$672**	**$922**

County Name (ARC Counties)	State	Wastewater Capital Needs		Wastewater Needs per Capita**	
		CWNS (Cat. I–V)	State Survey*	CWNS (Cat. I–V)	State Survey
Allegany	MD	$199,294,000	No data	$2,660	No data
Garrett	MD	14,232,000	No data	477	No data
Washington	MD	73,613,000	No data	558	No data
Maryland ARC Counties		**$287,139,000**	No data	**$1,213**	No data
Alcorn	MS	$ 14,398,000	No data	$ 417	No data
Benton	MS	241,000	No data	30	No data
Calhoun	MS	2,049,000	No data	136	No data
Chickasaw	MS	3,075,000	No data	158	No data
Choctaw	MS	607,000	No data	62	No data
Clay	MS	6,110,000	No data	278	No data
Itawamba	MS	3,574,000	No data	157	No data
Kemper	MS	211,000	No data	20	No data
Lee	MS	17,499,000	No data	231	No data
Lowndes	MS	3,239,000	No data	53	No data
Marshall	MS	4,548,000	No data	130	No data
Monroe	MS	15,312,000	No data	403	No data
Montgomery	MS	1,244,000	No data	102	No data
Noxubee	MS	866,000	No data	69	No data
Oktibbeha	MS	3,409,000	No data	79	No data
Panola	MS	0	No data	0	No data
Pontotoc	MS	7,713,000	No data	289	No data
Prentiss	MS	3,266,000	No data	128	No data
Tippah	MS	3,000,000	No data	144	No data
Tishomingo	MS	3,286,000	No data	171	No data
Union	MS	0	No data	0	No data
Webster	MS	1,220,000	No data	119	No data
Winston	MS	158,000	No data	8	No data
Yalobusha	MS	0	No data	0	No data
Mississippi ARC Counties		**$95,025,000**		**$154**	
Alexander	NC	0	No data	0	No data
Alleghany	NC	$ 529,000	No data	$ 50	No data
Ashe	NC	5,416,000	No data	222	No data
Avery	NC	6,745,000	No data	393	No data
Buncombe	NC	88,220,000	No data	428	No data
Burke	NC	27,987,000	No data	314	No data
Caldwell	NC	24,590,000	No data	318	No data
Cherokee	NC	25,134,000	No data	1,034	No data
Clay	NC	5,656,000	No data	645	No data
Davie	NC	1,713,000	No data	49	No data
Forsyth	NC	116,499,000	No data	381	No data
Graham	NC	2,746,000	No data	344	No data
Haywood	NC	13,304,000	No data	246	No data
Henderson	NC	110,662,000	No data	1,241	No data
Jackson	NC	31,756,000	No data	959	No data

County Name (ARC Counties)	State	Wastewater Capital Needs CWNS (Cat. I–V)	State Survey*	Wastewater Needs per Capita** CWNS (Cat. I–V)	State Survey
McDowell	NC	28,791,000	No data	683	No data
Macon	NC	45,133,000	No data	1,514	No data
Madison	NC	4,083,000	No data	208	No data
Mitchell	NC	1,805,000	No data	115	No data
Polk	NC	1,061,000	No data	58	No data
Rutherford	NC	11,573,000	No data	184	No data
Stokes	NC	3,502,000	No data	78	No data
Surry	NC	5,678,000	No data	80	No data
Swain	NC	7,407,000	No data	571	No data
Transylvania	NC	2,934,000	No data	100	No data
Watauga	NC	2,630,000	No data	62	No data
Wilkes	NC	31,517,000	No data	480	No data
Yadkin	NC	13,203,000	No data	363	No data
Yancey	NC	829,000	No data	47	No data
North Carolina ARC Counties		**$621,103,000**		**$407**	
Allegany	NY	$ 23,520,000	No data	$ 471	No data
Broome	NY	160,816,000	No data	802	No data
Cattaraugus	NY	44,796,000	No data	534	No data
Chautauqua	NY	49,266,000	No data	353	No data
Chemung	NY	87,719,000	No data	963	No data
Chenango	NY	11,320,000	No data	220	No data
Cortland	NY	690,000	No data	14	No data
Delaware	NY	75,759,000	No data	1,577	No data
Otsego	NY	7,913,000	No data	128	No data
Schoharie	NY	9,479,000	No data	300	No data
Schuyler	NY	9,043,000	No data	470	No data
Steuben	NY	7,731,000	No data	78	No data
Tioga	NY	24,633,000	No data	476	No data
Tompkins	NY	34,398,000	No data	356	No data
New York ARC Counties		**$547,083,000**		**$ 510**	
Adams	OH	$ 7,430,000	$ 8,841,000	$ 272	$ 323
Athens	OH	13,798,000	27,182,610	222	437
Belmont	OH	63,003,000	34,625,052	897	493
Brown	OH	3,909,000	16,597,850	92	393
Carroll	OH	1,669,000	2,480,000	58	86
Clermont	OH	227,070,000	54,883,369	1,276	308
Columbiana	OH	23,961,000	35,518,533	214	317
Coshocton	OH	1,056,000	3,450,188	29	94
Gallia	OH	7,060,000	2,389,706	227	77
Guernsey	OH	9,416,000	6,244,723	231	153
Harrison	OH	4,486,000	5,075,000	283	320
Highland	OH	4,226,000	20,408,648	103	499
Hocking	OH	3,183,000	4,098,900	113	145
Holmes	OH	1,899,000	23,489,813	49	603

County Name (ARC Counties)	State	Wastewater Capital Needs		Wastewater Needs per Capita**	
		CWNS (Cat. I–V)	State Survey*	CWNS (Cat. I–V)	State Survey
Jackson	OH	200,000	16,677,000	6	511
Jefferson	OH	53,012,000	33,615,279	717	455
Lawrence	OH	31,277,000	25,895,000	502	416
Meigs	OH	11,098,000	4,062,763	481	176
Monroe	OH	15,925,000	1,925,000	1,049	127
Morgan	OH	2,672,000	4,506,140	179	302
Muskingum	OH	31,362,000	10,704,261	371	127
Noble	OH	12,708,000	2,195,764	904	156
Perry	OH	6,861,000	8,821,670	201	259
Pike	OH	5,933,000	12,250,592	214	442
Ross	OH	5,615,000	4,415,000	77	60
Scioto	OH	35,918,000	42,145,000	454	532
Tuscarawas	OH	10,706,000	35,592,563	118	391
Vinton	OH	3,127,000	0	244	0
Washington	OH	761,000	8,688,000	12	137
Ohio ARC Counties		**$599,341,000**	**$456,779,424**	**$ 412**	**$314**
Allegheny	PA	$1,476,996,000	No data	$1,152	No data
Armstrong	PA	107,743,000	No data	1,488	No data
Beaver	PA	130,292,000	No data	718	No data
Bedford	PA	45,400,000	No data	908	No data
Blair	PA	135,551,000	No data	1,050	No data
Bradford	PA	48,623,000	No data	775	No data
Butler	PA	45,506,000	No data	261	No data
Cambria	PA	128,267,000	No data	841	No data
Cameron	PA	10,199,000	No data	1,707	No data
Carbon	PA	73,244,000	No data	1,246	No data
Centre	PA	104,053,000	No data	766	No data
Clarion	PA	9,289,000	No data	222	No data
Clearfield	PA	88,315,000	No data	1,059	No data
Clinton	PA	3,086,000	No data	81	No data
Columbia	PA	53,905,000	No data	840	No data
Crawford	PA	15,030,000	No data	166	No data
Elk	PA	4,263,000	No data	121	No data
Erie	PA	274,587,000	No data	978	No data
Fayette	PA	137,793,000	No data	927	No data
Forest	PA	0	No data	0	No data
Fulton	PA	5,388,000	No data	378	No data
Greene	PA	17,138,000	No data	421	No data
Huntingdon	PA	46,601,000	No data	1,022	No data
Indiana	PA	72,705,000	No data	811	No data
Jefferson	PA	33,977,000	No data	740	No data
Juniata	PA	8,476,000	No data	371	No data
Lackawanna	PA	308,029,000	No data	1,444	No data
Lawrence	PA	54,579,000	No data	577	No data
Luzerne	PA	212,293,000	No data	665	No data

County Name (ARC Counties)	State	Wastewater Capital Needs CWNS (Cat. I–V)	State Survey*	Wastewater Needs per Capita** CWNS (Cat. I–V)	State Survey
Lycoming	PA	192,287,000	No data	1,602	No data
McKean	PA	41,267,000	No data	898	No data
Mercer	PA	28,632,000	No data	238	No data
Mifflin	PA	12,749,000	No data	274	No data
Monroe	PA	13,957,000	No data	101	No data
Montour	PA	2,838,000	No data	156	No data
Northumberland	PA	130,241,000	No data	1,377	No data
Perry	PA	14,145,000	No data	324	No data
Pike	PA	9,137,000	No data	197	No data
Potter	PA	40,735,000	No data	2,253	No data
Schuylkill	PA	257,789,000	No data	1,715	No data
Snyder	PA	12,178,000	No data	324	No data
Somerset	PA	48,538,000	No data	607	No data
Sullivan	PA	831,000	No data	127	No data
Susquehanna	PA	24,533,000	No data	581	No data
Tioga	PA	51,242,000	No data	1,239	No data
Union	PA	3,644,000	No data	88	No data
Venango	PA	81,826,000	No data	1,421	No data
Warren	PA	67,012,000	No data	1,528	No data
Washington	PA	187,849,000	No data	926	No data
Wayne	PA	36,694,000	No data	769	No data
Westmoreland	PA	314,677,000	No data	850	No data
Wyoming	PA	20,036,000	No data	714	No data
Pennsylvania ARC Counties		**$5,244,165,000**		**$901**	
Anderson	SC	9,831,000	No data	59	No data
Cherokee	SC	7,156,000	No data	136	No data
Greenville	SC	481,753,000	No data	1,269	No data
Oconee	SC	0	No data	0	No data
Pickens	SC	4,045,000	No data	37	No data
Spartanburg	SC	11,923,000	No data	47	No data
South Carolina ARC Counties		**$514,708,000**		**$500**	
Anderson	TN	$ 2,207,000	$ 37,938,500	$ 31	$ 532
Bledsoe	TN	0	10,850,000	0	877
Blount	TN	0	71,787,360	0	678
Bradley	TN	0	14,277,000	0	162
Campbell	TN	1,462,000	15,150,000	37	380
Cannon	TN	0	1,000,000	0	78
Carter	TN	4,910,000	100,070,000	87	1,764
Claiborne	TN	9,377,000	16,922,375	314	567
Clay	TN	0	1,150,000	0	144
Cocke	TN	0	14,435,000	0	430
Coffee	TN	0	29,365,297	0	612
Cumberland	TN	0	99,300,000	0	2,122
De Kalb	TN	658,000	19,550,000	38	1,122

County Name (ARC Counties)	State	Wastewater Capital Needs		Wastewater Needs per Capita**	
		CWNS (Cat. I–V)	State Survey*	CWNS (Cat. I–V)	State Survey
Fentress	TN	0	3,250,000	0	195
Franklin	TN	0	32,808,000	0	835
Grainger	TN	0	15,040,000	0	728
Greene	TN	19,038,000	25,603,000	303	407
Grundy	TN	893,000	18,213,000	62	1,271
Hamblen	TN	0	21,530,000	0	370
Hamilton	TN	2,673,000	22,165,000	9	72
Hancock	TN	0	1,803,000	0	266
Hawkins	TN	0	60,136,450	0	1,123
Jackson	TN	0	6,050,000	0	551
Jefferson	TN	0	19,837,441	0	448
Johnson	TN	0	18,464,200	0	1,055
Knox	TN	0	134,254,682	0	351
Loudon	TN	1,294,000	50,696,000	33	1,297
McMinn	TN	0	12,896,600	0	263
Macon	TN	0	17,575,000	0	862
Marion	TN	2,653,000	20,140,000	96	725
Meigs	TN	0	3,400,000	0	307
Monroe	TN	1,940,000	8,536,351	50	219
Morgan	TN	0	18,623,000	0	943
Overton	TN	0	2,000,000	0	99
Pickett	TN	0	1,500,000	0	303
Polk	TN	0	9,549,250	0	595
Putnam	TN	0	9,900,000	0	159
Rhea	TN	0	10,716,200	0	377
Roane	TN	0	36,712,500	0	707
Scott	TN	0	16,214,000	0	767
Sequatchie	TN	0	7,225,250	0	635
Sevier	TN	0	90,998,850	0	1,279
Smith	TN	0	10,170,000	0	574
Sullivan	TN	0	123,672,356	0	808
Unicoi	TN	0	9,584,875	0	543
Union	TN	3,806,000	27,500,000	214	1,544
Van Buren	TN	1,313,000	8,000,000	238	1,452
Warren	TN	0	13,476,000	0	352
Washington	TN	0	112,843,500	0	1,053
White	TN	0	22,000,000	0	952
Tennessee ARC Counties		**$52,224,000**	**$1,454,880,037**	**$ 21**	**$ 587**
Alleghany	VA	6,761,000	No data	523	No data
Bath	VA	12,452,000	No data	2,467	No data
Bland	VA	11,448,000	No data	1,666	No data
Botetourt	VA	16,430,000	No data	539	No data
Buchanan	VA	5,386,000	No data	200	No data
Carroll	VA	29,150,000	No data	997	No data
Craig	VA	1,279,000	No data	251	No data

County Name (ARC Counties)	State	Wastewater Capital Needs		Wastewater Needs per Capita**	
		CWNS (Cat. I–V)	State Survey*	CWNS (Cat. I–V)	State Survey
Dickenson	VA	947,000	No data	58	No data
Floyd	VA	672,000	No data	48	No data
Giles	VA	3,486,000	No data	209	No data
Grayson	VA	23,496,000	No data	1,311	No data
Highland	VA	2,437,000	No data	961	No data
Lee	VA	30,980,000	No data	1,313	No data
Montgomery	VA	33,922,000	No data	406	No data
Pulaski	VA	15,277,000	No data	435	No data
Rockbridge	VA	4,594,000	No data	221	No data
Russell	VA	19,836,000	No data	654	No data
Scott	VA	8,874,000	No data	379	No data
Smyth	VA	27,481,000	No data	831	No data
Tazewell	VA	49,171,000	No data	1,103	No data
Washington	VA	37,829,000	No data	740	No data
Wise	VA	29,307,000	No data	730	No data
Wythe	VA	17,345,000	No data	628	No data
Bristol City	VA	6,131,000	No data	353	No data
Buena Vista City	VA	0	No data	0	No data
Clifton Forge City	VA	5,497,000	No data	1,282	No data
Covington City	VA	0	No data	0	No data
Galax City	VA	No data	No data	No data	No data
Lexington City	VA	No data	No data	No data	No data
Norton City	VA	970,000	No data	248	No data
Radford City	VA	0	No data	0	No data
Virginia ARC Counties		**$401,158,000**		**$ 603**	
Barbour	WV	$ 20,744,000	$ 51,956,000	$1,333	$3,340
Berkeley	WV	170,407,000	134,321,868	2,245	1,770
Boone	WV	7,193,000	100,140,988	282	3,922
Braxton	WV	14,146,000	15,642,000	962	1,064
Brooke	WV	73,617,000	56,308,800	2,893	2,213
Cabell	WV	34,248,000	43,539,000	354	450
Calhoun	WV	0	10,919,000	0	1,440
Clay	WV	0	21,482,000	0	2,080
Doddridge	WV	0	2,833,000	0	383
Fayette	WV	65,923,000	81,500,989	1,386	1,713
Gilmer	WV	684,000	7,329,646	96	1,024
Grant	WV	4,980,000	19,085,000	441	1,689
Greenbrier	WV	6,808,000	13,594,233	198	395
Hampshire	WV	1,661,000	9,666,000	82	478
Hancock	WV	32,572,000	28,309,280	997	867
Hardy	WV	16,847,000	36,514,200	1,330	2,882
Harrison	WV	105,742,000	114,629,297	1,540	1,670
Jackson	WV	10,173,000	20,529,000	363	733
Jefferson	WV	237,871,000	259,749,001	5,638	6,157
Kanawha	WV	176,442,000	238,658,941	882	1,193

County Name (ARC Counties)	State	Wastewater Capital Needs		Wastewater Needs per Capita**	
		CWNS (Cat. I–V)	State Survey*	CWNS (Cat. I–V)	State Survey
Lewis	WV	27,831,000	32,091,000	1,645	1,897
Lincoln	WV	7,661,000	48,114,000	347	2,176
Logan	WV	46,559,000	68,971,500	1,235	1,829
McDowell	WV	35,515,000	58,245,200	1,300	2,131
Marion	WV	97,856,000	137,814,180	1,729	2,435
Marshall	WV	38,378,000	52,132,000	1,080	1,468
Mason	WV	11,453,000	6,961,859	441	268
Mercer	WV	131,956,000	114,372,000	2,095	1,816
Mineral	WV	10,400,000	6,255,000	384	231
Mingo	WV	186,239,000	91,216,000	6,592	3,229
Monongalia	WV	204,414,000	217,646,923	2,497	2,659
Monroe	WV	9,205,000	9,316,000	631	639
Morgan	WV	6,683,000	12,898,300	447	863
Nicholas	WV	19,957,000	36,418,300	751	1,371
Ohio	WV	109,492,000	104,112,000	2,309	2,195
Pendleton	WV	2,547,000	14,648,575	311	1,787
Pleasants	WV	4,426,000	12,329,000	589	1,641
Pocahontas	WV	8,548,000	18,743,120	936	2,053
Preston	WV	2,706,000	20,441,000	92	697
Putnam	WV	43,839,000	21,461,515	850	416
Raleigh	WV	64,164,000	122,232,296	810	1,543
Randolph	WV	29,056,000	35,844,200	1,028	1,268
Ritchie	WV	5,023,000	13,760,000	486	1,330
Roane	WV	478,000	18,276,000	31	1,183
Summers	WV	8,022,000	21,737,000	617	1,672
Taylor	WV	36,422,000	42,488,538	2,264	2,641
Tucker	WV	17,858,000	32,073,000	2,439	4,381
Tyler	WV	0	12,988,000	0	1,354
Upshur	WV	34,970,000	45,923,000	1,494	1,962
Wayne	WV	137,510,000	139,153,845	3,205	3,243
Webster	WV	3,531,000	7,285,591	363	750
Wetzel	WV	8,100,000	18,300,000	458	1,034
Wirt	WV	0	5,154,000	0	878
Wood	WV	178,797,000	193,964,000	2,032	2,204
Wyoming	WV	20,605,000	44,642,000	802	1,737
West Virginia ARC Counties		**$2,530,259,000**	**$3,104,717,185**	**$1,399**	**$1,717**
ARC Region		**$14,398,380,000**		**$ 629**	

Source: Environmental Protection Agency, *Clean Watersheds Needs Survey 2000* (Washington, D.C.: EPA, 2003). There are no facilities located specifically in Bank County, GA, Galax City, VA, and Lexington City, VA, in the 2000 CWNS. All the facilities in 76 counties and 3 VA independent cities in the ARC region have no documented needs in the 2000 CWNS.

*KY: 20-year needs for the extension of sewer service to communities with no sewers (sewer lines, expansion of facilities, etc.). OH: 5-year wastewater infrastructure needs, from Capital Improvement Reports Summary Forms since 1999. TN: 5-year water and wastewater needs combined (data cannot be separated at the county level). WV: wastewater needs for treatment, collection, extension, compliance, and combined-sewer-overflow correction.

** Population estimates from Census 2000 Summary File 1 Table P1

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APPENDIX B

Public Funding Distributions to Each Appalachian County, 2000–2003

County Name (ARC Counties)	State	Federal Programs							State-Specific Programs	Total (2000–2003)	Per Cap-ita**
		ARC	EDA	CDBG*	SRFCW	SRFDW	STAG	USDA			
Bibb	AL	$ 200,000	–	$ 452,502	–	–	–	$ 1,581,000	–	$ 2,233,502	$ 27
Blount	AL	448,000	–	215,956	–	$ 1,775,000	$ 436,500	5,937,350	–	8,812,806	43
Calhoun	AL	–	$ 1,736,000	651,259	–	–	–	–	–	2,387,259	5
Chambers	AL	–	–	1,107,756	–	–	475,100	–	–	1,582,856	11
Cherokee	AL	13,500	–	302,035	–	–	712,688	1,066,000	–	2,094,223	22
Chilton	AL	75,000	75,000	343,845	–	1,455,000	–	–	–	1,948,845	12
Clay	AL	–	–	308,721	–	–	470,500	–	–	779,221	14
Cleburne	AL	–	–	95,642	–	–	–	–	–	95,642	2
Colbert	AL	–	–	612,726	–	–	1,468,700	7,996,500	–	10,077,926	46
Coosa	AL	–	–	231,902	–	–	–	–	–	231,902	5
Cullman	AL	400,000	–	331,410	$ 9,605,000	6,750,000	2,285,812	1,200,000	–	20,572,222	66
De Kalb	AL	200,000	–	1,051,240	–	530,000	2,883,800	6,004,000	–	10,669,040	41
Elmore	AL	–	–	436,261	3,315,000	6,155,000	–	–	–	9,906,261	38
Etowah	AL	–	–	559,921	–	130,000	513,000	4,272,500	–	5,475,421	13
Fayette	AL	–	–	3,004,350	–	–	665,600	500,000	–	4,169,950	56
Franklin	AL	400,000	1,250,000	739,255	–	6,395,000	3,440,100	3,110,000	–	15,334,355	123
Hale	AL	164,790	–	636,852	631,000	1,580,000	–	–	–	3,012,642	44
Jackson	AL	–	–	517,818	–	–	1,396,150	11,142,000	–	13,055,968	61
Jefferson	AL	–	–	996,922	–	–	950,200	1,124,000	–	3,071,122	1
Lamar	AL	–	–	984,735	–	–	–	–	–	984,735	15
Lauderdale	AL	400,000	–	1,742,029	–	–	242,000	364,000	–	2,748,029	8
Lawrence	AL	–	–	406,073	–	8,000,000	1,066,450	–	–	9,472,523	68
Limestone	AL	–	–	–	–	4,870,000	2,218,650	–	–	7,088,650	27
Macon	AL	250,000	1,230,400	621,563	–	–	281,900	1,403,000	–	3,786,863	39

County Name (ARC Counties)	State	Federal Programs							State-Specific Programs	Total (2000–2003)	Per Cap-ita**
		ARC	EDA	CDBG*	SRFCW	SRFDW	STAG	USDA			
Madison	AL	–	–	407,622	37,358,732	31,350,000	2,830,300	–	–	71,946,654	65
Marion	AL	250,000	1,004,000	1,654,832	–	525,000	1,575,800	–	–	5,009,632	40
Marshall	AL	–	–	1,410,426	4,610,000	6,195,000	1,240,500	–	–	13,455,926	41
Morgan	AL	–	–	335,006	2,445,000	3,495,000	3,235,050	–	–	9,510,056	21
Pickens	AL	700,731	–	224,203	–	–	–	206,600	–	1,131,534	14
Randolph	AL	–	–	1,218,488	–	–	–	822,542	–	2,041,030	23
Shelby	AL	–	–	777,363	–	–	2,274,500	8,000,000	–	11,051,863	19
St. Clair	AL	603,395	662,000	782,855	7,515,000	–	303,600	1,200,000	–	11,066,850	43
Talladega	AL	1,000,000	4,000,000	957,113	8,838,746	–	390,300	2,938,000	–	18,124,159	56
Tallapoosa	AL	–	1,683,103	1,131,067	–	–	–	–	–	2,814,170	17
Tuscaloosa	AL	–	–	773,888	29,480,000	9,091,450	485,000	1,753,000	–	41,583,338	63
Walker	AL	–	–	3,750,148	1,170,000	1,975,000	2,757,200	3,951,000	–	13,603,348	48
Winston	AL	477,700	1,120,000	421,912	–	–	58,100	–	–	2,077,712	21
Alabama ARC Counties		**$5,583,116**	**$12,760,503**	**$30,195,697**	**$104,968,478**	**$90,271,450**	**$34,657,500**	**$64,571,492**	**–**	**$343,008,235**	**$30**
Banks	GA	$ 300,000	–	$ 500,000	–	–	–	–	$ 1,206,600	$ 2,006,600	35
Barrow	GA	200,000	–	–	–	–	–	–	799,700	999,700	5
Bartow	GA	300,000	–	–	$ 475,000	–	$ 54,213	$ 808,100	1,787,000	3,424,313	11
Carroll	GA	–	–	–	–	$ 1,245,500	–	–	345,000	1,590,500	5
Catoosa	GA	300,000	–	261,850	–	–	–	–	100,000	661,850	3
Chattooga	GA	–	–	439,090	–	63,550	–	1,368,800	–	1,871,440	18
Cherokee	GA	–	–	45,000	–	–	54,213	–	7,104,800	7,204,013	13
Dade	GA	300,000	–	2,785	–	–	–	–	3,360,000	3,662,785	60
Dawson	GA	–	–	–	–	–	–	1,753,750	503,100	2,256,850	35
Douglas	GA	–	–	–	–	–	54,213	–	–	54,213	0
Elbert	GA	407,000	–	–	–	–	–	–	1,100,000	1,507,000	18
Fannin	GA	–	–	–	–	–	–	–	368,125	368,125	5
Floyd	GA	225,500	–	–	470,216	–	–	–	3,098,188	3,793,904	10
Forsyth	GA	–	–	–	–	–	54,213	–	–	54,213	0
Franklin	GA	450,000	–	242,112	–	2,954,000	–	–	72,750	3,718,862	46
Gilmer	GA	300,000	–	225,500	–	–	–	–	3,500,000	4,025,500	43

County Name (ARC Counties)	State	Federal Programs							State-Specific Programs	Total (2000–2003)	Per Cap-ita**
		ARC	EDA	CDBG*	SRFCW	SRFDW	STAG	USDA			
Gordon	GA	–	–	436,852	8,436,050	5,570,000	–	–	–	14,442,902	82
Gwinnett	GA	–	–	73,810	–	–	3,493,813	–	380,000	3,947,623	2
Habersham	GA	–	–	50,676	–	–	–	–	3,068,619	3,119,295	22
Hall	GA	–	–	–	64,391,000	–	54,213	–	12,000,000	76,445,213	137
Haralson	GA	300,000	–	452,040	–	–	–	2,032,600	1,143,000	3,927,640	38
Hart	GA	150,000	–	–	–	–	–	–	625,000	775,000	8
Heard	GA	–	–	458,887	–	–	–	–	500,000	958,887	22
Jackson	GA	300,000	$1,500,000	922,260	6,824,670	1,939,000	–	–	6,965,491	18,451,421	111
Lumpkin	GA	–	–	–	–	–	–	–	9,640,306	9,640,306	115
Madison	GA	190,767	–	375,886	–	539,639	–	–	1,140,589	2,246,881	22
Murray	GA	–	500,000	50,000	–	–	–	–	2,675,925	3,225,925	22
Paulding	GA	–	–	–	–	–	1,895,113	–	1,600,000	3,495,113	11
Pickens	GA	720,690	–	50,000	–	–	–	–	2,320,590	3,091,280	34
Polk	GA	541,400	–	355,945	–	–	–	–	2,255,404	3,152,749	21
Rabun	GA	300,000	–	50,000	–	2,172,900	–	–	2,483,350	5,006,250	83
Stephens	GA	300,000	892,000	–	–	–	–	–	1,756,800	2,948,800	29
Towns	GA	300,000	1,000,000	–	–	–	–	1,495,900	–	2,795,900	75
Union	GA	–	–	–	–	–	–	1,189,116	–	1,189,116	17
Walker	GA	300,000	–	37,282	–	–	–	–	2,601,500	2,938,782	12
White	GA	–	–	–	–	–	–	–	700,000	700,000	9
Whitfield	GA	–	–	–	–	–	–	–	–	–	0
Georgia ARC Counties		**$6,185,357**	**$3,892,000**	**$5,029,974**	**$80,596,936**	**$14,484,589**	**$5,659,991**	**$8,648,266**	**$75,201,837**	**$199,698,951**	**$23**
Adair	KY	$ 300,000	–	$ 1,000,000	–	–	–	$ 4,255,000	$ 1,782,200	$ 7,337,200	$106
Bath	KY	175,000	$ 1,500,000	–	$ 2,640,508	–	–	2,059,000	1,328,678	7,703,186	174
Bell	KY	700,000	–	–	–	$ 179,992	–	4,061,500	2,327,694	7,269,186	60
Boyd	KY	–	–	1,174,483	472,613	6,362,626	–	–	4,483,000	12,492,721	63
Breathitt	KY	950,000	1,500,000	1,000,000	–	–	–	3,117,000	6,648,912	13,215,912	205
Carter	KY	666,167	1,000,000	2,381,000	–	2,896,855	–	4,781,000	3,147,018	14,872,040	138
Casey	KY	350,000	–	–	–	–	$ 483,900	1,321,500	1,330,000	3,485,400	56
Clark	KY	–	–	–	–	–	500,982	–	1,231,792	1,732,774	13

County Name (ARC Counties)	State	Federal Programs							State–Specific Programs	Total (2000–2003)	Per Cap-ita**
		ARC	EDA	CDBG*	SRFCW	SRFDW	STAG	USDA			
Clay	KY	200,000	1,000,000	1,899,000	1,053,589	–	867,300	1,900,000	4,930,000	11,849,889	121
Clinton	KY	–	–	–	–	–	–	256,000	2,420,000	2,676,000	69
Cumberland	KY	300,000	–	–	–	–	–	912,000	1,975,000	3,187,000	111
Edmonson	KY	400,000	–	–	–	–	–	1,788,000	356,157	2,544,157	55
Elliott	KY	909,167	–	–	380,000	–	–	1,170,000	1,050,000	3,509,167	130
Estill	KY	88,000	–	–	–	–	211,082	–	830,000	1,129,082	18
Fleming	KY	250,000	–	–	–	–	–	8,714,700	4,000,000	12,964,700	235
Floyd	KY	433,919	24,000	1,840,000	–	–	650,500	6,545,000	4,773,986	14,267,405	84
Garrard	KY	62,500	–	595,000	–	–	17,082	–	265,000	939,582	16
Green	KY	–	–	344,000	–	–	–	1,624,000	1,372,000	3,340,000	72
Greenup	KY	–	–	1,219,000	3,816,913	–	–	1,132,000	1,330,750	7,498,663	51
Harlan	KY	1,085,000	800,000	976,000	–	1,620,000	950,250	2,500,000	8,881,235	16,812,485	127
Hart	KY	400,000	–	1,962,000	–	–	–	6,150,000	3,360,200	11,872,200	170
Jackson	KY	500,000	500,000	970,000	–	–	–	3,770,000	1,801,356	7,541,356	140
Johnson	KY	–	–	695,000	–	500,000	524,700	–	1,468,524	3,188,224	34
Knott	KY	48,000	–	–	–	–	1,900,500	2,870,000	8,690,425	13,508,925	191
Knox	KY	235,000	–	–	–	–	950,250	–	3,792,615	4,977,865	39
Laurel	KY	–	1,500,000	–	10,274,069	–	1,358,000	2,036,000	3,624,107	18,792,176	89
Lawrence	KY	871,087	–	–	–	3,646,238	967,800	–	2,551,820	8,036,945	129
Lee	KY	350,000	1,000,000	–	–	–	346,900	1,451,000	2,712,252	5,860,152	185
Leslie	KY	–	–	900,000	–	–	–	270,000	4,538,890	5,708,890	115
Letcher	KY	800,000	–	939,000	–	–	–	1,930,000	2,686,000	6,355,000	63
Lewis	KY	987,500	1,000,000	556,000	–	–	–	3,186,000	1,877,000	7,606,500	135
Lincoln	KY	991,500	1,000,000	–	–	–	17,082	463,000	1,634,720	4,106,302	44
Madison	KY	300,000	–	1,000,000	–	3,000,000	500,982	216,400	587,500	5,604,882	20
Magoffin	KY	500,000	1,000,000	1,967,000	3,028,658	–	–	1,465,000	1,199,141	9,159,799	172
Martin	KY	–	–	–	–	–	–	–	4,122,831	4,122,831	82
McCreary	KY	800,000	1,500,000	–	–	–	950,250	4,280,000	483,000	8,013,250	117
Menifee	KY	258,333	–	1,895,000	–	–	–	4,100,000	4,385,000	10,638,333	406
Monroe	KY	475,000	665,000	–	–	–	–	862,000	761,000	2,763,000	59
Montgomery	KY	125,000	–	–	10,562,032	–	–	1,364,300	918,249	12,969,581	144

County Name (ARC Counties)	State	Federal Programs							State–Specific Programs	Total (2000–2003)	Per Cap-ita**
		ARC	EDA	CDBG*	SRFCW	SRFDW	STAG	USDA			
Morgan	KY	1,808,333	–	–	–	–	–	2,170,000	1,425,000	5,403,333	97
Owsley	KY	–	–	–	–	557,000	570,100	1,373,300	631,035	3,131,435	161
Perry	KY	977,130	–	2,941,000	–	–	–	1,652,000	10,025,509	15,595,639	133
Pike	KY	500,000	1,437,500	–	1,016,802	1,197,072	967,800	2,870,000	3,135,827	11,125,001	40
Powell	KY	–	–	–	–	–	17,082	1,500,000	600,000	2,117,082	40
Pulaski	KY	462,500	1,500,000	–	–	–	4,822,350	12,712,000	2,478,000	21,974,850	98
Rockcastle	KY	162,500	–	–	–	–	–	983,000	650,000	1,795,500	27
Rowan	KY	475,000	3,000,000	–	350,245	5,500,000	346,900	1,950,000	3,976,014	15,598,159	176
Russell	KY	–	–	–	–	–	–	607,000	1,073,950	1,680,950	26
Wayne	KY	350,000	–	–	–	–	346,900	1,720,000	2,124,550	4,541,450	57
Whitley	KY	1,250,000	1,500,000	1,000,000	–	–	867,300	7,679,000	3,879,081	16,175,381	113
Wolfe	KY	1,008,333	–	–	4,396,000	–	–	2,101,000	–	7,505,333	266
Kentucky ARC Counties		**$21,504,969**	**$21,426,500**	**$27,253,483**	**$37,991,428**	**$25,459,783**	**$19,135,992**	**$117,867,700**	**$135,657,018**	**$406,296,873**	**$ 89**
Allegany	MD	$1,079,000	$1,000,000	$1,016,107	$10,918,900	$6,165,000	–	$12,371,000	$ 6,217,250	$38,767,257	$129
Garrett	MD	1,000,000	–	–	313,272	1,100,000	–	16,213,500	1,609,590	20,236,362	170
Washington	MD	250,000	–	–	4,417,759	2,000,000	$485,000	1,341,506	3,055,085	11,549,350	22
Maryland ARC Counties		**$2,329,000**	**$1,000,000**	**$1,016,107**	**$15,649,931**	**$9,265,000**	**$485,000**	**$29,926,006**	**$10,881,925**	**$70,552,969**	**$75**
Alcorn	MS	461,282	–	1,150,270	–	2,377,109	999,641	186,500	–	5,174,802	37
Benton	MS	333,500	–	993,995	–	–	–	757,000	–	2,084,495	65
Calhoun	MS	602,852	–	795,927	–	867,449	–	4,223,200	102,362	6,591,790	109
Chickasaw	MS	300,000	–	–	–	–	–	1,647,000	–	1,947,000	25
Choctaw	MS	169,200	–	892,511	–	–	–	1,069,000	103,468	2,234,179	57
Clay	MS	–	–	–	3,559,749	1,500,000	–	3,076,000	–	8,135,749	93
Itawamba	MS	800,000	1,500,000	247,535	–	–	–	2,938,500	–	5,486,035	60
Kemper	MS	817,825	–	531,828	–	–	–	2,222,000	–	3,571,653	85
Lee	MS	916,460	–	647,995	25,891,320	1,251,600	2,564,900	3,316,550	640,044	35,228,869	116
Lowndes	MS	500,000	–	495,956	3,734,515	–	873,000	8,664,003	–	14,267,474	58
Marshall	MS	600,000	–	445,371	–	–	–	6,293,500	–	7,338,871	52

County Name (ARC Counties)	State	Federal Programs							State-Specific Programs	Total (2000–2003)	Per Cap-ita**
		ARC	EDA	CDBG*	SRFCW	SRFDW	STAG	USDA			
Monroe	MS	2,375,000	–	902,355	–	–	–	8,747,000	–	12,024,355	79
Montgomery	MS	–	–	689,263	–	–	–	–	344,812	1,034,075	21
Noxubee	MS	506,000	–	562,991	–	–	–	3,287,000	–	4,355,991	87
Oktibbeha	MS	238,860	–	335,132	3,500,000	3,646,829	–	3,679,200	–	11,400,021	66
Panola	MS	–	–	1,324,213	–	269,855	–	2,013,776	494,898	4,102,742	30
Pontotoc	MS	–	–	23,461	5,937,000	991,200	–	–	–	6,951,661	65
Prentiss	MS	1,102,500	–	824,607	–	–	–	5,241,800	–	7,168,907	70
Tippah	MS	–	–	1,405,286	–	–	–	2,267,000	300,000	3,972,286	48
Tishomingo	MS	234,240	–	378,452	–	–	–	–	33,950	646,642	8
Union	MS	125,000	–	381,982	–	949,534	–	400,000	–	1,856,516	18
Webster	MS	200,000	–	662,343	–	–	–	1,496,000	–	2,358,343	57
Winston	MS	250,000	–	753,405	–	–	588,000	1,471,000	–	3,062,405	38
Yalobusha	MS	148,645	–	526,089	–	278,522	–	823,000	–	1,776,256	34
Mississippi ARC Counties		**$10,681,364**	**$1,500,000**	**$14,970,970**	**$42,622,584**	**$12,132,098**	**$5,025,541**	**$63,819,029**	**$2,019,534**	**$152,771,117**	**$62**
Alexander	NC	$ 72,400	–	$ 977,285	–	–	$ 22,773	–	$ 110,000	$ 1,182,458	9
Alleghany	NC	–	–	–	–	–	22,773	–	60,000	82,773	2
Ashe	NC	200,000	$ 800,000	597,414	$ 1,021,299	$1,203,205	22,773	–	6,992,550	10,837,241	111
Avery	NC	100,000	–	–	–	–	22,773	$ 3,736,000	65,572	3,924,345	57
Buncombe	NC	–	–	–	–	–	2,334,180	–	14,043,080	16,377,260	20
Burke	NC	545,300	–	3,098,080	–	–	499,773	485,325	1,993,600	6,622,078	19
Caldwell	NC	320,000	–	1,986,360	–	–	196,273	–	465,000	2,967,633	10
Cherokee	NC	–	–	466,044	–	323,706	1,283,773	–	8,389,671	10,463,194	108
Clay	NC	–	–	–	–	–	22,773	–	334,100	356,873	10
Davie	NC	–	–	2,098,328	–	–	22,773	–	–	2,121,101	15
Forsyth	NC	–	–	282,949	9,180,000	–	–	–	–	9,462,949	8
Graham	NC	200,000	–	77,120	–	–	22,773	–	1,127,185	1,427,078	45
Haywood	NC	400,000	–	–	–	–	497,893	–	5,415,433	6,313,326	29
Henderson	NC	–	–	378,560	–	–	2,915,073	–	5,528,709	8,822,342	25
Jackson	NC	–	–	–	–	–	22,773	–	713,000	735,773	6
Macon	NC	519,300	–	–	–	–	456,473	–	1,100,000	2,075,773	17

County Name (ARC Counties)	State	Federal Programs							State–Specific Programs	Total (2000–2003)	Per Cap-ita**
		ARC	EDA	CDBG*	SRFCW	SRFDW	STAG	USDA			
Madison	NC	200,000	–	2,151,500	–	–	22,773	–	476,078	2,850,351	36
McDowell	NC	400,000	–	332,774	–	–	22,773	–	9,127,164	9,882,711	59
Mitchell	NC	200,000	1,000,000	910,000	–	–	456,473	–	158,337	2,724,810	43
Polk	NC	–	–	–	–	–	22,773	–	880,490	903,263	12
Rutherford	NC	67,500	–	919,463	–	–	506,673	–	6,425,500	7,919,136	31
Stokes	NC	–	–	–	–	–	22,773	–	237,000	259,773	1
Surry	NC	580,000	–	489,928	–	1,564,282	22,773	7,147,000	10,288,388	20,092,371	71
Swain	NC	347,305	1,000,000	–	–	–	22,773	–	4,941,596	6,311,674	122
Transylvania	NC	–	–	231,500	–	–	990,673	–	528,533	1,750,706	15
Watauga	NC	100,000	–	–	–	–	22,773	–	418,000	540,773	3
Wilkes	NC	704,269	1,000,000	356,800	–	2,722,380	22,773	597,000	3,339,556	8,742,778	33
Yadkin	NC	200,000	–	57,906	–	–	22,773	–	20,000	300,679	2
Yancey	NC	–	–	–	–	–	507,773	–	957,550	1,465,323	21
North Carolina ARC Counties		**$5,156,074**	**$3,800,000**	**$15,412,011**	**$10,201,299**	**$5,813,573**	**$11,032,171**	**$11,965,325**	**$84,136,092**	**$147,516,545**	**$ 24**
Allegany	NY	–	–	$ 220,000	$ 1,358,149	$ 3,743,887	$ 15,245	$ 4,127,400	$ 5,059,506	$ 14,524,187	$ 73
Broome	NY	$ 200,000	–	114,376	25,548,949	14,897,250	708,293	1,876,867	2,260,000	45,605,735	57
Cattaraugus	NY	450,000	$1,000,000	494,665	50,514,346	7,209,616	–	8,643,600	8,209,616	76,521,843	228
Chautauqua	NY	300,000	500,000	1,642,827	45,446,917	3,186,224	–	1,848,500	4,436,224	57,360,692	103
Chemung	NY	635,125	454,000	382,000	186,750	2,066,000	20,993	5,000	4,066,000	7,815,868	21
Chenango	NY	–	–	–	9,802,673	5,306,796	20,993	386,000	5,567,693	21,084,155	103
Cortland	NY	150,000	–	22,029	2,232,000	–	745,093	500,000	–	3,649,122	19
Delaware	NY	300,000	–	488,238	90,961,638	3,049,254	–	2,010,200	3,646,858	100,456,188	523
Otsego	NY	–	–	140,725	790,193	900,000	20,993	672,900	900,000	3,424,811	14
Schoharie	NY	588,400	–	–	16,629,501	2,234,687	–	2,501,100	1,910,612	23,864,300	189
Schuyler	NY	300,000	–	–	2,729,716	2,069,991	–	–	–	5,099,707	66
Steuben	NY	950,000	1,000,000	97,698	4,475,005	2,411,592	20,993	3,125,000	4,637,523	16,717,811	42
Tioga	NY	–	–	–	5,667,520	122,752	15,245	7,572,700	122,752	13,500,969	65
Tompkins	NY	–	–	314,710	–	–	–	–	–	314,710	1

County Name (ARC Counties)	State	Federal Programs							State–Specific Programs	Total (2000–2003)	Per Cap-ita**
		ARC	EDA	CDBG*	SRFCW	SRFDW	STAG	USDA			
New York ARC Counties		**$3,873,525**	**2,954,000**	**$3,917,268**	**$256,343,357**	**$47,198,049**	**$1,567,848**	**$33,269,267**	**$40,816,784**	**$389,940,098**	**$91**
Adams	OH	$ 576,965	–	$ 401,686	$ 644,468	–	–	–	$ 9,534,761	$ 11,157,880	$102
Athens	OH	600,000	–	1,883,763	3,628,550	–	–	$10,409,000	4,596,115	21,117,428	85
Belmont	OH	–	–	870,900	–	–	$ 2,172,900	–	7,395,927	10,439,727	37
Brown	OH	300,000	$ 375,000	–	1,350,000	–	–	3,200,000	1,971,419	7,196,419	43
Carroll	OH	–	–	405,130	–	–	–	729,500	751,390	1,886,020	16
Clermont	OH	–	–	–	–	–	–	–	7,112,178	7,112,178	10
Columbiana	OH	215,500	1,000,000	1,006,018	150,000	$ 271,629	2,593,165	13,545,000	1,938,227	20,719,539	46
Coshocton	OH	–	–	–	–	9,763,600	–	–	1,317,088	11,080,688	76
Gallia	OH	200,000	–	239,500	–	–	–	940,000	203,262	1,582,762	13
Guernsey	OH	–	–	499,897	891,120	–	485,000	3,699,400	13,032,339	18,607,756	114
Harrison	OH	–	–	601,449	91,350	1,316,632	742,100	–	997,612	3,749,143	59
Highland	OH	143,000	–	499,091	–	–	–	800,000	2,570,880	4,012,971	25
Hocking	OH	300,000	–	123,343	25,184	–	376,000	–	67,500	892,027	8
Holmes	OH	–	–	500,000	6,314,000	–	–	–	1,572,825	8,386,825	54
Jackson	OH	405,500	–	841,223	36,928	–	1,354,100	18,395,000	910,930	21,943,681	168
Jefferson	OH	–	–	1,298,145	1,961,198	26,505,076	–	–	1,590,490	31,354,909	106
Lawrence	OH	–	–	805,500	–	–	–	–	1,710,030	2,515,530	10
Meigs	OH	–	–	884,550	–	–	650,500	–	2,262,541	3,797,591	41
Monroe	OH	540,450	–	340,000	–	–	–	–	720,585	1,601,035	26
Morgan	OH	700,000	–	768,629	–	110,333	–	–	1,623,609	3,202,571	54
Muskingum	OH	–	–	751,178	575,911	191,833	–	2,068,660	5,693,497	9,281,079	27
Noble	OH	–	–	–	–	–	–	–	948,195	948,195	17
Perry	OH	300,000	–	2,634,835	–	–	1,778,100	3,154,000	9,978,682	17,845,617	131
Pike	OH	411,000	–	1,009,000	4,266,543	–	–	–	1,318,800	7,005,343	63
Ross	OH	75,000	1,392,000	522,811	2,550,869	–	–	10,901,700	968,000	16,410,380	56
Scioto	OH	275,000	–	500,000	3,707,442	–	–	2,496,000	4,551,937	11,530,379	36
Tuscarawas	OH	600,000	1,500,000	751,500	16,471,532	279,130	–	1,024,000	3,707,847	24,334,009	67
Vinton	OH	444,000	192,000	568,800	–	–	–	–	–	1,204,800	24
Washington	OH	–	–	629,894	474,552	110,333	–	4,042,000	1,730,401	6,987,180	28

County Name (ARC Counties)	State	Federal Programs							State–Specific Programs	Total (2000–2003)	Per Cap-ita**
		ARC	EDA	CDBG*	SRFCW	SRFDW	STAG	USDA			
Ohio ARC Counties		**$6,086,415**	**$4,459,000**	**$19,336,841**	**$43,139,647**	**$38,548,566**	**$10,151,865**	**$75,404,260**	**$90,777,067**	**$287,903,662**	**$49**
Allegheny	PA	–	–	$11,180,007	$16,511,381	$ 5,613,827	$12,582,048	–	$ 16,563,293	$ 62,450,556	$12
Armstrong	PA	–	–	1,173,352	9,081,751	–	–	$ 8,317,000	9,964,381	28,536,484	99
Beaver	PA	$ 225,000	–	1,623,337	43,057,900	6,390,892	470,500	–	996,900	52,764,529	73
Bedford	PA	–	–	459,658	11,913,018	1,200,000	760,093	6,858,800	742,000	21,933,568	110
Blair	PA	–	–	519,726	4,791,715	–	2,642,093	–	14,168,000	22,121,534	43
Bradford	PA	–	–	212,000	1,948,292	1,287,029	20,993	6,027,400	3,672,725	13,168,439	52
Butler	PA	–	–	890,611	–	–	–	–	–	890,611	1
Cambria	PA	325,000	$ 510,000	1,256,649	14,391,230	7,311,230	1,883,389	8,401,650	27,196,500	61,275,649	100
Cameron	PA	–	–	–	–	–	20,993	–	–	20,993	1
Carbon	PA	–	–	582,341	22,024,294	–	–	953,700	1,460,000	25,020,336	106
Centre	PA	–	–	970,127	9,000,703	–	20,993	–	3,121,768	13,113,591	24
Clarion	PA	–	–	900,693	1,770,461	12,265,261	–	1,855,000	1,738,000	18,529,415	111
Clearfield	PA	250,000	–	3,112,993	17,467,110	6,650,000	1,319,593	600,000	9,592,100	38,991,796	117
Clinton	PA	–	–	624,422	4,018,730	184,594	20,993	1,511,300	724,000	7,084,039	47
Columbia	PA	–	–	241,853	3,642,710	–	20,993	5,405,900	–	9,311,456	36
Crawford	PA	400,000	–	399,881	8,669,648	–	873,000	–	2,360,000	12,702,529	35
Elk	PA	250,000	500,000	200,604	15,455,395	–	20,993	–	1,837,870	18,264,862	130
Erie	PA	230,000	–	1,488,500	12,540,738	–	873,000	–	16,720,645	31,852,883	28
Fayette	PA	774,650	–	2,652,223	36,611,075	–	–	31,912,460	5,979,300	77,929,708	131
Forest	PA	–	–	86,626	–	–	–	–	–	86,626	4
Fulton	PA	200,000	–	–	604,622	–	20,993	3,121,000	–	3,946,615	69
Greene	PA	435,000	–	298,400	5,624,645	2,087,385	475,100	7,500	729,350	9,657,380	59
Huntingdon	PA	50,000	510,000	519,718	11,675,550	–	20,993	–	1,949,000	14,725,261	81
Indiana	PA	–	–	1,430,231	13,155,686	455,500	470,500	13,608,965	680,500	29,801,382	83
Jefferson	PA	–	–	1,705,621	2,977,000	–	–	4,808,800	2,660,500	12,151,921	66
Juniata	PA	–	–	623,902	–	–	20,993	–	–	644,895	7
Lackawanna	PA	200,000	–	1,706,047	23,866,806	–	3,029,463	–	350,000	29,152,316	34
Lawrence	PA	–	–	–	–	–	433,700	–	–	433,700	1
Luzerne	PA	480,000	–	1,433,338	11,524,694	3,874,269	1,327,693	21,407,400	5,300,700	45,348,094	36

County Name (ARC Counties)	State	Federal Programs							State–Specific Programs	Total (2000–2003)	Per Cap-ita**
		ARC	EDA	CDBG*	SRFCW	SRFDW	STAG	USDA			
Lycoming	PA	–	–	1,067,890	6,372,894	–	454,693	5,201,700	–	13,097,177	27
McKean	PA	200,000	–	291,037	–	–	–	–	300,000	791,037	4
Mercer	PA	–	–	544,327	1,127,401	–	1,920,200	4,726,445	2,342,526	10,660,899	22
Mifflin	PA	–	–	171,613	1,566,308	–	931,593	622,900	–	3,292,414	18
Monroe	PA	–	–	–	–	–	1,429,400	–	11,026,017	12,455,417	22
Montour	PA	–	–	88,450	1,820,193	–	20,993	–	–	1,929,636	26
Northumber-land	PA	–	–	946,711	38,721,569	2,656,824	20,993	1,784,200	–	44,130,296	117
Perry	PA	–	1,289,000	458,788	7,785,352	570,000	20,993	675,000	1,822,000	12,621,133	72
Pike	PA	–	–	5,537	–	8,793,840	897,000	7,744,900	2,708,100	20,149,377	109
Potter	PA	400,000	1,000,000	568,000	7,339,000	–	990,993	1,000,100	9,223,046	20,521,139	284
Schuylkill	PA	109,981	550,000	806,402	57,054,460	5,284,482	20,993	14,783,350	14,951,312	93,560,980	156
Snyder	PA	–	–	860,546	5,484,854	829,000	888,293	–	–	8,062,693	54
Somerset	PA	185,000	–	378,946	23,727,516	2,502,915	3,948,777	–	870,000	31,613,154	99
Sullivan	PA	150,000	–	150,000	1,243,612	378,500	20,993	–	–	1,943,105	74
Susquehanna	PA	–	–	21,703	953,014	–	454,693	1,722,900	–	3,152,310	19
Tioga	PA	–	–	650,271	–	–	107,868	5,694,500	–	6,452,639	39
Union	PA	–	–	532,750	–	–	20,993	–	1,620,000	2,173,743	13
Venango	PA	–	–	1,098,806	–	603,267	433,700	4,222,300	–	6,358,073	28
Warren	PA	–	–	807,665	13,328,674	–	–	8,883,200	–	23,019,539	131
Washington	PA	300,000	700,000	1,955,557	13,167,535	4,580,200	1,210,400	19,848,960	1,337,100	43,099,752	53
Wayne	PA	50,000	–	174,265	3,067,354	1,606,750	863,980	350,000	418,000	6,530,349	34
Westmore-land	PA	–	–	4,139,506	42,220,155	14,073,577	1,492,227	922,000	2,606,727	65,454,192	44
Wyoming	PA	–	–	–	–	–	20,993	3,042,000	265,337	3,328,330	30
Pennsylvania ARC Counties		**$5,214,631**	**$5,059,000**	**$52,011,629**	**$527,305,046**	**$89,199,341**	**$43,499,877**	**$196,021,330**	**$177,997,697**	**$1,096,308,552**	**$ 47**
Anderson	SC	$ 568,948	–	$1,457,492	$1,856,569	–	–	$ 6,349,200	$ 2,779,688	$13,011,897	$20
Cherokee	SC	1,250,000	$704,867	1,083,113	–	–	–	–	1,443,473	4,481,453	21
Greenville	SC	–	–	730,750	600,000	–	$3,757,500	1,091,000	764,300	6,943,550	5
Oconee	SC	–	–	953,232	–	–	190,800	1,352,400	787,740	3,284,172	12

County Name (ARC Counties)	State	Federal Programs							State-Specific Programs	Total (2000–2003)	Per Cap-ita**
		ARC	EDA	CDBG*	SRFCW	SRFDW	STAG	USDA			
Pickens	SC	2,012,500	–	1,897,403	–	–	–	–	3,861,522	7,771,425	18
Spartanburg	SC	735,000	–	2,097,670	–	–	–	1,376,000	1,773,934	5,982,604	6
South Carolina ARC Counties		**$4,566,448**	**$704,867**	**$8,219,660**	**$2,456,569**	**–**	**$3,948,300**	**$10,168,600**	**$11,410,657**	**$41,475,101**	**$10**
Anderson	TN	–	–	$ 958,139	$ 4,485,000	–	$1,451,800	$ 1,320,000	$ 5,265,660	$ 13,480,599	$ 47
Bledsoe	TN	–	–	1,018,326	–	–	519,000	2,408,000	–	3,945,326	80
Blount	TN	–	–	331,552	–	–	–	4,216,000	–	4,547,552	11
Bradley	TN	–	–	1,095,619	–	–	–	–	–	1,095,619	3
Campbell	TN	$ 993,200	–	1,849,476	200,000	$ 1,060,000	–	1,526,600	–	5,629,276	35
Cannon	TN	–	–	958,046	–	–	–	2,335,700	–	3,293,746	64
Carter	TN	756,000	$ 1,000,000	475,500	–	–	959,700	1,600,000	–	4,791,200	21
Claiborne	TN	521,080	–	421,877	–	–	–	499,500	100,000	1,542,457	13
Clay	TN	–	–	–	–	–	–	732,000	–	732,000	23
Cocke	TN	979,200	–	1,297,540	–	–	–	–	–	2,276,740	17
Coffee	TN	387,500	–	475,500	–	–	–	470,000	12,306,000	13,639,000	71
Cumberland	TN	–	1,200,000	755,075	575,000	9,175,000	–	4,245,000	–	15,950,075	85
De Kalb	TN	–	–	1,829,958	–	1,000,000	–	700,000	–	3,529,958	51
Fentress	TN	–	–	1,476,152	–	–	–	2,270,000	–	3,746,152	56
Franklin	TN	600,000	1,800,000	1,367,793	–	–	–	1,450,000	–	5,217,793	33
Grainger	TN	–	–	882,490	–	–	–	–	–	882,490	11
Greene	TN	200,000	1,200,000	1,611,620	–	–	–	6,126,000	–	9,137,620	36
Grundy	TN	1,108,561	–	535,505	–	–	–	1,040,000	–	2,684,066	47
Hamblen	TN	500,000	–	145,648	–	10,500,000	–	730,000	–	11,875,648	51
Hamilton	TN	–	1,500,000	1,882,760	37,505,181	615,000	–	2,596,500	3,800,000	47,899,441	39
Hancock	TN	–	–	530,760	–	–	–	772,400	–	1,303,160	48
Hawkins	TN	–	–	1,344,427	610,000	–	–	8,096,700	–	10,051,127	47
Jackson	TN	500,000	–	1,166,127	–	–	–	1,100,000	–	2,766,127	63
Jefferson	TN	–	–	1,897,809	1,353,800	–	–	2,245,000	500,000	5,996,609	34
Johnson	TN	–	–	485,850	2,000,000	–	–	2,670,200	–	5,156,050	74
Knox	TN	200,000	1,500,000	307,431	–	–	–	7,507,800	–	9,515,231	6

County Name (ARC Counties)	State	Federal Programs							State–Specific Programs	Total (2000–2003)	Per Cap-ita**
		ARC	EDA	CDBG*	SRFCW	SRFDW	STAG	USDA			
Loudon	TN	500,000	1,000,000	729,943	13,739,680	8,116,882	–	2,340,000	5,000,000	31,426,505	201
Macon	TN	–	1,000,000	1,809,792	–	–	–	3,132,000	–	5,941,792	73
Marion	TN	92,500	–	2,769,289	–	–	–	2,328,000	–	5,189,789	47
McMinn	TN	473,500	650,000	3,423,219	–	–	2,268,900	1,275,600	10,750,000	18,841,219	96
Meigs	TN	–	–	672,843	–	33,333	–	2,683,000	–	3,389,176	76
Monroe	TN	251,060	–	939,782	1,200,000	–	–	602,000	–	2,992,842	19
Morgan	TN	610,520	–	547,225	–	995,000	1,900,500	2,941,500	–	6,994,745	89
Overton	TN	–	–	1,311,417	–	1,500,000	–	325,000	–	3,136,417	39
Pickett	TN	520,000	–	466,451	–	–	–	–	–	986,451	50
Polk	TN	120,000	–	849,860	–	1,215,000	1,040,800	1,690,300	–	4,915,960	77
Putnam	TN	–	–	2,762,290	400,000	–	–	1,717,000	10,500,000	15,379,290	62
Rhea	TN	–	–	962,350	–	33,333	–	5,625,000	–	6,620,683	58
Roane	TN	600,000	750,000	2,120,931	5,991,500	1,028,333	–	7,823,900	3,500,000	21,814,664	105
Scott	TN	690,000	–	1,411,500	–	–	–	5,342,200	–	7,443,700	88
Sequatchie	TN	–	740,000	299,389	–	–	1,161,900	5,877,000	1,875,000	9,953,289	219
Sevier	TN	–	–	1,149,231	–	–	–	592,900	–	1,742,131	6
Smith	TN	–	–	1,255,265	–	–	–	378,000	–	1,633,265	23
Sullivan	TN	–	–	232,833	610,000	–	–	2,735,000	–	3,577,833	6
Unicoi	TN	–	–	1,027,568	–	–	–	593,000	–	1,620,568	23
Union	TN	187,422	–	2,020,820	84,000	–	–	2,427,000	–	4,719,242	66
Van Buren	TN	100,000	–	480,500	–	–	–	–	–	580,500	26
Warren	TN	500,000	1,000,000	379,739	–	4,270,000	–	318,000	–	6,467,739	42
Washington	TN	450,000	1,400,000	562,351	–	–	–	2,489,000	–	4,901,351	11
White	TN	–	–	755,778	–	–	–	1,078,000	–	1,833,778	20
Tennessee ARC Counties		**$11,840,543**	**$14,740,000**	**$54,041,345**	**$68,754,161**	**$39,541,881**	**$9,302,600**	**$110,970,800**	**$53,596,660**	**$362,787,991**	**$37**
Alleghany	VA	–	–	$ 705,000	$10,380,454	$ 217,000	–	$ 315,000	–	$ 11,617,454	$225
Bath	VA	–	–	–	–	–	–	–	–	–	0
Bland	VA	–	–	562,978	–	–	–	909,700	–	1,472,678	54
Botetourt	VA	–	–	–	20,591,277	–	$ 130,100	–	–	20,721,377	170
Bristol City	VA	–	–	–	–	–	–	–	–	–	0

County Name (ARC Counties)	State	Federal Programs							State–Specific Programs	Total (2000–2003)	Per Cap-ita**
		ARC	EDA	CDBG*	SRFCW	SRFDW	STAG	USDA			
Buchanan	VA	$1,775,000	–	2,566,021	–	3,117,573	–	3,550,000	$ 9,925,000	20,933,594	194
Buena Vista City	VA	–	–	–	–	–	–	3,300,000	–	3,300,000	130
Carroll	VA	–	–	573,344	–	2,456,128	–	6,908,000	–	9,937,472	85
Clifton Forge City	VA	–	–	–	–	–	–	–	–	–	0
Covington City	VA	–	–	–	–	–	–	–	–	–	0
Craig	VA	46,000	–	–	–	–	–	–	–	46,000	2
Dickenson	VA	1,375,000	–	1,774,644	–	7,158,951	–	5,623,500	1,595,000	17,527,095	267
Floyd	VA	–	–	332,608	–	–	–	250,000	–	582,608	10
Galax City	VA	–	–	14,315	–	–	–	–	1,125,000	1,139,315	42
Giles	VA	–	–	668,550	704,000	–	–	6,906,100	–	8,278,650	124
Grayson	VA	–	–	65,342	–	–	–	129,800	–	195,142	3
Highland	VA	75,000	–	20,722	–	–	–	1,614,000	–	1,709,722	169
Lee	VA	2,267,571	–	2,212,086	–	10,923,680	1,187,812	9,652,600	–	26,243,749	278
Lexington City	VA	–	–	–	–	–	–	–	2,500,000	2,500,000	91
Montgomery	VA	–	–	20,351	–	–	–	3,763,700	–	3,784,051	11
Norton City	VA	–	–	–	–	–	–	–	1,635,000	1,635,000	105
Pulaski	VA	500,000	–	4,994	10,500,000	–	867,300	6,111,100	–	17,983,394	128
Radford City	VA	–	–	–	–	–	–	–	–	–	0
Rockbridge	VA	500,000	–	–	9,078,000	–	–	1,265,500	940,000	11,783,500	142
Russell	VA	270,833	–	958,161	148,500	6,710,057	–	335,300	–	8,422,851	69
Scott	VA	320,833	–	942,448	1,000,000	4,752,016	–	5,159,900	–	12,175,197	130
Smyth	VA	–	–	184,722	–	946,000	654,800	7,857,800	–	9,643,322	73
Tazewell	VA	–	–	1,477,702	1,000,000	18,090,329	1,680,500	2,987,400	–	25,235,931	141
Washington	VA	–	–	355,510	8,214,200	3,815,340	–	1,269,200	1,785,000	15,439,250	76
Wise	VA	1,036,019	$1,000,000	2,591,585	860,000	5,137,773	–	1,461,550	–	12,086,927	75
Wythe	VA	–	–	–	200,000	–	–	5,312,000	–	5,512,000	50

County Name (ARC Counties)	State	Federal Programs							State-Specific Programs	Total (2000–2003)	Per Capita**
		ARC	EDA	CDBG*	SRFCW	SRFDW	STAG	USDA			
Virginia ARC Counties		**$8,166,256**	**$1,000,000**	**$16,031,082**	**$62,676,431**	**$63,324,847**	**$4,520,512**	**$74,682,150**	**$19,505,000**	**$249,906,279**	**$ 94**
Barbour	WV	$ 789,000	–	$ 606,054	$ 1,162,700	–	$ 2,160,474	$ 6,751,000	$ 4,716,211	$ 16,185,439	$260
Berkeley	WV	–	–	–	36,137,682	$ 7,564,000	654,800	16,104,000	13,922,098	74,382,580	245
Boone	WV	680,000	–	2,097,138	–	2,130,000	–	–	4,909,000	9,816,138	96
Braxton	WV	35,000	–	1,550,000	–	–	–	–	5,793,064	7,378,064	125
Brooke	WV	–	–	104,905	712,050	–	10,908,700	–	4,963,338	16,688,993	164
Cabell	WV	–	–	2,232,217	17,512,598	–	2,354,500	–	21,333,164	43,432,479	112
Calhoun	WV	–	–	1,739,553	–	–	–	2,400,000	–	4,139,553	136
Clay	WV	–	–	12,331	–	–	–	–	–	12,331	0
Doddridge	WV	–	–	160,043	–	–	–	–	810,000	970,043	33
Fayette	WV	1,508,457	$ 1,195,000	1,964,352	580,645	2,741,000	–	3,622,000	14,053,080	25,664,534	135
Gilmer	WV	–	1,000,000	1,745,000	–	–	–	54,000	1,470,000	4,269,000	149
Grant	WV	–	–	293,417	4,415,311	–	–	–	2,390,450	7,099,178	157
Greenbrier	WV	–	–	7,614	–	–	–	–	950,000	957,614	7
Hampshire	WV	663,100	–	213,545	–	–	–	761,000	2,390,000	4,027,645	50
Hancock	WV	–	–	1,506,958	–	–	7,206,800	–	4,509,880	13,223,638	101
Hardy	WV	1,010,000	–	1,500,000	–	–	–	1,450,000	1,750,024	5,710,024	113
Harrison	WV	500,000	912,000	1,814,750	4,934,977	2,383,850	1,009,800	10,838,000	12,519,254	34,912,631	127
Jackson	WV	1,400,000	–	1,489,793	–	–	–	12,075,000	7,624,924	22,589,717	202
Jefferson	WV	–	–	–	4,318,670	2,000,000	–	–	4,700,000	11,018,670	65
Kanawha	WV	500,000	–	3,546,981	30,516,917	–	–	–	27,766,906	62,330,804	78
Lewis	WV	–	–	1,175,000	3,192,097	–	–	1,280,000	12,118,434	17,765,531	263
Lincoln	WV	–	–	1,547,904	–	–	–	2,280,000	1,676,000	5,503,904	62
Logan	WV	–	–	535,700	5,684,440	–	–	6,847,060	13,298,705	26,365,905	175
Marion	WV	–	–	1,978,995	885,543	–	1,235,316	6,601,000	3,547,197	14,248,051	63
Marshall	WV	–	–	2,539,153	318,300	–	2,344,840	–	19,029,588	24,231,881	171
Mason	WV	–	–	457,883	–	1,610,000	–	4,857,000	875,000	7,799,883	75
McDowell	WV	250,000	–	2,684,656	–	1,786,911	4,751,200	7,569,500	57,098	17,099,365	156
Mercer	WV	–	–	2,244,321	1,018,976	1,275,000	–	7,750,000	1,482,491	13,770,788	55
Mineral	WV	425,000	–	3,966,319	1,689,051	–	–	175,000	4,444,984	10,700,354	99

County Name (ARC Counties)	State	Federal Programs							State–Specific Programs	Total (2000–2003)	Per Cap-ita**
		ARC	EDA	CDBG*	SRFCW	SRFDW	STAG	USDA			
Mingo	WV	75,000	–	3,826,026	–	258,000	–	4,000,000	20,046,540	28,205,566	250
Monongalia	WV	–	–	297,895	15,953,813	1,068,500	–	1,062,000	6,700,470	25,082,678	77
Monroe	WV	–	–	238,053	–	–	–	9,952,500	5,330,000	15,520,553	266
Morgan	WV	–	–	1,297,248	1,316,000	1,150,000	–	–	10,740,000	14,503,248	243
Nicholas	WV	1,240,200	–	1,425,000	682,314	2,388,495	–	7,007,850	6,056,505	18,800,364	177
Ohio	WV	–	–	469,693	–	–	3,395,000	–	528,000	4,392,693	23
Pendleton	WV	650,000	–	143,626	1,332,645	2,528,623	–	–	368,750	5,023,644	153
Pleasants	WV	–	–	–	–	–	–	–	4,850,000	4,850,000	161
Pocahontas	WV	635,726	–	282,131	–	–	–	–	8,009,000	8,926,857	244
Preston	WV	–	1,000,000	5,754,632	878,181	–	1,805,461	3,447,640	3,815,500	16,701,414	142
Putnam	WV	–	–	–	1,521,250	–	260,200	7,078,000	23,518,544	32,377,994	157
Raleigh	WV	1,000,000	900,000	293,500	14,839,246	–	–	6,285,500	12,062,000	35,380,246	112
Randolph	WV	–	434,000	234,446	300,000	–	229,800	4,186,000	8,188,540	13,572,786	120
Ritchie	WV	–	1,700,000	1,457,803	638,000	–	–	–	–	3,795,803	92
Roane	WV	400,000	–	1,175,000	–	–	–	3,578,000	2,295,000	7,448,000	121
Summers	WV	500,000	–	1,269,151	–	–	–	15,000	–	1,784,151	34
Taylor	WV	–	–	192,971	718,500	–	3,647,100	1,520,000	1,786,819	7,865,390	122
Tucker	WV	–	–	1,314,117	–	760,000	4,855,149	–	1,600,000	8,529,266	291
Tyler	WV	480,000	1,600,000	342,188	–	–	438,900	1,800,000	790,000	5,451,088	142
Upshur	WV	757,500	–	1,493,703	–	–	–	7,563,000	1,271,220	11,085,423	118
Wayne	WV	1,000,000	1,138,000	270,276	1,318,357	–	–	2,617,200	1,322,000	7,665,833	45
Webster	WV	–	–	199,653	–	–	629,100	–	–	828,753	21
Wetzel	WV	154,080	–	506,220	–	1,483,979	339,500	2,503,745	3,305,290	8,292,814	117
Wirt	WV	–	–	1,175,000	–	–	–	–	–	1,175,000	50
Wood	WV	–	–	989,009	6,953,705	–	–	8,110,000	18,784,620	34,837,334	99
Wyoming	WV	2,000,000	1,800,000	1,015,538	5,364,000	360,000	–	4,867,000	12,814,980	28,221,518	274
West Virginia ARC Counties		**$16,653,063**	**$11,679,000**	**$65,377,463**	**$164,895,968**	**$31,488,358**	**$48,226,640**	**$167,007,995**	**$347,284,668**	**$852,613,153**	**$118**

County Name (ARC Counties)	State	Federal Programs							State–Specific Programs	Total (2000–2003)	Per Cap-ita**
		ARC	EDA	CDBG*	SRFCW	SRFDW	STAG	USDA			
ARC Region		**$107,840,761**	**$84,974,870**	**$312,813,531**	**$1,417,601,834**	**$466,727,534**	**$197,213,837**	**$964,322,220**	**$1,049,284,938**	**$4,600,779,526**	**$50**

Source : UNCEFC Master Funding Database, 2004

*About 5% of CDBG funding amounts for Non-entitlement Cities could not be identified at a county level; these funds are not included in this table.

** Population estimates from Census 2000 Summary File 1 Table P1

APPENDIX C

Appalachian Region Water and Sewer Needs Assessment: Consultations and Discussion Forums

Organizations Consulted

People in the following organizations were consulted in meetings and phone interviews concerning drinking water and clean water needs surveys in the ARC region:

EPA Region 3, Clean Watersheds Needs Survey Program

AL Department of Environmental Management, Water Division

GA Department of Natural Resources, Environmental Protection Division, Water Protection Branch

KY Bluegrass Area Development District

KY Division of Water, Drinking Water Branch

KY Division of Water, Facilities Construction Branch, Municipal Planning Section

KY Infrastructure Authority

KY Kentucky River Area Development District

KY Lake Cumberland Area Development District

KY Northern Kentucky Area Development District

MD Department of the Environment, Water Quality Infrastructure Program

MS Department of Environmental Quality, Office of Pollution Control, Construction Branch,

NC Department of Environment and Natural Resources, Division of Water Quality

NC Department of Environment and Natural Resources, Division of Water Quality, Public Water Supply

NC Rural Economic Development Center

NY Department of Environmental Conservation, New York State Environmental Facilities Corporation

OH EPA, Division of Drinking and Ground Waters, Water Supply Revolving Loan Account

OH Public Works Commission

PA Department of Environmental Protection, Bureau of Water Supply and Wastewater Management

PA Department of Environmental Protection, Clean Watersheds Needs Survey Program

SC Department of Health and Environmental Control, Bureau of Water

SC Department of Health and Environmental Control, Clean Watersheds Needs Survey Program

TN Advisory Commission on Intergovernmental Regulations

TN Department of Environment and Conservation, Division of Community Assistance

VA Department of Environmental Quality, Construction Assistance Program

VA Department of Health, Division of Water Supply Engineering

WV Department of Health and Human Resources

WV Infrastructure and Jobs Development Council

WV State Revolving Fund Program

Discussion Forums on Preliminary Results

UNCEFC held several forums to discuss the preliminary results of the Appalachian region water and sewer needs assessment. Following is a brief summary of these forums with a list of forum attendees and the organizations they represent.

EPA Region 4 Meeting, July 6, 2004

UNCEFC presented the preliminary ARC findings to a group at EPA Region 4. Some of the topics discussed included water and wastewater gaps, water and wastewater service and needs, and public capital project funding; attendees included:

Wayne Aronson, Permits, Grants and Technical Assistance Branch
Betty Barton, Grants and Technical Assistance Section
Ben Chen, Grants and Technical Assistance Section
Bill Cox, Watersheds & Nonpoint Source Section
Dale Froneberger, Water, Ground Water & Drinking Water
Jim Giattina, Waste Management Division
Jeff Hughes, University of North Carolina, Environmental Finance Center
David Parker, Eastern Enforcement Section
Matt Richardson, University of North Carolina, Environmental Finance Center
Tom Welborn, Wetlands, Coastal & Watershed Branch
Lynn Weller, University of North Carolina, Environmental Finance Center

Environmental Finance Advisory Board (EFAB) Workgroup Meeting, August 13, 2004, and Phone Conferences

UNCEFC had a series of informal meetings and phone conferences to discuss the ARC study preliminary findings with the EFAB, an advisory group to the administrator of EPA and program offices on how to pay for environmental protection. The EFAB consists of experts from all levels of finance and government, including elected officials, the finance and banking communities, business and industry, and national organizations. Two components of the ARC study in particular have implications for the EFAB's Joint-Operations SRF Work Group: the funding manager's survey and the public funding inventory. The UNCEFC described these components and the preliminary findings of the study to the workgroup.

Syracuse Roundtable Discussion, August 25, 2004

The Syracuse University Environmental Finance Center facilitated a roundtable discussion of the preliminary results of the ARC study. Some of the key topics were issues with needs surveys, how the surveys define "needs," and under-reporting. There were also discussions of how to bridge the funding gap, as well as the knowledge gap; attendees included:

Charlie Amento, New York State Department of Health

Robert Augenstern, Southern Tier East Regional Planning Board

Jeremy Campbell, New York State Department of Environmental Conservation

Lynn Cebula, Southern Tier East Regional Planning Board

Susan Delehanty, New York State Environmental Facilities Corporation

Diane Hill, New York State Governor's Office for Small Cities

Ginger Malak, Southern Tier West Regional Planning Board

Susan Mayer, New York State Environmental Facilities Corporation

Eric McCandless, New York State Environmental Facilities Corporation

Tom McGarry, New York State Governor's Office for Small Cities

David Miller, U.S. Department of Agriculture, Rural Utilities Service

Scott Mueller, Rural Community Assistance Partnership (RCAP) Solutions, Inc.

Catherine Rees, Rural Community Assistance Partnership (RCAP) Solutions, Inc.

Chris Rienzo, New York State Environmental Facilities Corporation

Pat Scalera, New York State Rural Water Association

J. C. Smith, New York State Environmental Facilities Corporation

Jim Stearns, New York State Environmental Facilities Corporation

Fred Testa, New York State Environmental Facilities Corporation

Kyle Wilber, New York State Department of State Division of Local Government

Washington, D.C., Meeting, October 19, 2004

UNCEFC made a presentation to ARC, EPA, and others in federal EPA Washington, D.C., offices. Topics discussed included the current state of water and wastewater service in the ARC region, the critical infrastructure needs in the region, and the types of gaps that exist and the capacity to bridge those gaps. The group also discussed the financial management and financing strategies that are likely to have the biggest impact on service in the region and what funding agencies and technical assistance providers can do to improve and expand service in the region; attendees included:

Steve Allbee, EPA, Office of Wastewater Management (OWM), Municipal Support Division (MSD)

George Ames, EPA, CWSRF

Bob Barles, EPA, Office of Groundwater and Drinking Water (OGWDW)

Ron Bergman, EPA, OGWDW

Jenny Bielanski, EPA, OGWDW

Greg Bishak, ARC

Veronica Blette, EPA, OGWDW

Katherine Dowell, EPA, Office of Water (OW), Water Policy Staff

Shadi Eskaf, University of North Carolina, Environmental Finance Center

Rick Farrell, Council of Infrastructure Financing Authorities

Len Fleckenstein, EPA, OW, Water Policy Staff

Sheila Frace, EPA, OWM, MSD

Jan Goodwin, EPA, OWM

Steve Heare, EPA, Drinking Water Protection Division

Adriana Hochberg, EPA, OWM, MSD

Steve Hogye, EPA, OWM, MSD

Jeff Hughes, University of North Carolina, Environmental Finance Center

Jim Maras, U.S. Department of Agriculture, Rural Utilities Service

Joe McNealy, EPA, OGWDW

Tim McProuty, EPA, Office of the Chief Financial Officer, Electronic Fund Transfer

Dan Nees, University of Maryland, Environmental Finance Center

Michelle O'Herron, University of Maryland, Environmental Finance Center

Michael Plastino, EPA, OW, Detail to OWM

Matt Richardson, University of North Carolina, Environmental Finance Center

Ben Shuman, U.S. Department of Agriculture, Rural Utilities Service

Afsheen Siddiqi, University of Maryland, Environmental Finance Center

Eric Stockton, ARC

Molly Theobald, ARC

Phil Zahreddine, EPA, OWM, MSD, Municipal Technology Branch

Western North Carolina Onsite Sanitation Forum, October 26, 2004

UNCEFC conducted a forum to discuss onsite sanitation funding in the western North Carolina region, which includes portions of the ARC region. The meeting gathered stakeholders involved in financing onsite wastewater system repair and maintenance programs to advance understanding of centralized financing mechanisms. The group looked at several North Carolina case studies as well as models from other states that use Clean Water State Revolving Fund (SRF) funds for onsite repair programs. Some key discussions included the need to create finance models that are self-sustaining because of the decrease in grants, and the need to involve local health departments in managing onsite funding systems; attendees included:

Susan Austin, University of North Carolina, School of Government

Michele Ball, Region D Council of Governments (COG)

Tom Barefoot, U.S. Department of Agriculture

Terry Bolick, Catawba County, North Carolina

Ken Castelloe, Buncombe County (N.C.) Health Department

Gerold Elliot, Ashe and Allegheny County Health Departments, Appalachian Health Districts

Chad Ensley, Swain County, North Carolina

Rich Holder, North Carolina Rural Communities Assistance Project

Ron Holdway, Orange County (N.C.) Health Department

Jeff Hughes, University of North Carolina, Environmental Finance Center

Pam Hysong, U.S. Department of Agriculture

Terrell Jones, North Carolina Department of Environment and Natural Resources, Division of Environmental Health , Onsite Wastewater section

Karen Kienha, Land-of-Sky Regional Council

Tom Massie, Clean Water Management Trust Fund

Keith Rowland, Buncombe County (N.C.) Health Department

Mike Struve, Water Quality Administrator

Teresa Spires, Isothermal Planning & Development Commission

Evie Tashie, Equinox Environmental Consultation and Design, Inc.

Lynn Weller, University of North Carolina, Environmental Finance Center

APPENDIX D

Drinking Water and Wastewater Infrastructure Funding Survey

This survey was authorized by the Appalachian Regional Commission. The goal of this survey was to identify needs, practices, and strategies related to financing water and sewer infrastructure projects in the Appalachian region. In particular, we are interested in what is likely to happen in the ARC region in the next 20 years and how that compares to national level studies on infrastructure funding gaps.

For questions regarding this survey, contact Lynn Weller, Program Manager, UNC Environmental Finance Center, 919.966.4199 or weller@iogmail.iog.unc.edu.

Who Responded to the Survey

72 Program Managers from 86 water and sewer funding programs responded to the survey. The following funding programs participated:

AL	Appalachian Regional Commission Grant Program
AL	Clean Water State Revolving Fund (CWSRF)
AL	Drinking Water State Revolving Fund (DWSRF)
AL	USDA RUS Water and Wastewater Disposal Loans and Grants
GA	Equity Fund Program
GA	USDA RUS Water and Wastewater Disposal Loans and Grants
GA	Drinking Water State Revolving Loan Fund
GA	Georgia Fund Loan Program
GA	Appalachian Regional Commission Grant Program
GA	Public Works Program (EDA)
GA	Community Development Block Grant (CDBG)
KY	Waste Water Revolving Loan Fund (Fund A) (SRF-CW)
KY	Community Development Block Grant: Kentucky Small Cities (Public Facilities)
KY	Drinking Water State Revolving Fund (SRF-DW)
KY	USDA RUS Water and Wastewater Disposal Loans and Grants
KY	Interim Finance Program
KY	Flexible Term Finance Program
KY	Public Works Program (EDA)
MD	Appalachian Regional Commission Grant Program
MD	State Revolving Fund Loan Programs: Drinking Water Revolving Loan Fund
MD	State Revolving Fund Loan Programs: Water Quality Revolving Loan Fund
MD	Public Works Program (EDA)
MS	Water Pollution Control (Clean Water) Revolving Loan Fund Program
MS	Community Development Block Grant Program: Public Facilities

MS	Capital Improvements Revolving Loan Program
NC	Public Works Program (EDA)
NC	Community Development Block Grant Program
NC	Supplemental Grants Program
NC	North Carolina Clean Water Management Trust Fund
NC	Unsewered Communities Grants Program
NC	Appalachian Regional Commission Grant Program
NC	Drinking Water State Revolving Fund Program
NC	NC Revolving Loan and Grant Program: High Unit Cost Fund; Drinking Water
NC	CWSRF
NC	Rural Center's Unsewered Communities, Supplemental Grants, & Capacity Building
NC	Small Cities CDBG
NY	CWSRF
NY	USDA RUS Water and Wastewater Disposal Loans and Grants
NY	Public Works Program (EDA)
NY	Drinking Water State Revolving Fund
OH	Water Supply Revolving Loan Account
OH	USDA Water and Wastewater Disposal Loans and Grants
OH	Small Cities CDBG
OH	Public Works Program (EDA)
OH	Programs under Ohio Water Development Authority
OH	OPWC State Capital Improvements Program
OH	Water and Sanitary Sewer Program (CDBG)
OH	Water Pollution Control Loan Fund Program
OH	OWDA Master Program: Fresh Water Fund
OH	Drinking Water Assistance Fund Program
PA	USDA Water and Wastewater Disposal Loans and Grants
PA	Clean Water State Revolving Fund (Federal Source)
PA	Drinking Water State Revolving Fund (Federal Source)
PA	Appalachian Regional Commission Grant Program
PA	USDA RUS Water and Wastewater Disposal Loans and Grants
SC	Appalachian Regional Commission Grant Program
SC	USDA Water and Wastewater Disposal Loans and Grants
SC	Public Works Program (EDA)
SC	Community Development Block Grant Program
SC	Budget and Control Board Grant Program
SC	Clean Water State Revolving Fund
SC	Drinking Water State Revolving Fund
SC	Drinking Water State Revolving Fund
SC	Clean Water State Revolving Fund
TN	Community Development Block Grant Program
TN	Appalachian Regional Commission Grant Program
TN	Clean Water State Revolving Fund Loan Program

TN	USDA RUS Water and Wastewater Disposal Loans and Grants
TN	Drinking Water State Revolving Fund Loan Program
TN	Clean Water State Revolving Fund Loan Program
TN	Public Works Program (EDA)
VA	Public Works Program (EDA)
VA	USDA Water and Wastewater Disposal Loans and Grants
VA	VA Pooled Financing Program
VA	Wastewater Revolving Loan Fund Program (CWSRF)
VA	Drinking Water State Revolving Fund Program
VA	Self-Help Virginia Program
WV	CWSRF
WV	Small Cities CDBG
WV	Low Interest Loan Program - Clean Water State Revolving Fund
WV	Appalachian Regional Commission Grant Program
WV	West Virginia Infrastructure & Jobs Development Loan Program
WV	West Virginia Water Development Authority Loan Programs

Definitions and Scope of ARC Region

For the purposes of this survey, **water and sewer infrastructure capital needs** refer to the capital projects and investments needed to provide households in communities with drinking water and wastewater treatment services. Projects include costs related to new facilities and upgrading or replacing outdated facilities. Projects include both centralized facilities (distribution lines, treatment plants, etc.) as well as decentralized facilities (septic tanks).

Many questions in this survey call for answers about communities and counties in the Appalachian Regional Commission (ARC) region. That region and the counties included in it are shown in the ARC map online at:
http://www.efc.unc.edu/projects/ARC_project/ARC%20region.pdf

Definitions and Scope of ARC Region

We define "public funding assistance" as grants or below-market loans financed by state or federal revenues. Roughly, what percentage of water/wastewater service providers in your state do you think are able to meet their upcoming needs without public funding assistance? (Click on one choice)

	Response Percent	Response Total
0-20% (most need public assistance funding)	40.3%	29
20-40%	**41.7%**	**30**
41-60%	12.5%	9
61-80%	5.6%	4
80-100% (very few need	0%	0

public funding assistance)		
Total Respondents		**72**
(No Response)		**5**

What percentage of communities within the ARC region in your jurisdiction do you think are able to meet their needs without public funding assistance?

	Response Percent	Response Total
0-20% (most need public assistance funding)	**64.8%**	**46**
20-40%	23.9%	17
41-60%	7%	5
61-80%	4.2%	3
80-100% (very few need public funding assistance)	0%	0
Total Respondents		**71**
(No Response)		**6**

In general, do you think the communities within the ARC region have a higher ratio of needs (infrastructural) to available resources than other communities throughout your state? (For information on which counties in your state are within the ARC region, see map at: http://www.efc.unc.edu/projects/ARC_project/ARC%20region.pdf)

	Response Percent	Response Total
Yes	**53.4%**	**39**
No	46.6%	34
Total Respondents		**73**
(No Response)		**4**

There have been a series of recent national and state-wide reports highlighting water and wastewater infrastructure capital needs and the funding gaps facing communities in paying for those needs. The list below indicates some of the more prominent studies and surveys.
If you are familiar with the survey or study, please give your opinion about the accuracy of their needs estimates for your region:

	0 - Substantially Under-estimates Your Needs	**1 - Somewhat Under-estimates Your Needs**	**2 - Accurately Estimates Your Needs**	**3 - Somewhat Over-estimates Your Needs**	**4 - Substantially Over-estimates Your Needs**	**Familiar, but no opinion**	**Not Familiar With**
EPA Drinking Water Needs Survey	15% (8)	20% (11)	15% (8)	4% (2)	2% (1)	15% (8)	**31% (17)**
EPA Clean Watershed Needs Survey	9% (5)	21% (12)	12% (7)	2% (1)	2% (1)	12% (7)	**41% (23)**
EPA Gap Analysis	6% (3)	9% (5)	8% (4)	6% (3)	0% (0)	19% (10)	**53% (28)**
AWWA Gap Analysis	2% (1)	4% (2)	4% (2)	2% (1)	0% (0)	15% (8)	**73% (38)**
Total Respondents							**56**
(No Response)							**21**

Does your state have a water and wastewater needs survey separate from the EPA needs surveys listed above? If yes, please identify below.

Total Respondents 51

•Not yet, but we are in the process of developing one just for the drinking water systems.
•Yes. Wastewater needs survey conducted by EFC.
•NYS Department of Health produced a Needs survey, but the last I saw included the needs of existing systems. A big gap is in assessing the needs to create new water systems, and extensions to existing systems, in rural hamlets and villages.
•Yes - Prepared by the NYSDOH with input from other Agencies
•NC Rural Economic Development Center
•The annual Project Priority is a better gage of the short term need assessment. It typically provides a realistic 5 to 7 year view of what the real capital needs are.

•West Virginia Infrastructure and Jobs Development Council Public Water/Wastewater Inventory and Needs Assessment Report - 2002
•Virginia Regional Coalfields Water Study. A separate Regional Coalfields Sewer Study is in the process of funding and the study should begin within the next 8 months.
•Yes. The TN Advisory Commission on Intergovernmental Relations conducts an infrastructure needs survey.
•Yes can be found at www.state.tn.us/tacir/publications.htm
•Maryland Department of Planning Infrastructure Survey
•One is currently being developed and should be done later this year.
•Kentucky Infrastructure Authority $ 1.7 billion for 0 to 2 year projects
•One survey, performed in 1996, by the NC Rural Center
•Yes. Infrastructure & Jobs Development Council Has an assessment study completed once every three years.
•Rural Center did a study some years ago.
•Yes, NC Rural Economic Development Center's Water 2030 Initiative (now underway)
•Ohio Public Works Commission's Capital Improvement Reports
•Every three years the WV Infrastructure Council conducts an inventory and needs assessment of all the water and sewer utilities in the state. These have been issued 1996, 1999, 2002 and the next in 2005.
•Multiple local/regional assessments, some by government and others by interest organizations. I've not seen a comprehensive state survey in some time.
•No; the Mississippi State Department of Health is currently developing a survey instrument.
•WRIS (Water Resource Information System) database populated by Area Water Management Councils (geographically based with Area Development District (ADD). Councils are responsible for coordinating with local constituents to determine local need. Fifteen ADD's combine information to create state's need for both water and wastewater.

(No Response) **26**

For the state program above (if you listed one in question 10), please give your opinion about the accuracy of their needs estimates for your region:

	0 - Substantially Under-estimates Your Needs	**1 - Somewhat Under-estimates Your Needs**	**2 - Accurately Estimates Your Needs**	**3 - Somewhat Over-estimates Your Needs**	**4 - Substantially Over-estimates Your Needs**
State Survey	0% (0)	26% (5)	**58% (11)**	16% (3)	0% (0)
Total Respondents					**19**
(No Response)					**58**

Is your funding program/organization involved in documenting capital needs in the ARC region?		
	Response Percent	**Response Total**
Yes	**50.8%**	**33**
No	49.2%	32
Total Respondents		**65**
(No Response)		**12**

Please rate the following factors in terms of their impact on preventing communities from accessing funds to meet their capital needs.

	0 - No Impact on Accessing Funds	**1 - Minor Impact on Accessing Funds**	**2 - Major Impact on Accessing Funds**	**No Opinion**	**Do Not Know**	**Response Average**
Inability of customers to pay rates that would be needed to cover full cost of their service	2% (1)	20% (13)	**68% (45)**	5% (3)	6% (4)	**2.94**
Lack of willingness to charge customers more	0% (0)	31% (21)	**61% (41)**	3% (2)	4% (3)	**2.81**
Too small a customer base	2% (1)	21% (14)	**64% (42)**	9% (6)	5% (3)	**2.94**
Lack of grant assistance	3% (2)	18% (12)	**73% (48)**	3% (2)	3% (2)	**2.85**
Lack of capital funds in general	3% (2)	40% (27)	**48% (32)**	3% (2)	6% (4)	**2.69**
Communities do not know about existing public assistance programs	18% (12)	**62% (41)**	9% (6)	6% (4)	5% (3)	**2.17**
Total Respondents						**68**
(No Response)						**9**

Are there other obstacles (not listed in question 13) that prevent communities from accessing funds to meet their capital needs? If so, please specify.

Total Respondents **24**

- Board members of public water systems are complacent in their thinking. They believe that everything is fine and that periodic/needed improvements are not necessary. In reality, most of those systems have possible problems with treatment, source, and/or distribution.

- Meeting different state and federal agency program and policy requirements in "packaging" joint assistance from those sources.
- Most communities have no budgets to plan, hire engineers to design, or hire grant writers to apply for assistance. Therefore it takes them a long time to get off the ground. Their governing boards tend to be very conservative about spending public money, and therefore will not opt for a solution that does not include a great percentage of grant funds.
- Lack of institutional capacity, lack of strategic planning capacity, need major technical assistance to expedite application processes
- Lack of capital reserve funds
- In some cases, local politics prevent communities from coming together to solve water and wastewater needs on a more regional basis. This would help to provide economies of scale to expensive projects and help to keep rates more affordable.
- Our state has a large number of small communities that each have their own systems. More cooperation and consolidation would help.
- Most grant programs require job creation or retention, and many counties need infrastructure for development, but don't have documented jobs, so they cannot access federal grant programs.
- Competition from other communities political favoritism general topography increasing costs
- Lack of competent technical assistance to help some areas of local government.
- Unwilling to raise rates by cities or towns. Last option for most and wait for State or Funding Agency to force rate increase.
- Debt levels incurred to serve large water-using industries that have closed and left significant gaps in the cash flow from the user base--debt levels are higher than supportable with remaining users and restrict ability to incur additional debt to meet mandated improvements
- Some communities simply lack capacity development (FMIT expertise)
- Unwillingness to take on debt.
- Insufficient knowledge at community level of available sources of funding. Some public officials unwilling to undertake major improvement projects that place a financial burden on community.
- Difficulty in understanding all of the required documentation and federal and state rules for obtaining the money. "Too many hoops to jump through."
- Lack of up front local funds needed to prepare the initial planning documents and loan/grant applications required to obtain loans or grants.
- Don't know how to access funds, documenting needs, preparing applications that can be complicated. Also, don't do adequate long range planning of operation and maintenance needs.

(No Response)	**53**

Views On Capital Financial Management Strategies

How much effect do you think each of the following strategies would have in helping communities in the ARC region meet their infrastructure capital needs?

	0 - No Effect At All	**1 - A Small Effect**	**2 - A Moderate Effect**	**3 - A Large Effect**	**Response Total**
Consolidation/regionalization of utilities	0% (0)	9% (6)	**59% (40)**	32% (22)	**68**
Increasing amount of available subsidized loans (rates/terms below market rate)	3% (2)	25% (17)	34% (23)	**38% (26)**	**68**
Increasing amount of available grant funds	3% (2)	3% (2)	13% (9)	**81% (55)**	**68**
Increasing access to commercial capital funds	17% (11)	**49% (32)**	29% (19)	5% (3)	**65**
Financial assistance to help low income customers pay bills	6% (4)	33% (22)	**36% (24)**	25% (17)	**67**
Easier pairing of multiple financing sources	3% (2)	32% (22)	**35% (24)**	29% (20)	**68**
Setting rates to reflect full cost of service	5% (3)	31% (20)	29% (19)	**35% (23)**	**65**
Technical assistance to help communities reduce their costs	1% (1)	**44% (30)**	31% (21)	24% (16)	**68**
Improved asset management	3% (2)	32% (22)	**40% (27)**	25% (17)	**68**
Increase economic status of communities	0% (0)	14% (9)	41% (27)	**45% (30)**	**66**
Reduce the environmental regulations and standards communities are required to meet	8% (5)	**48% (32)**	27% (18)	17% (11)	**66**
Total Respondents					**68**
(No Response)					**9**

If you think there are other strategies that can help communities in the ARC region meet their infrastructure capital needs, please describe below.

Total Respondents 15

- Increased use of alternative and experimental infrastructure systems
- Environmental Management Systems Tax credits for investors that provide funds to communities that demonstrate excellence in water sustainability. More access to private activity tax exempt financing.
- Additional training & technical assistance.
- Encourage self-help with major federal grant programs.
- Long term capital improvement planning. Too many communities don't know or have a vision for the future of their communities
- Alternative ways to meet discharge requirements i.e., cluster system, package plants
- Generally speaking, water rates in the ARC areas are the highest in the state. They have maxed out on their potential to incur debt. Other areas have not - lack of leadership, understanding and political will are reasons why.
- Operating grants to allow local government to contract for the necessary expertise to meet capacity development standards
- 1. Decreasing water loss 2. Better billing system technology 3. 100% metering of customers 4. Higher tap-on fees
- Electronic application process which would serve as the "pre-application" for all state/federal grant and loan dollars within a state. Additional information needed by individual funding sources could be asked for after initial pre-screening of pre-application.

(No Response) 62

Do any of your programs provide incentives or otherwise foster any of the following strategies?

	Yes	No	Do Not Know	Response Total
Consolidation/regionalization of utilities	**75% (51)**	24% (16)	1% (1)	**68**
Setting rates to reflect full cost of service	**50% (33)**	41% (27)	9% (6)	**66**
Technical assistance to help communities reduce their costs	**65% (44)**	28% (19)	7% (5)	**68**
Total Respondents				**68**
(No Response)				**9**

What do you think a funding program's role should be in promoting or providing incentives to encourage specific capital financial management strategies?		
	Response Percent	**Response Total**
Funding programs should strongly promote specific strategies	41.8%	28
Funding programs should do some promotion of specific strategies	**50.7**%	**34**
Funding programs have no role in promoting specific strategies. It's "not our business"	7.5%	5
Total Respondents		**67**
(No Response)		**10**

What methods do you use to work with other funding programs? Please select all applicable choices.		
	Response Percent	**Response Total**
Informal discussions	**94.1**%	**64**
Shared databases or information	55.9%	38
Part of an infrastructure coordination organization	52.9%	36
Rely on shared application forms	17.6%	12
Total Respondents		**68**
(No Response)		**9**

What are your thoughts about the current level of funding coordination between different funding programs?		
	Response Percent	**Response Total**
I would like to see funding coordination increase	47.1%	32
Funding coordination is sufficient	**52.9**%	**36**
There is too much funding coordination	0%	0
Total Respondents		**68**
(No Response)		**9**

Program Specific Information

Name of funding program.

86 programs responded to this section - 64 answered the first program section, and 22 answered the second.

Total Respondents	**86**
(No Response)	**13**

Compared to other available public funding assistance programs, how important do you think this program is to communities within the ARC counties?

	Response Percent	Response Total
0 - Not At All Important	1%	1
What are your thoughts about the current level of funding coordination between different funding programs? 1 - Somewhat Important	27%	24
2 - Very Important	**72%**	**62**
Total Respondents		**87**
(No Response)		**12**

Does your program specifically target assistance to distressed or financially disadvantaged communities over non-distressed communities?

	Response Percent	Response Total
Yes	**70%**	**59**
No	30%	27
Total Respondents		**86**
(No Response)		**13**

Please rate how the following obstacles impact the ability of your program to provide funding to the most distressed/disadvantaged communities in your region.

	0 - Not An Obstacle	1 - A Minor Obstacle	2 - A Major Obstacle	No Opinion	Do Not Know
Difficulty completing application process	38% (32)	**53% (47)**	7% (5)	2% (2)	0% (0)
Inability to offer	40% (33)	10% (9)	**48% (41)**	3% (5)	0% (0)

communities grants						
Timing constraints (application deadlines, funding deadlines)	**51% (44)**	41% (36)	6% (4)	2% (2)	0% (0)	
Eligibility criteria	44% (38)	**39% (33)**	13% (11)	4% (3)	0% (0)	
Total Respondents						**88**
(No Response)						**12**

Does your program have other obstacles (not listed in previous question) to providing funding to the most distressed/ disadvantaged communities in your region? Please specify.

Total Respondents 40

- Program is only available to systems having a major emergency thereby having a major effect on the public health of the community.
- For our program, the area served must be at least 51 % low and moderate income
- Always more demand than available resources provided.
- Inadequate grant allocation to meet "affordability" to user.
- THE NEED TO DEMONSTRATE ECONOMIC IMPACT (JOB CREATION AND PRIVATE INVESTMENT)
- The 1.15x Debt Service Coverage Ratio Guideline for Bonds Issued with a Revenue Pledge as Security for the Loan. This excess coverage ratio may be a challenge to the most distressed communities.
- Our Agency does have a comprehensive set of guidelines, regulations, and policies that sometimes hamper the level of assistance we are able to offer, also there are specific criteria for professional services and construction as related documents required.
- There are no real obstacles over all. However, the program is not set up specifically to assist distressed/disadvantages communities.
- These communities tend to have volunteer boards who lack the sophistication to adequately deal with these types of projects/funding programs.
- There are not enough funds to do what needs to be done.
- Current critical need - community must have a current problem; we cannot fund proactive projects meant to prevent a problem, under the bond language
- Demonstrated ability to repay loan willingness to incur debt for project
- Public Service Commission (Regulates Utilities User rates and issues certificates of approval for new construction) allowed 270 days to give final approval for projects.
- Lack of grant funds to provide the level they need.
- Application requires that 70% of beneficiaries or households must be low and moderate-income (80% or less of the median income of the county)
- Inability of communities to meet minimum matching requirements. ARC &

state distressed criteria are different
- We have been trying since 1995 to have Congress authorize principal subsidy (e.g., blended grants and loans) from the Clean Water SRFs in much the same way that the Drinking Water SRFs can do.
- Lack of willingness to increase user rates if necessary.
- In order for any community in our state to receive subsidized loan from the DWSRF program, the system must be charging 1.25% of the community's 2000 MHI for 6000 gallons of water per month. Many communities are very reluctant to increase their water rates high enough to meet this criteria.
- To clarify #24 - we can offer grants, but we have limited grant funding, so some communities get less grant than we would like to see, or no grants even though they are eligible because they are not as disadvantaged as other competing communities.
- Grant funds are limited
- Must show economic impact of the project.
- Our grants are exclusively tied to private sector job creation and investment.
- The project must create a significant number of jobs and result in significant private sector investment in order to be competitive. Local share must be available and on-hand.
- Program is only available to systems having a major emergency thereby having a major effect on the public health of the community.
- DOCUMENTING THE ECONOMIC IMPACT (JOBS CREATION AND PRIVATE INVESTMENT) FOR INVESTMENT TO BE COMPETITIVE FOR FAVORABLE FUNDING CONSIDERATION
- These communities tend to have volunteer boards who lack the sophistication to adequately deal with these types of projects/funding programs.
- The ability of the community to access other funds to complete project funding.
- Our CWSRF program does not loan money to distressed/disadvantaged communities.

(No Response) **46**

Is affordability factored into funding decisions for your program?

	Response Percent	Response Total
Yes	**76%**	**67**
No	24%	21
Total Respondents		**88**
(No Response)		**12**

Do you have a definition of "affordable rates" that you use in making funding decisions?		
	Response Percent	**Response Total**
Yes	**54%**	**48**
No	46%	39
Total Respondents		**87**
(No Response)		**12**

Does your program include a condition that would require rates to be increased or set at a certain level in order to qualify for funds?		
	Response Percent	**Response Total**
Yes	**52%**	**46**
No	48%	41
Total Respondents		**87**
(No Response)		**13**

How well do you believe your system of addressing affordability actually works to target funding to most disadvantaged/distressed communities?		
	Response Percent	**Response Total**
0 - Does Not Work At All	3%	2
1 - Works Somewhat Well	**54%**	**41**
2 - Works Very Well	43%	31
Total Respondents		**74**
(No Response)		**17**

Do you have any general comments on affordability? **32**

- Affordability in our programs is reflected in a distressed generated maximum grant rate, not utility rate. Policy wise, the intent is not to exceed 50% of total cost but can go to max of 80% by law. This is a discretionary program targeted to creating jobs not fixing infrastructure.
- Sometimes based upon how badly the community wants "service"
- Affordability is way down on the list of important project evaluation criteria. The first hurdles should be severity of the threat to public health, water quality impact, and effectiveness of the proposed project to solve the problem. Once it is clear what those priorities are then seeking the most affordable financing mechanism is used to fund every project.
- Although we have a well documented set of water and sewer rates to use as a

guide to help communities not only establish a rate structure but also allow the Agency to provide grant assistance, these are the communities that are the most economically challenged. Their citizens are faced with lower wage jobs than urbanized areas and unemployment is typically higher...these are the people that pay the most for water and sewer. The more dense the population, the greater the economies of scale and the lower the utility bills for customers. Citizens of the coalfields don't have the same abilities to have vast economies of scale.

- This is a hard issue to consider when reviewing applications. Each project has different needs or issues involved which will affect rates/affordability. Our program is a grant program and therefore, rates are driven by other funding sources that provide loan funds.
- We calculate an affordable rate based on a lot of demographic criteria at the county level based on census data. From there we calculate where the project cost would put them relative to that rate. We lower the interest rate from a county cap rate (3/4 of the state GO Bond rate) down to 1% minimum, until they meet the target rate. If they still need additional help, we target state grant funds (limited) to those areas with 250 Households or less (where the $$s will have the most impact). If needed, we will extend the term from 240 months up to 360 months.
- Affordability is based on projections. If the true "flow" is not met, then revenues will not be forthcoming that may impair the system's ability to pay debts.
- 1.5% of MHI is the benchmark used for water and sewer systems as an upper limit for affordability If rates are higher on average bill (4500 gallon usage per month) Community is considered for low interest loans and/or grant funding.
- Grant monies should not be used to subsidize rates for localities lacking the political will to raise rates when others have. Grant monies should only be used after the ability to incur debt has been maximized.
- We look at similar systems to assure they have rates at reasonable level as compared to other systems in area.
- Our SRF program has specific provisions for reduced interest rates and loan forgiveness and our grant programs are integrated with SRF - same agency administers
- We do not specifically target disadvantaged communities. However, it we do have criteria for disadvantaged communities that, if met, allows for a lower interest rate.
- In our state, the rate structure is based on usage. The usage has declined to an average of about 4000 gallons / household; therefore we are looking at the rate for 4000 gallons and the affordability criteria is set to that rate. Also a community cannot artificially raise rates to the "target" just to qualify - we prefer a cash flow based on their financial report and consider "remaining cash" and coverage requirements.
- Affordability also encompasses the cost of facilities, i.e., appropriate technology.
- Our affordability target user rate/yr is 1% of Median Household Income, which is on the lower end. Communities with user rates exceeding the target rate qualify for additional subsidies.
- We have seen that those communities who increase their rates to get a subsidized or 0% loan, generate enough revenue to get the system out of the hole

and often times generate enough funds to afford a market rate loan in the future.

- Our programs are to create economic development....not affordable rates.
- We calculate an affordable rate based on a lot of demographic criteria at the county level based on census data. From there we calculate where the project cost would put them relative to that rate. We lower the interest rate from a county cap rate (3/4 of the state GO Bond rate) down to 1% minimum, until they meet the target rate. If they still need additional help, we target state grant funds (limited) to those areas with 250 Households or less (where the $$s will have the most impact). If needed we will extend the term from 240 months up to 360 months.
- Our program does not factor in the rates and fees for a water or sewer system. We target distressed communities by giving points for economic condition, and for job creation or retention
- Communities with user rates higher than the affordability target are eligible to receive additional subsidies including loan forgiveness.
- As long as a community can afford the debt, they will be offered a CWSRF loan at 3%.

(No Response) **52**

If your organization decided it wanted to enact policies that would increase public funding assistance to distressed communities, how difficult would it be to make the administrative changes needed?

	Response Percent	Response Total
0 - Very Difficult	13%	13
1 - Somewhat Difficult	41%	34
2 - Not at all Difficult	**46%**	**38**
Total Respondents		**85**
(No Response)		**14**

Please indicate the importance of the following decision factors in awarding public funds from your program.

	0 - Not At All Important	**1 - Somewhat Important**	**2 - Very Important**
Economic development impact	29% (27)	32% (28)	**39% (34)**
Public health	2% (2)	28% (24)	**70% (63)**
Environmental quality	2% (2)	34% (31)	**64% (56)**
Regulatory compliance	3% (3)	28% (24)	**69% (62)**
Regional cooperation	12% (10)	**54% (49)**	34% (30)
Inability to access capital from private sources	36% (31)	**36% (33)**	28% (24)
Total Respondents			**89**

(No Response)	**11**

At the time of your last funding cycle, what was the general ratio of requests (completed applications) for your funding versus what is available?

	Response Percent	Response Total
Requested amount was below available funds	7%	7
Requested amount equaled available funds	12%	12
Requested amount was twice available funds	**29%**	**25**
Requested amount was three times available funds	21%	13
Requested amount was more than three times available funds	21%	18
Do not know	6%	5
Not Applicable	10%	9
Total Respondents		**89**
(No Response)		**11**

Special Sub-section for Drinking Water SRF Program Managers

Do you have a program for disadvantaged communities within your Drinking Water SRF Program?

	Response Percent	Response Total
Yes	43%	23
No	**57%**	**30**
Total Respondents		**53**
(No Response)		**24**

Yes, have a Program for Disadvantaged Communities.

How important do you think your program for disadvantaged communities is to helping communities within the ARC region?

	Response Percent	Response Total
0 - Not at all important	0%	0

		Total
0 - Not at all important	0%	0
1 - Somewhat Important	38%	11
2 - Very Important	**62%**	**18**
Total Respondents		**29**
(No Response)		**48**

No Program for Disadvantaged Communities

Are you now considering establishing such a program?

	Response Percent	Response Total
Yes	3%	1
No	**97%**	**29**
Total Respondents		**30**
(No Response)		**47**

If there any specific reasons why you have not set up a program, please describe them below.

Total Respondents **17**

- 1. Maintenance of the fund corpus 2. The availability of a state grant program and other state and federal programs focused on these communities 3. Our ability to assist these communities through other entities 4. Capacity Development objectives.
- Lack of resources to create & maintain.
- Currently drafting rules, program will go into effect by 7/1/05.
- Not covered in enabling legislation.
- In our regular program, we prioritize based on a number of factors, including community size and median household income. The smallest and poorest communities get priority.
- Program funds are grant funds

(No Response) **60**

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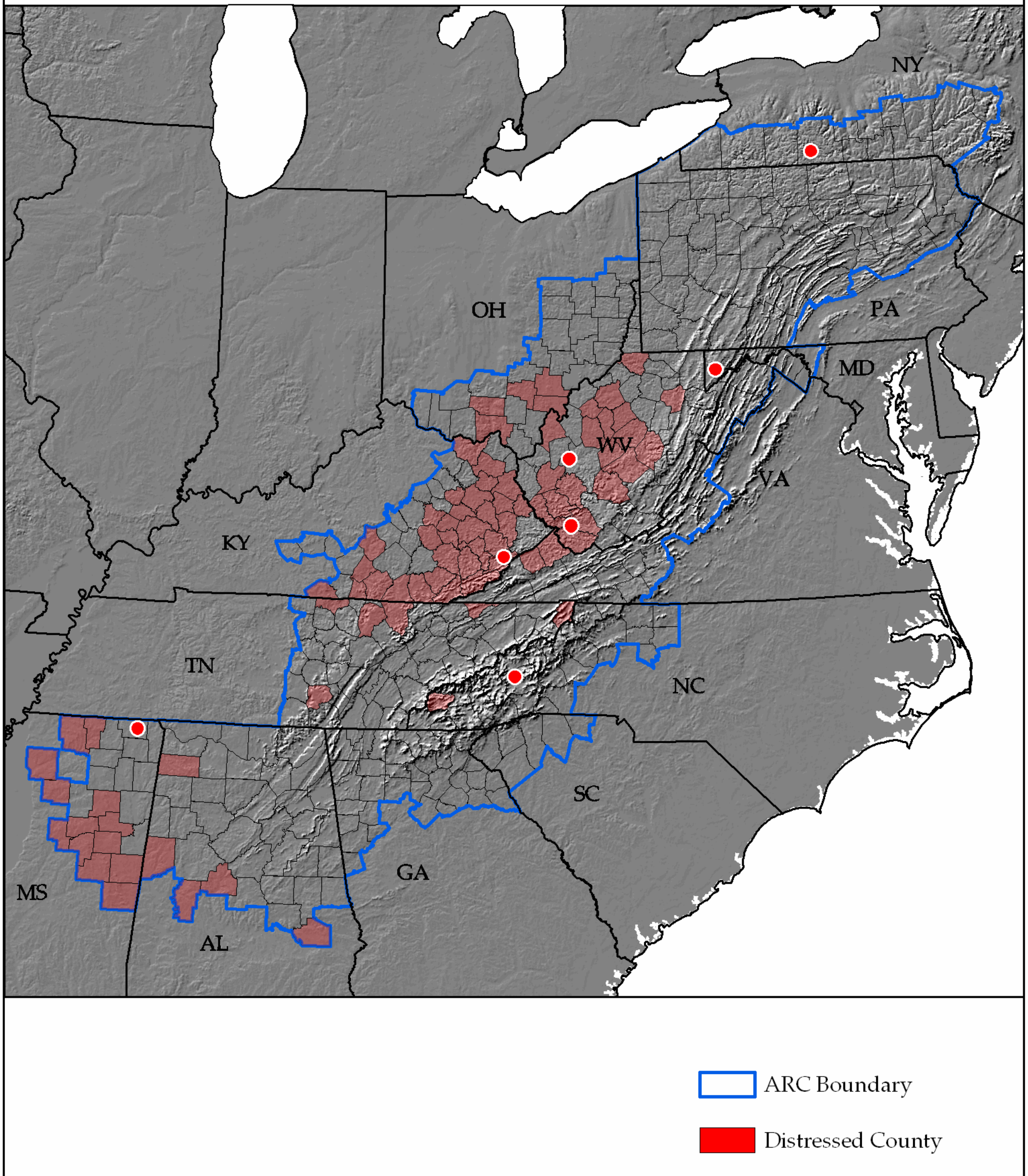
APPENDIX E

Community and System Level Case Studies: Introduction

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 discussed in six case studies.

A selective inventory and case studies of best practices and financial management challenges and strategies are addressed. 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 provided below (refer to Figure E-1) .

Figure E-1. Case Study Site Locations



Data Source: ESRI

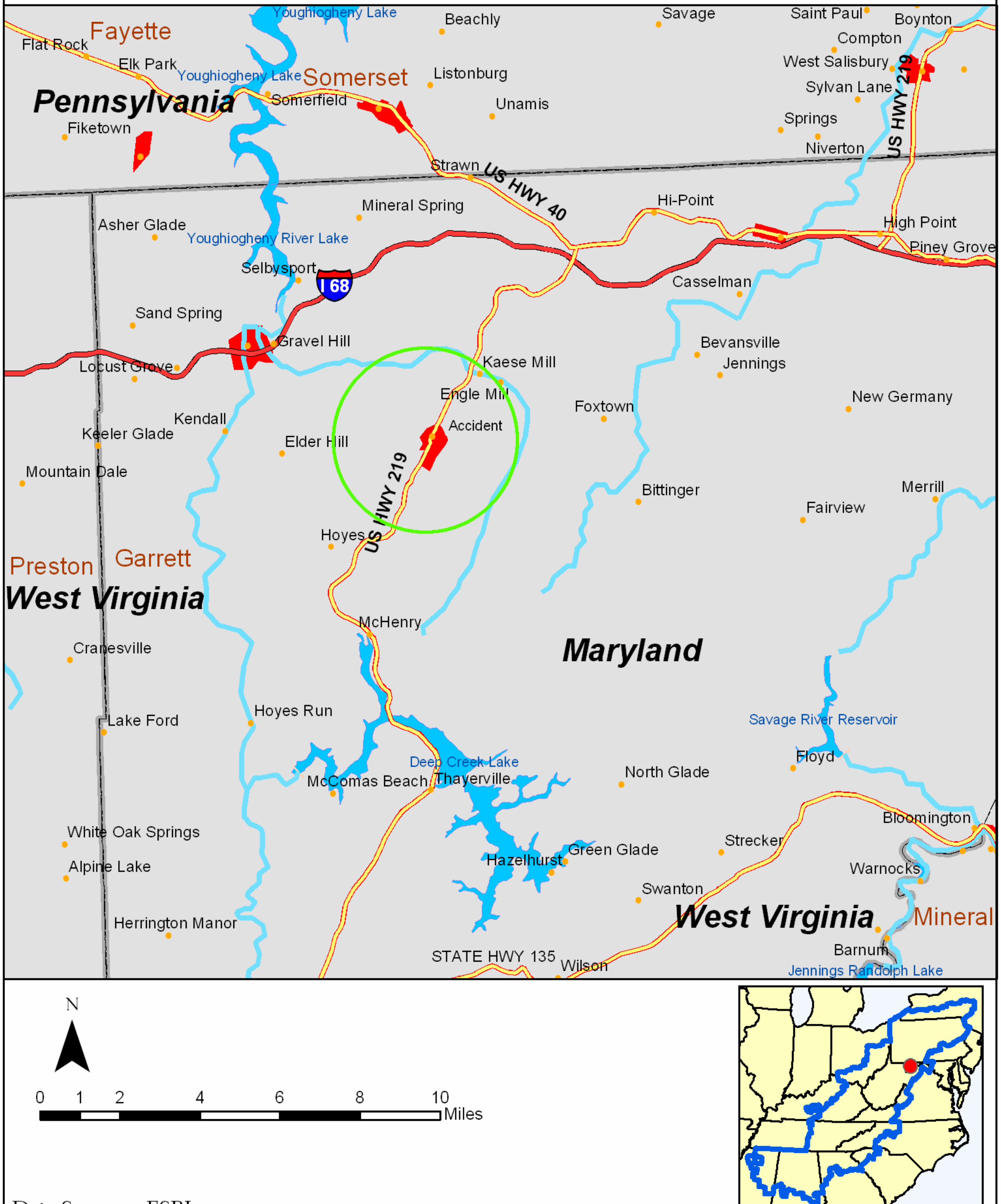
Case Study:
Accident, Maryland

Accident, Maryland, is like numerous other communities in Appalachia: small, very rural, and lacking many of the resources necessary for maintaining basic community services. However, the town has successfully leveraged outside resources, both fiscal and technical, to address its water and wastewater needs. The town has a consent order with the Maryland Department of the Environment because of effluent violations and unmet obligations for completing improvements to its wastewater treatment plant. This case study provides a brief description of Accident and its recent capacity-building efforts (refer to Figure E-2).

Economic Setting

Accident is located in the northeast corner of Garrett County, in the far western end of the state, near the watershed divide between the Upper Potomac and the Youghiogheny river basins. Like many other communities in Appalachia, Accident is agriculturally based. In fact, most of the land in Garrett County is maintained in some form of agricultural use. Accident consists of roughly 0.5 square miles, with one main road and a few secondary streets. Dairy farming is the main source of income for many residents. Other sources of employment are a bank, a country store, a bakery, a laundromat, an elementary school, a church, a car wash, senior citizen facilities, and a gas station.

Figure E-2. Location of Accident, MD, in Garrett County



Data Source : ESRI

Many residents of Accident are retired. The University of Maryland at Frostburg is within commuting distance, so a few students reside in the town. Although Accident has many of the problems typical of communities in Appalachia, including high unemployment and poverty rates and low per capita income, the Appalachian Regional Commission (ARC) considers it a "transitional" community (that is, one that has higher-than-average rates of poverty and unemployment and lower--than-average per capita market income). In 1999 its unemployment rate was 6.8 percent, which was higher than the average rates that year for the United States (4.2 percent) and Maryland (4.4 percent). In 2000 the poverty threshold was $17,603 for a household of four. The poverty rate in Accident that year was 17.5 percent, compared with Maryland at 8.5 percent and the United States at 11.7 percent.[1] The per capita income in 1999 was only $11,950, quite low compared with $25,614 for Maryland and $29,847 nationwide. The median household income that year was $22,500, compared with Maryland at $52,868 and the nation at $41,994.

Population Trends

Accident has a population of about 350, according to the 2000 Census. That represents an increase of only 4 people since the 1990 census. This population trend contrasts with trends in some other communities in Appalachia. For example, in nearby Berkeley County, West Virginia, population growth is the fastest in the state, the county having experienced a 28 percent increase in the last decade. Much of Berkeley County's rapid growth is due to its proximity to Washington, D.C., and its relatively low cost of living. Garrett County and other

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[1] Appalachian Regional Commission, 'The Appalachian Region', www.arc.gov
City-data.com, Accident, Maryland, www.city-data.com/city/Accident-Maryland.html
Calculated from 2000 Census Summary File 3, Table P-87

western Maryland communities have not yet experienced the same growth pressure. Accident is located about 172 miles from Washington, D.C., and 288 miles from Philadelphia and thus is not within commuting distance of these large cities.

Many communities in Appalachia are losing population in response to the reconstruction of the coal mining industry. For example, West Virginia as a whole experienced its greatest reduction in population during the mid-1980s because of declining investments in that industry.[2] In western Maryland, at the industry's peak (between 1900 and 1918), production was between four and five million tons annually.[3] When the industry declined, so did employment rates throughout the region. Decreasing job prospects caused numbers of people, especially younger residents, to leave. As a result of the accompanying decline in their tax base, communities in Appalachia, Accident among them, often have trouble generating the funds necessary to support themselves.

Community Water Infrastructure

Accident is one of a few towns in Garrett County that own and operate their own separate drinking water and wastewater systems. Constructed in 1974, Accident's two systems each serve 197 customers, mostly residential.

The town has the authority to assess taxes, and in 2004 it was considering a tax increase to pay for necessary changes to the system. As might be expected in a

[2] College of Business and Economics, WVU, Brian Lego, Dec. 17, 1999, 'The population roller coaster: WVU releases a century perspective on West Virginia's population'.

[3] Maryland Department of the Environment, 'Abandoned Mine Land Reclamation Program: General Historical Perspective', http://www.mde.state.md.us/Programs/WaterPrograms/MiningInMaryland/MiningInWestMD/index.asp

community where most of the residents are living on low or fixed incomes, there was opposition to the proposed increase.

The utility takes readings from only 150 water meters, with a total of 197 hook-ups. Single meters exist at an apartment complex, a senior citizens home, and a trailer park, each containing multiple lines. The systems are considered small, with both the drinking water and the wastewater system containing about 5 miles of distribution and collection system piping.

The sewer system was partially upgraded in 1994 because of leaks in the lines. The original pipes were made from steel and terra cotta. Terra cotta cracks easily, and when water infiltrates through the cracks, the steel rusts, causing a buildup that further deteriorates the piping.[4] The 1994 repairs included replacing the original pipes with ones made of PVC (polyvinyl chloride), and replacing manholes, castings, and lids.

Because of the physical deterioration of the pipes, inflow and infiltration of stormwater into the sewer pipelines has been the wastewater system's biggest problem. Even after the upgrades in 1994, the system was found to be deficient, with major leaks, illegal tie-ins of roof drains, cracked laterals, and some surface runoff causing pollutant discharge.[5] As a result, the Maryland Department of Education and the town filed a consent order in 2000 requiring the town to correct the problems with its sewage collection lines.

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[4] Traditional Building, Product Report of the Month, Terracotta Restoration, http://www.traditional-building.com/3-terra.htm

[5] USDA Rural Development, 'Earth Day 2003: Town of Accident, MD', www.rurdev.usda.gov/rd/earthdat/2003/md-accident.html

Capital Needs

The consent order was issued because of pollutant discharge into the South Branch of Bear Creek, which is a state-protected waterway. The pollutant discharge was caused by high flow rates into the plant (above its 50,000 gallons per day capacity) from precipitation and melting snow. The violations reported included elevated levels of biochemical oxygen demand, total suspended solids, and fecal coliform counts recorded over nearly four years.

Accident was directed to submit a facilities plan to be approved by the Maryland Department of Education. Once the plan was approved, the town was put on a schedule to complete Phase I and II of the plan and monitor the effectiveness of its efforts. In addition, the town was required to get the department's permission for any connections to the wastewater system above 20 equivalent daily units. Strict penalties were outlined for noncompliance with the consent order. Currently the town is obtaining bids for work to be completed in Phase I of the consent order. The town expects to meet all conditions and complete all updates on schedule.

Future needs of the wastewater system include repair of deteriorating mortar joints and crumbling blocks on the east wall of the plant, repair of fire hydrants at the plant, purchase of laboratory items, and purchase of a stationary emergency generator for backup.

Other possible improvements include a new computer, a new plow, valve replacements, a pick-up truck replacement, and some telemetry units that will allow for remote monitoring, level sensing, and state regulation monitoring. According to the 1999 Drinking Water Needs Survey administered by EPA, the national average need of a groundwater system serving fewer than 500 people is $392,020 over the next twenty years. The 2000 Clean Watersheds Needs Survey estimates that Accident needs $206,000 of the county's $14 million in needs to cover rehabilitation, replacement, and upgrades of the system.

Accident does not have a capital improvement plan. Instead it relies on M. Mullan, the town circuit rider, and the Maryland Rural Development Corporation, for advice. Neither Mr. Mullan nor Mr. Murray nor the Accident town clerk was able to estimate or confirm the town's capital needs for the next twenty years.

Most of the water supply system is designed for residential homes, but there are a few other major users, including the laundromat, the elementary school, and the car wash. Two wells and one above-ground water tank supply the drinking water. The town relies exclusively on the two wells, as there are no back-up sources or intakes. Water is supplied by one well at a time, and the town has not had any problems with supply shortages. On average, 61,000 gallons of water are treated and pumped each day.

The water tank is currently in need of repair. Preliminary engineering assessments are being conducted as part of a process to purchase a new tank (estimated at $285,000). The old tank has been deteriorating because of chemicals such as chlorine and soda ash (sodium carbonate) that are used to treat the water. In 1998 a rubber seal had to be placed inside the tank because of some cracks. To place the seal in the tank, the plant had to drain the tank, repair it, and fill it again. That cost the town roughly $21,300.

Future needs for the drinking water system include replacing the fire hydrant, installing chlorine leak detectors, and replacing the feed system for the soda ash. According to town officials, the only problem associated with the drinking water system in Accident has been related to the tank. Currently there is no identified contamination or pollution of the town's groundwater source.

Community Resources

Accident has limited government resources. The town clerk works only part-time and is single-handedly responsible for bookkeeping and accounting. Mr. Mullan regularly attends town council meetings and helps with the town's proposal writing. He is paid $1,500 a year for his assistance. Mr. Murray provides help with technical aspects of upgrades. He is not in the town budget. The water system has two operators, one full-time and one part-time. Neither has been certified, but according to the town clerk, one is in the process of being certified, as required by the town's current grant agreement with the U.S. Department of Agriculture (USDA).

The operators work on repairs but are not well trained to handle large-scale problems. Therefore the town relies extensively on the Garrett County Sanitary District for technical assistance. The Garrett County Sanitary District operates water and wastewater systems throughout Garrett County.

Because of Accident's limited resources, it has not adopted a maintenance plan, so the systems work on a fix-when-broken policy. The town also has orally agreed with the USDA that the systems will remain municipally owned and governed. The town benefits from owning the plants, for it can control rates.

Water and Sewer Rates

Although residents are quite proud that the town owns and operates its own systems, repairs have been a significant drain on the town's limited fiscal resources. In fact, from 1999 to 2001, the town experienced a funding shortfall for maintaining the wastewater system. Over the last several years, water and wastewater rates in Accident have increased to keep up with rising operating and maintenance expenses (see Table E-1). The town charges each customer for 4,600 gallons of drinking water, whether they use all 4,600 gallons or not. It then charges them for each 1,000 gallons they use above that. As of the last rate increase, effective July 2004, the rates are $14.05 for the 4,600 gallons and $3.25 for each additional 1,000 gallons. The town estimates a 5 percent increase in rates over the next five years.

Table E-1. Rates billed for Drinking Water (DW) and Sewer Water (SW)

Year *	DW rate for 4600 gallons	DW rate per 1000 additional gallons	SW flat rate	SW rate for each 1000 gallons used
1994	10.14	2.20	8.87	1.40
1995	10.14	2.20	8.87	1.40
1996	10.44	2.20	9.14	1.44
1997	10.44	2.20	9.14	1.44
1998	10.44	2.20	9.14	1.44
1999	11.48	2.64	10.05	1.58
2000	11.48	2.64	10.05	1.58
2001	11.48	2.64	10.05	1.58
2002	13.80	3.15	12.05	1.80
2003	13.80	3.15	16.50	2.50
2004	14.05	3.25	19.50	3.25
Projected 2005	14.19	3.28	19.77	3.29
Projected 2006	14.33	3.31	20.04	3.33
Projected 2007	14.47	3.34	20.31	3.37
Projected 2008	14.61	3.37	20.58	3.41
Projected 2009	14.75	3.41	20.87	3.48
Projected 2010	14.89	3.44	21.14	3.52

* Rates from 1994 to 2004 are actual rates. After 2004 rates for DW are estimated to increase by 5% in the next five years and a 7% increase is estimated for SW in the next five years.

The wastewater system has had a slightly higher increase in rates, with an extra increase effective in 2003. Service is billed at a flat monthly minimum rate, plus a separate rate for every 1,000 gallons of wastewater produced. In 2004 the base rate was $19.50, and the rate for each 1,000 gallons was $3.25. A 7 percent increase in rates is expected to occur over the next five years to cover maintenance.

On average, the water pumped to each customer is less than 4,000 gallons a month. It ranges from about 330 gallons billed to a single individual to 9,900 gallons to a household of two with a hot tub.

Wastewater is not metered. Therefore customers are billed the equivalent amount of drinking water metered. The capacity of the system is about 50,000 gallons per month, but the system is generally running above capacity, mainly because of the town's inflow and infiltration problems. The average household bill as a percentage of the median household income for the town is shown in Table E-2.

Table E-2. Percent of Median Household Income (MHI) billed for Both Drinking and Sewer Water over time *

Year	MHI ($) **	Average DW customer billed/year	%MHI	Average SW customer billed/year	%MHI	Combined DW and SW billed %MHI	Percentage increase
1994	21875	121.68	0.56	173.64	0.79	1.35	(n/a)
1995	22000	121.68	0.55	173.64	0.79	1.34	-0.01
1996	22125	125.28	0.57	178.80	0.81	1.37	0.03
1997	22250	125.28	0.56	178.80	0.80	1.37	0.00
1998	22375	125.28	0.56	178.80	0.80	1.36	-0.01
1999	**22500**	137.76	0.61	196.44	0.87	1.49	**0.13**
2000	22625	137.76	0.61	196.44	0.87	1.48	-0.01
2001	22750	137.76	0.61	196.44	0.86	1.47	-0.01
2002	22875	165.60	0.72	231.00	1.01	1.73	**0.26**
2003	23000	165.60	0.72	318.00	1.38	2.10	**0.37**
2004	23125	168.60	0.73	390.00	1.69	2.42	**0.31**
2005	23250	170.28	0.73	395.16	1.70	2.43	0.02
2006	23375	171.96	0.74	400.32	1.71	2.45	0.02
2007	23500	173.64	0.74	405.48	1.73	2.46	0.02
2008	23625	175.32	0.74	410.64	1.74	2.48	0.02
2009	23750	177.00	0.75	417.48	1.76	2.50	0.02
2010	23875	178.68	0.75	422.64	1.77	2.52	0.02

* Based on average water used as 4000 gallons a month per customer.

** MHI are estimated as a linear increase, 1999 is actual data.

The highest increase in rates was in 2003, but 1999, 2002, and 2004 all had above-average increases. The average bill varies little from season to season. The total monthly bill in August 2000 was about 675,000 gallons, and in December 2003, about 750,000 gallons (still, on average, less than 4,000 gallons a month per customer).

Infrastructure Financing

Recently Accident had significant success in obtaining outside funds to finance improvements to its water and wastewater systems. In 2001 it received a grant from the Maryland Department of Education worth $150,000 for improvements to its wastewater system. It has tapped the money four times, and there is a remaining balance of $55,000.

The first payout, $40,000, was to Thrasher Engineering in 2001 to engineer a facility plan. The firm presented three sewer alternative rehabilitation plans, and it performed a smoke test and monitored the flow. In 2002 the town paid $15,000 for engineering design. It paid $40,000 and $15,000 again in 2003 and 2004 for engineering design and process billing, respectively.

In 2004 the town received several additional grants and loans including:

- An ARC grant for $250,000
- A Community Development Block Grant for $500,000
- A USDA Rural Utilities Service grant of $1,210,100
- A USDA Rural Utilities Service loan for $480,000

The USDA loan has a payback term of forty years with a below-market "poverty" interest rate of 4.5 percent. The interest rate is fairly high compared with those on loans provided by the Maryland Department of Education from the state revolving fund (SRF). The standard rate for SRF loans is 1.1 percent, and rates for disadvantaged communities go as low as 0.4 percent.

Impact of Funding Package

The town plans to refinance the loan in a few years. A look at Accident's repayment plan on the loan of $480,000 at various interest rates is instructive (see Table E-3). A market-rate loan at 5.25 percent is compared with the poverty-rate loan of 4.5 percent provided by USDA. Additionally the rates for SRF loans are compared for the actual loan amount and for the total amount of funds provided to the town. SRF loans have twenty-year repayment periods as opposed to the forty-year USDA loan repayment time.

Table E-3. Loan Payments at Different Amounts and Rate *

Loan type	Interest Rate (%)	Loan Amount	Monthly Payments	Per 197 customers	Annual Payment	Per 197 customers
USDA (40 years)	4.50	480000	($2,173.73)	($11.03)	($26,084.71)	($132.41)
USDA (40 years)	4.50	2940100	($13,314.52)	($67.59)	($159,774.29)	($811.04)
Market (20 years)	5.25	2940100	($20,078.99)	($101.92)	($240,947.91)	($1,223.09)
SRF (20 years)	0.40	2940100	($12,771.44)	($64.83)	($153,257.25)	($777.96)

* The actual loan amount to town was $480,000 at a 4.5%APR over 40 years provided by the USDA. The total loan and grant amounts totaled $2.9 million.

The percentage of median household income needed to pay for the drinking water and wastewater needs, plus the loan repayment, can be examined under four scenarios: (1) the actual loan agreement of $480,000 at a 4.5 percent interest rate over the next forty years; (2) a loan of $480,000 at the SRF interest rate of 1.1 percent over the next twenty years; (3) a loan for the full amount needed to fund sewer repairs ($2.9 million) at the SRF interest rate of 0.40 percent over the next twenty years; and (4) a market-rate (5.25 percent) loan for the $2.9 million over the next twenty years (see Table 4). The data projections assume no change in number of customers and no inflation in the next five years. Less than 1 percent of the MHI is needed every year to pay for the actual $480,000 loan; an average of about $132 is billed to each customer every year (see Table E-3).

Table E-4. Percent of Median Household Income (MHI) Billed for Utilities Needed to Pay Back Different Loan Amounts (Loan amounts from Table E-3)

Year	MHI	%MHI (Drink-ing and Sewer)	USDA LOAN %MHI of Loan worth $480,000 (4.5% APR) at an annual payment of: ($26,085)	Total %MHI	SRF RATE %MHI of Loan worth $2,940,100 (0.40% APR) at an annual payment of: ($153,257)	Total %MHI	MARKET RATE %MHI of Loan worth $2,940,100 (5.25% APR) at an annual payment of: ($240,948)	Total %MHI
2004	23125	2.42	0.57	2.99	3.36	5.78	5.29	7.70
2005	23250	2.43	0.57	3.00	3.35	5.78	5.26	7.69
2006	23375	2.45	0.57	3.01	3.33	5.78	5.23	7.68
2007	23500	2.46	0.56	3.03	3.31	5.77	5.20	7.67
2008	23625	2.48	0.56	3.04	3.29	5.77	5.18	7.66
2009	23750	2.50	0.56	3.06	3.28	5.78	5.15	7.65
2010	23875	2.52	0.55	3.07	3.26	5.78	5.12	7.64

The lower interest rate available through an SRF loan of this same amount would not reduce the annual payment per customer, but the life of the loan would be cut in half and hence the loan payment would also be cut in half (see Table E-3). If the total amount of funds that Accident has been able to generate through grants had been all from loans, residents would be paying on average an additional 3.3 percent of their MHI in loan repayments. This would be more than twice the amount that the average customer is paying right now. A higher interest rate (5.25 percent) reveals an even higher burden on the residents (see Table E-4).

Conclusion

Accident is an illustration of a small town dealing with the kinds of financial challenges that are common in Appalachia. Often, not enough revenue can be generated through fees to allow for necessary but costly repairs in the basic infrastructure. Accident has done remarkably well in meeting the challenges through grants and loans, providing a good example of the possibility for small towns to find funds. With only a couple of people managing its systems, the town often finds it difficult to meet all the demands and required improvements. It still lacks a maintenance plan, a capital investment plan, and knowledgeable operators with the proper certification. Nevertheless, Accident is providing the basic utility of water to its citizens and working on resolving its wastewater problems. With the amount of funding it has recently acquired, Accident is on the right track.

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Case Study:
Corinth, Mississippi

Corinth is a small city tucked in the northeast corner of Mississippi, 5 miles from the Tennessee state line and 20 miles from Alabama (refer to Figure E-3). The almost 14,000 residents of the city have a median household income of $23,436, almost $8,000 less than the state average.[6] As the largest city and county seat of Alcorn County, Corinth's 18.9% population increase has been the driving force in the county's 8.9% growth during the last decade.[7] Corinth is an example of an Appalachian community that faces important water infrastructure financing challenges due to population growth pressure, uncertain water resources, and the desire for economic development.

In 1954 the city created the Corinth Public Utilities Commission, a chartered nonprofit organization recognized by the state as a separate governing authority.[8] Although the original intent was that the commission would operate all city utilities, the sewer department remains under the control of the city. Therefore the commission has authority over only the natural gas and water distribution systems, which are operated jointly as the Corinth Gas and Water Department.

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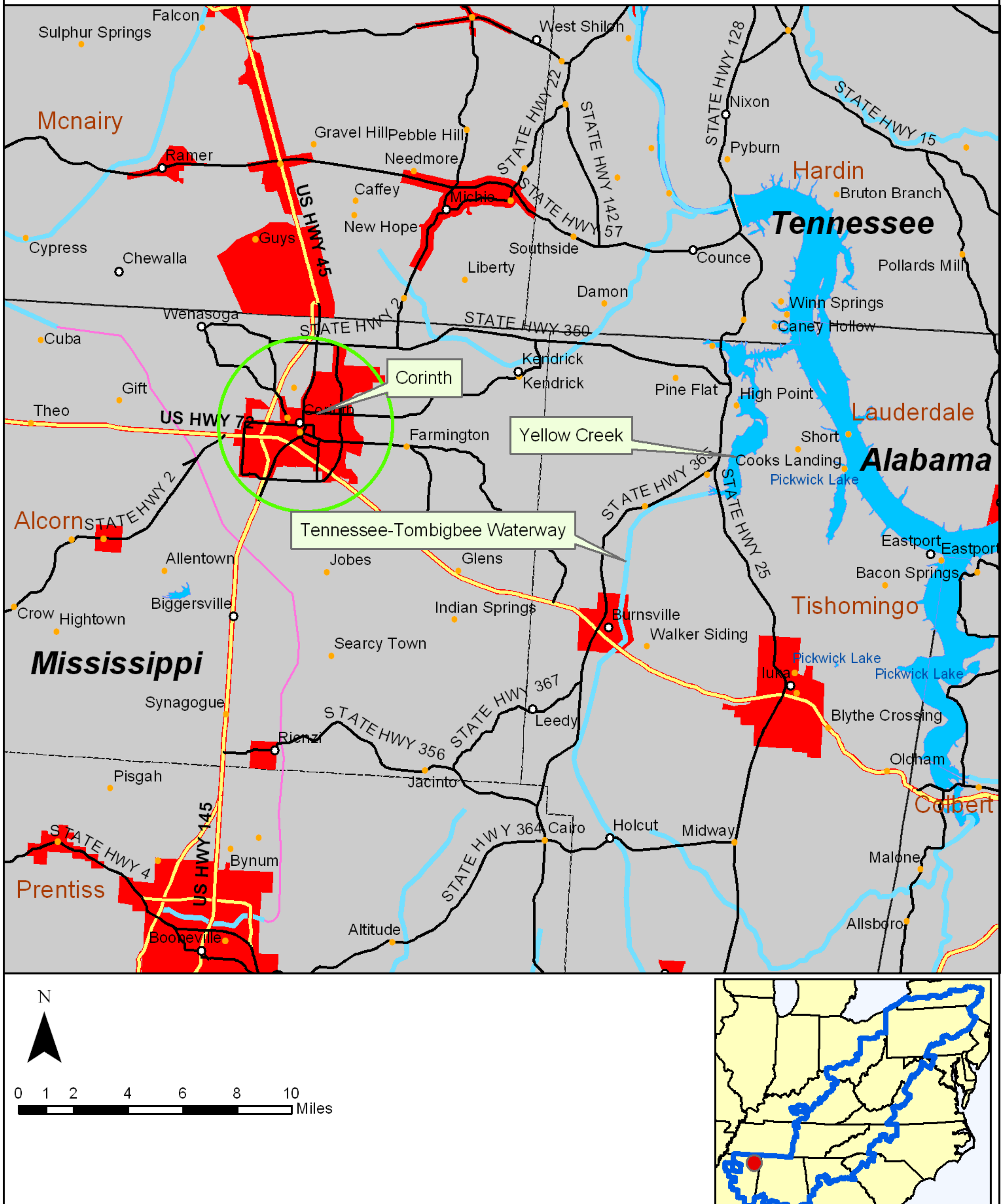
[6] Census Bureau, Census 2000, Summary File 3, Table P53

[7] Census Bureau, Census 1990, Summary Tape File 1, Table P001; Census 2000, Summary File 1, Table P1

[8] Corinth Water and Gas Department website, at www.corinthgasandwater.com.

Figure E-3. Location of Corinth, MS, in Alcorn County



Data Source: ESRI

Drawing groundwater from twelve wells that average 500 feet in depth, the department is the largest water system in the county.[9] Its 7,200 water meters serve 17,500 residents and several large commercial and industrial customers that, combined, withdraw an average of 3 million gallons of water a day from a Paleozoic aquifer.[10] The average Corinth household that uses 5,000 gallons of water a month pays about $15 a month for water service.[11]

The Need for a New Water Source

Beginning in the early 1980s, the Corinth Gas and Water Department sold water to neighboring rural communities and to industries within the city limits. However, by the end of that decade, the department noticed a decline in the water level of its wells and began to monitor withdrawal more frequently. The Mississippi Office of Land and Water Resources now reports that the water level of Corinth's wells is dropping by up to 3 feet each year.[12] Although the physical connection and the meters remain in place, the department no longer provides water to rural communities. However, as Corinth grows and other water systems have drilled additional wells into the aquifer, water continues to be drawn out faster than it can be replenished. The Corinth Public Utilities Commission estimates that with no increase in population, no expansion of service, and no increase in withdrawal rates, the aquifer could provide water for eighty more

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[9] *Ibid.*

[10] Environmental Protection Agency, FY03Q4 SDWIS data frozen January 2004, downloaded from http://www.epa.gov/OGWDW/data/pivottables.html.

[11] Ron Lilly, general manager, Corinth Gas and Water Department, interview, July 2004 and May 2005

[12] Jamie Crawford, Mississippi Department of Environmental Quality, Division of Land and Water, interview, May 2005.

years.[13] However, because of the growth of Corinth and the rural communities, the withdrawal rate has increased over the past decade and is expected to continue to increase. Even after discontinuing service to other communities, the department began to search for a more reliable and permanent water source.

Discussions about Consolidation

Once Corinth Gas and Water became aware of the diminished aquifer in the late 1980s, the department attempted to initiate a dialogue with the rural communities about a partnership. The department pushed for consolidation into a regional supply district to more adequately serve the needs of the tri-county area. However, after thirteen years of discussions, local politics and a lack of financial resources forced the department to withdraw from the discussions and independently plan its water future.

Economic Development

Corinth is home to several corporations, the largest a Kimberly-Clark plant that opened five years ago.[14] Recently the plant planned to implement a new industrial process that would have required 3 million additional gallons of water a day, doubling the department's typical withdrawal. Although hesitant to guarantee that much water, the city was interested in the economic development opportunity. The Corinth Gas and Water Department approached the state about issuing a permit for a new well but was denied because of fears of water shortages. Although the state had no control over the existing municipally owned wells, it threatened to deny new drilling permits in the future if the city

[13] Lilly, interview.

[14] *Ibid.*

accepted Kimberly-Clark's plan. Eventually, Kimberly-Clark bought Scott Paper and altered its plan to draw only an extra 300,000 gallons a day.

After the department was unable to guarantee water to Kimberly-Clark, Corinth realized that its groundwater system would be insufficient to attract other industries. The composition of the Paleozoic aquifer makes it difficult to determine the amount of water remaining in the fissures of the rock. Since water recharges into the Paleozoic aquifer more slowly than it does into other groundwater systems, the department was unable to increase industrial withdrawal without compromising its residential customers' supply of potable water. Because it cannot identify water-filled fissures from the surface, the department has drilled many test wells at a considerable cost but with limited success. Although the wells are currently adequate to address the drinking water needs of the community, Corinth could not consider new economic development opportunities without a more reliable water source.

Ten years ago, Tupelo, a city in nearby Lee County, experienced many of the same economic development concerns as a result of a declining aquifer. It decided to build a surface water plant and 20 miles of pipeline to attract industries. This plant became a model for Corinth.

Corinth's Plan

The Corinth Gas and Water Department is planning to build a new surface water plant that will draw 15 million gallons per day from the Yellow Creek section of the Tennessee-Tombigbee Waterway. The department has bought 70 acres of land on which to build the plant, but the water will first have to be pumped 9 miles across land owned by the Army Corps of Engineers. This creates additional bureaucratic hurdles that have slowed the process. Although there currently are only three surface water plants in Mississippi, the department views this site as the only realistic source of water because the National Park Service owns the nearby Shiloh Civil War battlefield, making digging for additional groundwater more difficult. According to the Corinth Public Utilities Commission, the Tennessee-Tombigbee Waterway "is the only water supply source that will satisfy an unlimited capacity with an unlimited design lifetime to meet the long-term needs of Corinth and Alcorn County."[15] The most recent estimate of the total cost of the undertaking is $26 million, and current plans call for the facility to be operational within six to eight years. This projected cost is slightly under the $29 million quoted by Corinth in the Environmental Protection Agency's 2000 Drinking Water Needs Survey.[16]

The Corinth Gas and Water Department already has withdrawn $250,000 from its reserve fund to cover preliminary engineering costs, purchase land, and gain approval from the Army Corps of Engineers. The remainder of the project's cost will be financed through revenue bonds and small grants, although the department has not yet investigated its potential to procure federal or state grants. The department does have experience with the state revolving fund (SRF) system and is currently using SRF funds to initiate fire protection in a newly annexed area. The city of Corinth will not play a large role in the surface water project, and no revenue from the city or the sewer department will be used to subsidize the new plant.

Corinth Gas and Water expects to generate funds for debt retirement and operating expenses through water sales once the plant is completed. It estimates that the average customer will see rates rise to about $22 per month for 5,000

[15] Associated Press, "City to Tap Tennessee River for Water Supply," *Jackson (Miss.) Clarion-Ledger*, 22 August 2003.

[16] Data from Environmental Protection Agency, *Drinking Water Infrastructure Needs Survey: Second Report to Congress* (Washington, D.C.: EPA, 2001), compiled by UNCEFC.

gallons, an increase of $7.[17] If the full cost of the project is financed with revenue bonds at the market rate of 5.25 percent over a twenty-year timeframe, the department's debt retirement will require annual payments of $2,130,759, almost 100 percent of the department's total operating revenue for water in fiscal year 2003–04. Even if Corinth Gas and Water received a loan from the U.S. Department of Agriculture that could be repaid over forty years, the annual payment would be $1,567,446, more than 70 percent of last year's operating revenue.

Impact on Other Communities

The Farmington Water Association serves 7,365 residents of the neighboring rural towns and draws its water from the same aquifer as the Corinth Gas and Water Department.[18] Since the department stopped providing water, Farmington has made infrastructure improvements and drilled additional wells to provide service to its customers without having to purchase water from other systems. However, the association remains interested in planning for a more reliable water future. As Corinth continues to grow and the department pumps at increasing rates, the Farmington Water Association's ability to draw water for its growing community is being compromised. Although Farmington was one of the communities involved in consolidation discussions, the news that Corinth (the aquifer's largest water consumer) was building a new surface water plant made Farmington back out of consolidation discussions. With Corinth off the aquifer, the rural communities are more likely to depend on it in the future.

[17] Lilly, interview.

[18] Environmental Protection Agency, FY03Q4 SDWIS data frozen January 2004, downloaded from http://www.epa.gov/OGWDW/data/pivottables.html.

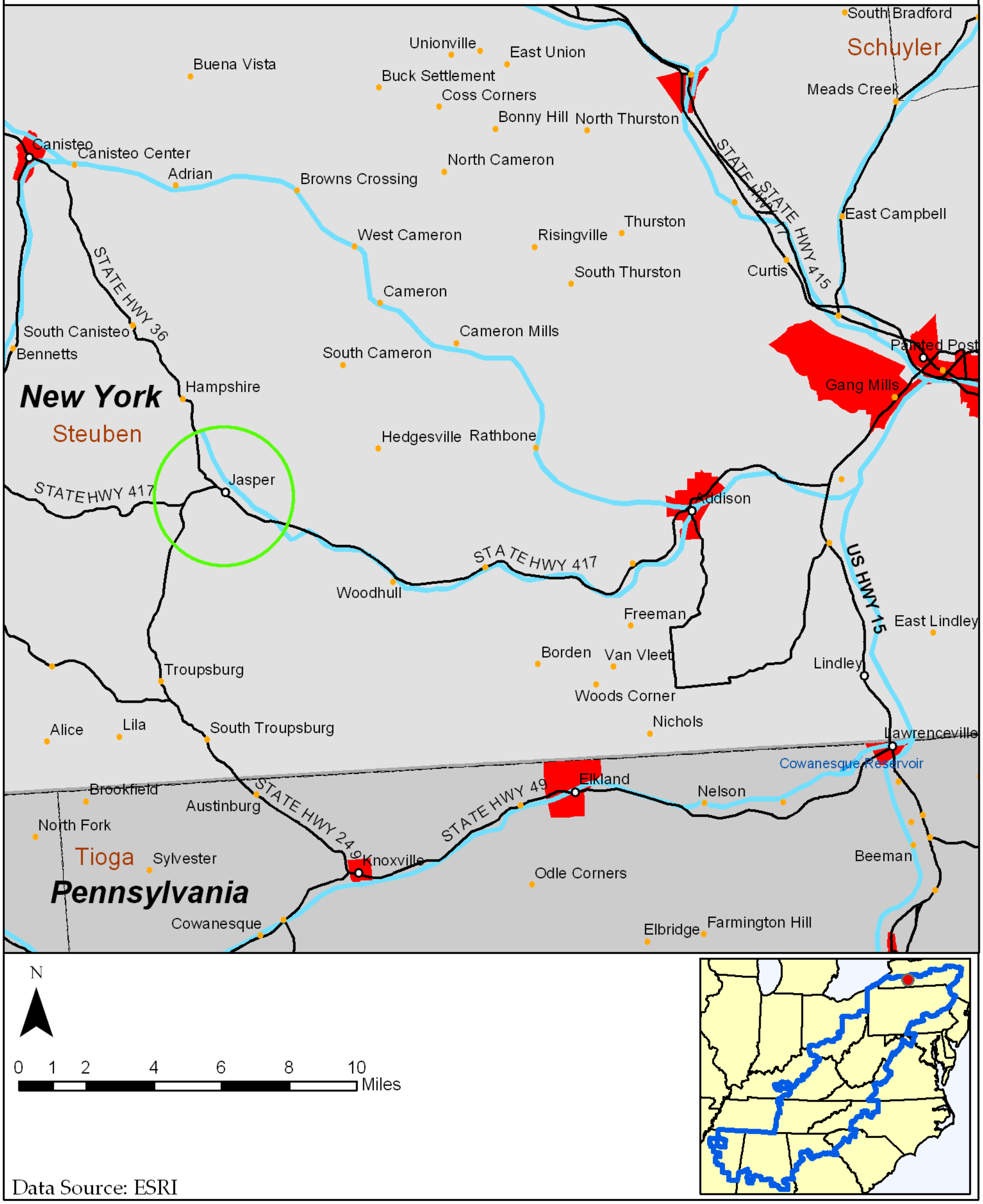
Furthermore, with most of the rural communities already in debt, consideration of consolidation is not currently economically feasible.

The supply volumes and the design criteria of the new surface water project reflect Corinth Gas and Water's belief that, like Tupelo's surface water project, it will eventually evolve into a regional system. To that end, the board of the Corinth Public Utilities Commission passed a resolution to sell wholesale water from the surface water plant to any rural community that exhibits a need. Farmington Water Association officials are not currently concerned with the aquifer level and are waiting to measure the wells once Corinth begins drawing surface water. Corinth's surface water plant is a reprieve for the association's short-term water future, but the association's ability to provide a long-term supply is still unknown.

Case Study:
Jasper, New York

The Hamlet of Jasper, New York, is not unusual for the area: It has no water or wastewater infrastructure, little industry, few high-paying employment opportunities, and few services for residents. All residents and businesses are on septic systems, which in many cases are failing, resulting in public health problems. The lack of infrastructure has had a direct, negative impact on economic development opportunities. In 2000, town officials began a process to build a wastewater system for the community. This case study illustrates their efforts and the importance of early technical assistance, committed leadership and an involved public to the successful completion of infrastructure projects in small rural communities. Municipalities in New York consist of unincorporated Towns (County subdivisions) and incorporated Villages and Cities. Hamlets are population centers within Towns. Although Hamlets have no official designation or authority, they are generally recognized as Town "centers." Towns generally have one or more Hamlets within them. Unless otherwise noted, "Jasper" in this case study refers to the Hamlet of Jasper, a population center within the Town of Jasper (refer to Figure E-4).

Figure E-4. Location of Jasper, NY, in Steuben County



Data Source: ESRI

Background and Demographics

The Town of Jasper is about 10 miles north of the Pennsylvania–New York border in rural southwestern Steuben County. The town's population in the 2000 Census was 1,270. It is located on the Appalachian Plateau and is predominantly agricultural and forested. The region's principal enterprises are agriculture and timber harvesting. Tuscarora Creek runs intermittently 500 feet from the center of Jasper and drains via the Canisteo River into the Chemung and Susquehanna rivers. The water table ranges from 18 to 24 inches below the surface in the hamlet and slopes in the area average 12%. Median household income in the town in 2000 was $33,393. Over 52 percent of the homes were built before 1939, and the average house is worth $47,500.

The wastewater project area is the hamlet, which had a population of 262 in 2002. There are 96 residences and 20 commercial or public buildings in the hamlet. The Jasper Troupsburg High School serves more than 300 students and staff on a daily basis. An income survey completed by the Northeast Rural Community Assistance Program (RCAP) found that 52.8 percent of the residents were of low or very low income according to U.S. Department of Housing and Urban Development guidelines for Steuben County, and 29 percent were below the poverty level. The survey determined Jasper's median household income to be $25,000.

In New York, villages and cities have authority for municipal water and wastewater infrastructure within their borders, although they often provide these services to customers outside their municipal limits. If property owners in unincorporated areas of a town want water or sewer service, they must approve the creation of a special district. In the case of water or sewer, the town administers the system on behalf of district residents. A single town can contain several water or sewer districts, all administered by the town.

The Problem

Like many unincorporated communities in the region, Jasper has never had a municipal water or wastewater system. Residents rely on private wells and septic systems. In many cases the septic systems have outlived their useful life and are failing, resulting in unhealthy conditions due to discharge of raw sewage. In older communities like Jasper, lot sizes are small, and as a result, septic systems are sited close to wells. Thus the potential exists for contamination of drinking water. Because of Health Department regulations on well and septic system sighting, residents with failing septic systems often are unable to install new systems because of their lot size and the proximity of their system to their own or a neighbor's well.

The lack of municipal water and wastewater services also has limited economic development opportunities. "Seniors who wanted to sell their homes and move into something smaller couldn't" because their septic systems failed percolation tests (the soil in the area is largely clay, which impedes absorption and therefore makes it unsuitable for septic system leach fields).[19] These homes were unable to pass full disclosure requirements, necessary for banks to approve a mortgage. (Among other tests, the NYS Department of Health requires that properties for sale with septic systems pass a percolation, or PERC, test. Any sale contract that is based on passing the PERC test is invalid if the system fails to pass the test, according to the NYS Department of State.)

The lack of wastewater infrastructure also has depressed property values. As one resident noted, "I am a senior citizen who needs to sell my home. One of the major questions by the buyer is 'Do we have a central sewer system?' Having

[19] Lucille Kernan, Supervisor, Town of Jasper, interview, July and August 2004

one would aid in selling property as well as increasing the value."[20] Two restaurants were built in the area but could not open because of well contamination and the inability to build appropriate onsite wastewater treatment systems. One owner noted in her support letter for the project, "Because of this waste problem, it also has been hard for me to sell the business and or building, and as long as there is this problem, then it will be unlikely that I will ever sell it."[21] Residents believed that the lack of an adequate wastewater system blocked economic development opportunities. A business owner noted, "It has never been an option for us to recommend Jasper as a location [to start or expand a business] due to its lack of wastewater treatment."[22]

Because of the obvious wastewater problems in the community, the Town Planning Board was compelled to address the issue. In 2001 an Ad Hoc Water and Wastewater Committee was created to explore the planning and funding process of infrastructure development in Jasper. The committee's eventual success was attributed to broad community support and the efforts of leaders to have a variety of stakeholder interests represented. "We tried to get a cross-section of the community, a well driller, a senior citizen. That gets more people talking on the street. The initiative [for the project] came from the community, and that's what kept it going."[23] A 1999 Community Master Plan Survey had found that "utilities," including water, sewer, and natural gas, was the most commonly cited challenge facing the town. The same survey asked business

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[20] Public comment included in the Town of Jasper Application for New York State Small Cities Community Development Block Grant, submitted to the New York Governor's Office for Small Cities, April 12, 2002

[21] *Ibid*
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[22] *Ibid.*

[23] Carol Whitehead, chair, Town of Jasper Ad Hoc Water Wastewater Committee, interview, August 2004

owners what services would enhance their business and improve business retention and expansion. The most common response was "utilities."

The Process

In spring 2001 the town learned about the Southern Tier Central Regional Planning and Development Board's Community Connections Program, which provides planning grants for infrastructure projects in the region. The town's successful application brought it together with technical assistance providers from Rural Community Assistance Partnership, the New York State Environmental Facilities Corporation (NYSEFC), the Rural Development Program of the U.S. Department of Agriculture (USDA), and the New York State Department of Health (NYSDOH). Several meetings were held with these agencies and town and planning board representatives, which resulted in local leaders becoming more familiar with the technical assistance available to them, funding alternatives, and the steps that they would need to take to complete a wastewater project successfully. Lucille Kernan, a town supervisor, characterized the initial grant as "pivotal" to the project's success: "It all came together at that point . . . This spearheaded it."[24]

Through the board's work with the Community Connections Program, the committee realized that it had to have data on the need for a wastewater system in the hamlet. A prime concern for the community was the potential of drinking water contamination from leaking septic systems. The NYSDOH agreed to work with the town to test drinking water, and not to pursue a consent order if there was no evidence of widespread contamination. Supervisor Kernan credits this informal agreement between the Town and the DOH to the success of this phase

[24] Lucille Kernan, Supervisor, Town of Jasper, interview, July and August 2004

of the project. More than 90 percent of the residents agreed to have their water tested. The success of the testing program is attributed to the manner in which it was conducted. Members of the committee contacted each resident of Jasper to gain his or her approval, and a committee member accompanied NYSDOH staff to each home and business for the test. According to a planning board member, without that contact and presence, "I think [residents] would have been apprehensive: 'Why are you here? Am I going to be fined if there's a problem with my water?' We developed a script for the committee members to use when they called people."[25]

The DOH tested 117 wells and one spring in the hamlet in May 2001. They found *Escherichia coli* in 3 wells and total coliform bacteria in 26 wells. Also, 7 wells exceeded NYSDOH limits for nitrate. Further, on the basis of observations and residents' responses to questionnaires, "most homes and businesses did not have onsite water supplies and onsite sewage systems that met separation distances [100 feet] that are recommended to protect water supplies from sewage contamination."[26] NYSDOH recommended that the town complete feasibility studies to assess the cost and the practicality of a wastewater system.

RCAP conducted a diagnostic survey of Jasper residents in May 2001. The survey asked about the type and the depth of their well, the location, the type and the age of their septic system, and so forth. Ninety-eight surveys were returned, a response rate of more than 90 percent. More than 62 percent of the respondents thought that there were septic system problems in their neighborhood, more than 72 percent had a water supply source less than 100 feet

[25] Carol Whitehead, chair, Town of Jasper Ad Hoc Water Wastewater Committee, interview, August 2004

[26] Diagnostic Survey of Current Conditions and the Need for Public Water Supply and Sewerage, Catherine Rees, The Northeast RCAP, January 2002, submitted with Block Grant application

from a septic system, and 80 percent favored a public wastewater system. It was apparent that there was broad public support for a wastewater system in Jasper.

Although there was anecdotal evidence that septic systems in Jasper were failing, the town realized that it needed data to support this claim. The town sent letters to all the property owners in the project study area, asking about their willingness to have their septic systems tested for leakage**.** In July 2001, committee volunteers conducted dye tests, which involved flushing dye through the system to be able to detect leaks. The conclusion was that of the 71 systems tested, 73 percent either regularly or occasionally discharged raw or partially treated sewage. "Some were so bad [that the testers] didn't even get outside before the dye leaked" from the septic system.[27] The effluent flowed into ditches, onto sidewalks, onto streets, and into Tuscarora Creek.

The committee issued requests for proposals to engineering firms, and the town board selected MRB Group of Rochester in October 2001 to prepare two engineering reports for a water and wastewater system (the town was considering pursuing both projects but decided to concentrate on the wastewater project). The decision to hire MRB Group was made after public input and after considering advice from NYSDOH and the New York State Department of Environmental Conservation.

The planning board recognized the need for public support of the project. Town leaders engaged the public early and kept them informed of the project's progress. They knew that a wastewater system would mean additional costs for residents and thus would require outreach and education to gain support. They held an initial public meeting in March 2001. The proposal for a wastewater system was introduced to the public, and representatives from RCAP and

[27] Lucille Kernan, Supervisor, Town of Jasper, interview, July and August 2004

NYSEFC talked with residents and business owners about the process of building a system in Jasper. Another meeting was held in July 2001 to report the results of NYSDOH's well tests, RCAP's diagnostic survey, and the committee's dye tests. At meetings in February and March 2002, residents were presented with the results of engineering reports, funding options, and project timelines. The local newspapers, the *Hornell Evening Tribune* and the *Corning Leader*, papers reported on the progress of the project throughout its evolution. Because of the demonstrated need for the project and the approach taken by the town and the committee—for example, committee volunteers accompanying NYSDOH staff for water testing—strong public support was generated. Supervisor Kernan noted, "We had an easement party with cookies, where people came in, and we paid them a dollar, and they got their easement notice." Kernan continued, "[The town] opted to go the more proactive way and do a petition [rather than a vote for district formation]. It was not on the ballot. It was the people who wanted it that signed the petition. It was widely supported." Kernan believes that this kind of outreach was a key to the project's acceptance and success.

The Funding

In September 2000 the town, along with several other communities in Steuben County, became a USDA Rural Development Champion Community. The town's active participation and successful petition were used as evidence of its commitment to the USDA program's goals of improving social and economic conditions and achieving sustainable community development.

The demonstrated need for a wastewater treatment system in Jasper (as evidenced by the NYSDOH well test and septic system dye test results), the financial status of Jasper residents, and the economic development potential created a case for significant financial assistance from state, regional, and federal agencies. Jasper qualified for an NYSEFC hardship loan ($628,250) at 0 percent interest because of the community's low median household income. It also will receive an ARC grant for $150,000 and a New York Governor's Office for Small Cities Community Development Block Grant for $361,250. The bulk of the project will be funded by a USDA grant for $1,619,800 and a USDA loan for $100,000 at 4.5 percent interest. The town supervisor said, "The dye and water testing and the income survey, the letters of public support—all helped. Without the income survey, we might not have gotten the hardship loan."[28] The project had strong public support—the town received sixty-nine letters of support. Public health and quality of life were the chief concerns expressed by residents and business owners in the letters.[29] For example:

- "We have a little creek that runs [by] our house . . . that contains raw sewage that flows down it from the residences above our place."
- "Raw sewage flows across walkways in several areas of the community."
- "The septic system at [address deleted] had surfaced, and raw sewage was bubbling out of the ground onto our lawn, as well as having gone underground into our water well. At the time, we became ill from the e-coli contamination in our well."
- "The smell has gotten so bad you can't sit on your porch or yard."

The Project

The town received final approval of the project plan from USDA. It has received its funding from ARC and NYSEFC. Once USDA approval was received, the project was put out for a construction bid, and construction began in May 2005.

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[28] Lucille Kernan, Supervisor, Town of Jasper, interview, July and August 2004

[29] Diagnostic Survey of Current Conditions and the Need for Public Water Supply and Sewerage, Catherine Rees, The Northeast RCAP, January 2002, submitted with Block Grant application

The design calls for an anaerobic sludge treatment plant with a capacity of 35,000 gallons per day capacity. The plant will discharge into Tuscarora Creek. The system will have about 15,500 feet of 8-inch collection pipe and lateral service connections. The project will serve 150 estimated dwelling units (EDUs), including 96 residences, 20 commercial or institutional customers, and the high school, a permanent population of 262. The plant requires an operator with a 2-A permit, who will be shared with the neighboring town of Troupsburg. According to Supervisor Kernan, it was “not feasible for an inter-municipal system. The service area is ten miles from the nearest system [Troupsburg]. The geology and hills would require pumping stations,” which would increase the project cost. System billing and accounting will be the responsibility of the Town Clerk. The Clerk, a part time position, will use a billing software program. Supervisor Kernan does not expect any significant increase in the Clerk’s workload. Customers will receive a separate bill for sewer services, rather than include the charges in tax bills. The average annual cost billed per EDU is estimated at $450.

The total project capital cost is $2,859,300, which breaks down as follows:

Table E-5: Project Costs

Wastewater collection system	$1,404,864
Treatment facility	850,000
Contingency (7% of construction)	157,836
Engineering and technical services	358,600
Legal, fiscal, and administrative costs	88,000
Total Project Cost	$2,859,300

As noted earlier, the project will be financed by grants and loans from several sources, as outlined below.

Table E-6: Project Financing

Funding Source	Amount
NYS Governor's Office for Small Cities Community Development Block Grant	$ 361,250
ARC grant	150,000
USDA Rural Development grant	1,619,800
Total Grants	$2,131,050
USDA Rural Development loan (38 years @ 4.5%)	100,000
NYSEFC SRF loan (30 years @ 0%)	628,250
Total Loans	$728,250
Total Financing	$2,859,300

Annual system operating and maintenance costs are estimated to be $42,300:

Table E-7: O&M Costs

Treatment plant electricity	$ 3,100
Building energy costs	3,500
Pump stations electricity	600
Sludge hauling	300
Testing (monthly and annual)	2,000
Miscellaneous equipment and repairs	8,000
Operator salary and benefits	20,800
Vehicle costs	1,000
Administrative salary and benefits	3,000
Total Annual O&M	$42,300

Annual system costs will be $67,489:

Operating and maintenance costs	$42,300
SRF loan repayment	19,648
USDA RD loan repayment	5,541
Total Annual Costs	$67,489

Additional Issues

Like many small communities in Appalachia, Jasper lacks the capacity to develop a large infrastructure project on its own. Although elected leaders and town staff are committed to responding to constituents' needs and improving their communities, they often are part-time and in most cases do not have the experience or the background needed to see a project through. Communities frequently do not know where to start when facing an infrastructure project. Further, some funding agencies in New York have policies that can create hardships for communities trying to complete a project. These potential barriers to successful project completion are outlined in the following sections.

The Knowledge Gap

Jasper was lucky in being able to obtain a planning grant from the Southern Tier Central Regional Planning and Development Board and participate in the agency's Community Connections Program. This enabled Jasper to receive technical assistance early in its project and move ahead relatively quickly to resolve a serious health problem in the community. Not all communities have access to this type of assistance. Further, there is little institutional memory for large infrastructure development in these communities. Few people in elected office or on town staff have experience with water or wastewater projects. Therefore, they often do not know where to go for needed assistance. As Supervisor Kernan said, "You have to know someone who knows about them [assistance programs]. It's getting better but still not the best. Many communities aren't computer literate, and they can't find information on line. It takes a lot of time to look for information. I have a part-time clerk, and she's not knowledgeable to look for information. There's no time and no staff to look." Richmondville Mayor Kevin Neary said, "Unless they have an engineering firm, they don't know where to go . . . I wasn't aware these skilled personnel were available."[30]

When asked how this knowledge gap could be closed, she offered some suggestions; "Teleconferences, but people don't always attend these. I've tried to help other communities that are starting a project. No more reading matter—we have piles of stuff to go through. Local training sessions with people from the different agencies would be good."[31]

The Application Process

Multiple, detailed funding applications can be a problem for many communities. One supervisor said, "You have to make sure you use the right forms. Everyone has a different application."[32] A resident who worked on a wastewater project commented, "We would have choked on the grant applications. The village didn't have the capacity for that."[33]

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[30] Kevin Neary, Mayor, Village of Richmondville, interview, July 2004.

[31] Lucille Kernan, Supervisor, Town of Jasper, interview, July and August 2004

[32] Myrton Sprague, Supervisor, Town of Perrysburg, interview, July 2004

[33] Allan Noble, Alleghany County Planning Board, interview, July 2004

Funding agencies also may have differing criteria. One technical assistance provider said, “Some communities hire a consultant or engineering firm [to complete applications], which is a big waste. From my perspective one application would be great. They’re [the applications] vastly different.

“It’s also the *emphasis*,” the provider continued. “ARC is interested in the number of jobs created; [USDA] and [NYSEFC] are interested in residential impact . . . You have to change emphasis for the different applications for the same project . . . If they could get together on that, it would be great.”[34]

Another mayor had a suggestion for streamlining the process: “I’m not sure how the agencies work together. Do they talk with each other about our applications? It would be good if we could just present our problem and they could come up with a solution. Businesses want one-stop shopping for regulations . . . They could have something like that.”[35]

“A Use-It-or-Lose-It Situation”

Jasper received a block grant from New York based on its median household income and the health issues in the community. However, the Governor’s Office for Small Cities has a two-year deadline during which a community must use the funds or the grant will be withdrawn. Supervisor Kernan described the situation: “We haven’t been able to spend their money fast enough, so we could lose $300,000 [sic] if we don’t spend it by December [2004]. It’s a use-it-or-lose-it situation. That makes it harder for us. We’re between a rock and a hard place.”

A technical assistance provider acknowledged that this policy can create a serious problem for a community’s project. “Jasper moved quickly, so it’s not

[34] Catherine Rees, Water Resources Specialist, RCAP Solutions, interview, August 2004

[35] Kevin Neary, Mayor, Village of Richmondville, interview, July 2004

been as much of a problem," the provider said. "You can imagine what it could be like in other communities . . . for example, if the engineering reports have to be redone. I have another community whose *only* funding is a CDBG grant, and they could lose it. If Small Cities pulled back that grant, it would be devastating."[36]

References for Jasper, NY Case Study

Town of Jasper, New York, *Application for New York State Small Cities Community Development Block Grant* (April 12, 2002).

Donna Clark, New York State Department of State, interview, December 2004.

Lucille Kernan, Supervisor, Town of Jasper, interview, July and August 2004.

Jim Meacham, New York State Department of Health, Bureau of Water Supply Protection, interview, December 2004.

Kevin Neary, Mayor, Village of Richmondville, interview, July 2004.

Allan Noble, Alleghany County Planning Board, interview, July 2004.

Catherine Rees, Water Resources Specialist, RCAP Solutions, interview, August 2004.

Myrton Sprague, Supervisor, Town of Perrysburg, interview, July 2004.

Carol Whitehead, chair, Town of Jasper Ad Hoc Water Wastewater Committee, interview, August 2004.

[36] Catherine Rees, Water Resources Specialist, RCAP Solutions, interview, August 2004

Case Study:
McDowell County, West Virginia, and Letcher County, Kentucky

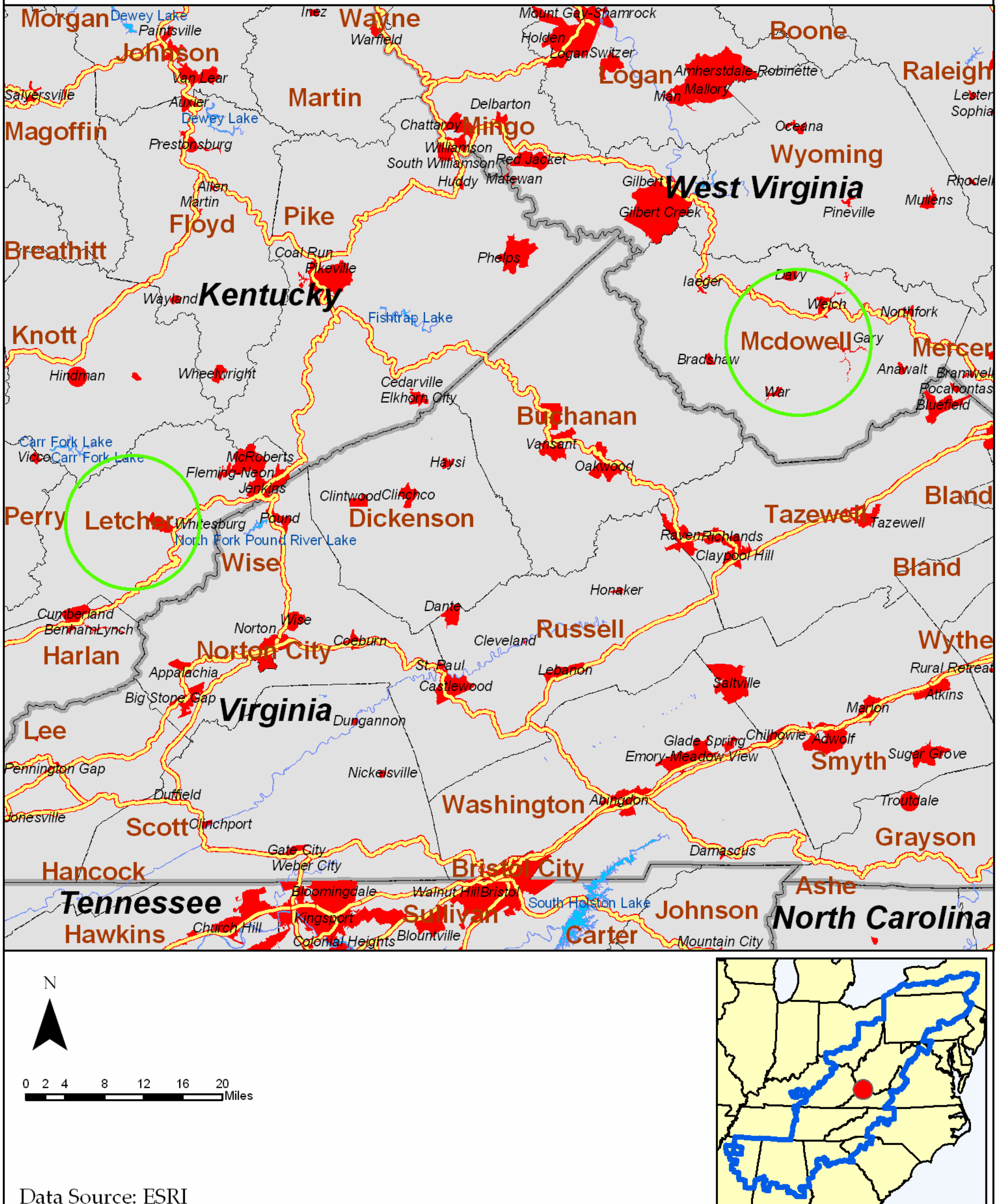
By Gary A. O'Dell[37]

Among the distressed counties at the core of central Appalachia, in the southern coalfields of the Allegheny/Cumberland Plateau, are McDowell County, West Virginia, and Letcher County, Kentucky (refer to Figure E-5). As in many parts of Appalachia, much of the population in these counties has neither a reliable water supply of good quality nor an effective means of wastewater disposal. Many rural neighborhoods comprising hundreds of families have never had access to any public water system.[38] Such households have, by necessity, been obliged to develop any water sources locally available. Individual water supplies are obtained from wells, springs, and rainwater collection, or by purchase of transported water.

[37] Gary A. O'Dell is assistant professor of geography at Morehead State University (Kentucky). He thanks the many citizens and officials who provided information and insights concerning water and wastewater development issues. Particular appreciation is due to (West Virginia) Shirley Auville, Bill Baird, David Cole, Al Corolla, Lawrence Crigger, Kirk Easterling, Dr. Thomas C. Hatcher, David Hughes, Jim Stutso, Jack Whittaker, and Troy Wills; and (Kentucky) Chrystel Blackburn, Tracy Frazier, James McAuley, Ed Neal, Phil O'Dell, Mark Sexton, Jim Tolliver, and Robert W. Ware.

[38] A "public water system" is a publicly or privately owned system supplying piped water to a community, a subdivision, or a mobile home park. The Environmental Protection Agency provides technical definitions for classes of public water systems, according to the number of connections, the number of users, and the duration of use.

Figure E-5. Location of McDowell County, WV, and Letcher County, KY



Data Source: ESRI

Table E-8: Case Study Data

McDowell County	Population, 1950: 98,887 Population, 2000: 27,329 Median household income, 2000: $16,931
Letcher County	Population, 1950: 39,522 Population, 2000: 25,277 Median household income, 2000: $21,110

Thus many people depend on untreated sources of unknown quality for their drinking, cooking, and wash water. Water testing programs have shown that many Appalachian water sources, when untreated, are in fact health hazards, contaminated with wastewater, pesticides, or heavy metals. In addition to its being contaminated by human activity, water quality may be degraded by naturally occurring substances. Particularly in the Appalachian coalfield region, residents may be required to pump groundwater that has unpleasant if not harmful qualities; it stains clothing red (because it contains iron) or reeks like rotten eggs (because it contains sulfur).

Even in communities served by public water systems, many of the systems have undersized, aging lines and treatment facilities and are hard-pressed to supply the existing population cluster, let alone to broaden coverage to a dispersed rural population. In numerous areas a declining customer base for water utilities, the result of emigration from central Appalachia to areas of the nation with better economic opportunities, precludes sufficient revenues to upgrade or expand service.

Yet McDowell and Letcher counties, like other parts of the longest-mined areas in Appalachia, also contain aquifers of high-quality potable water, plentiful and free from harmful characteristics that might serve a much greater population than present if managed in a sustainable manner. The difficulty lies in making this water available to the population economically, either through community or neighborhood water systems or public systems of larger scale.

Of equal importance is the problem of wastewater disposal. Entire towns and rural households that lack wastewater treatment systems discharge raw wastewater directly into rivers and streams through open lines known as "straight pipes." Onsite septic systems often are impractical because of small lot sizes or unfavorable conditions of the local soil or bedrock geology. The lack of proper wastewater disposal promotes environmental degradation and creates potential health hazards, including contamination of drinking water sources.

The problems of water supply and wastewater disposal are inextricably linked. Per capita rates of water use in "self-supplied" households (those that supply their own water) are far less than in households connected to public water systems.[39] Providing public water system service to self-supplied households without sewer connections greatly increases domestic water use and therefore production of untreated wastewater, thus further degrading surface and groundwater quality. Ironically, because wastewater discharges provide much of

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[39] Estimates for water use in Kentucky in 1995 were 50 gallons per day per capita by self-supplied users and 70 gallons per day per capita by users on public systems. Wayne B. Solley, Robert R. Pierce, and Howard A. Perlman, *Estimated Use of Water in the United States in 1995*, U.S. Geological Survey Circular 1200 (Washington, D.C.: U.S. Government Printing Office, 1998). The authors note, however, "Self-supplied domestic systems are seldom metered and few data exist" (p. 24). Data on water use by self-supplied households collected for twenty-six rural Appalachian households in Kentucky indicated a mean per capita consumption of less than 22 gallons daily. This study concluded that difficulties in obtaining water promoted rigorous conservation measures. Gary A. O'Dell, "The Search for Water: Self-Supply Strategies in a Rural Appalachian Neighborhood (M.A. thesis, University of Kentucky, 1996).

the flow of surface streams in McDowell and Letcher counties during dry months, replacing straight-pipe discharges with sewer connections may result in shortages of flow to plants that extract and treat surface water for public water systems. So the issues of water supply and wastewater disposal must be addressed simultaneously.

The greatest obstacle to provision of water and wastewater services in McDowell and Letcher counties is financial, and it has several dimensions. Water and wastewater projects are enormously expensive, particularly in Appalachia because of the rugged terrain. Funding sources are limited. The costs of connection to water and wastewater services, and the monthly charges necessary to repay loans, often are prohibitive in the economically distressed Appalachian counties where per capita incomes are among the lowest in the nation. For example, the community of Dayhoit, in Harlan County, Kentucky, was provided with a public system gratis, with no initial connection charge, by a manufacturing company that had been held legally responsible for chemical pollution of the local aquifers. Even so, within a few years, many of the initial customers had discontinued service and gone back to using traditional sources such as wells because they could not afford the monthly service fees.[40]

In West Virginia and Kentucky, as in many other states, agencies have established structures to assist communities with infrastructure development. The West Virginia Infrastructure and Jobs Development Council disburses state matching funds for water and wastewater development, and eleven regional planning and development councils serve as planners and financial facilitators for their respective regions. The Kentucky Infrastructure Authority allocates the 20 percent state match for projects funded by either of the two Environmental

[40] Phillip W. O'Dell, Kentucky Division of Water, personal conversation, 1999.

Protection Agency (EPA) state revolving funds; the funds are derived from an ad hoc bond issue incorporated in the annual state budget.[41] Fifteen local area development districts (ADDs)—public corporations consisting of elected officials, technical experts, and local citizens—engage in regional planning and work with individual communities to obtain funding for projects.

Many of the water-quality problems experienced in coal country appear to result from numerous shallow wells that tap poor-quality aquifers near the surface rather than deeper aquifers of far better quality. A 1997 estimate for Letcher County projected an average cost of $10,700 per household to provide public water system service.[42] For less than half of this amount, a drilled well that taps deep aquifers while sealing off shallow, poor-quality water can be constructed.[43] Although individual wells may not be the best solution in many cases, the example illustrates the concept that small-scale innovative solutions tailored to localities may sometimes be more desirable than large public utilities. In McDowell County, the community of War acquired the aging and deteriorated city waterworks from a non-responsive private company, and with labor provided by citizen volunteers, it is installing a modern system. In Letcher County, water and wastewater development has been undertaken at the grassroots level, combining regionalization with locally tailored solutions. In each case an external, nongovernment organization served as a catalyst to motivate the population and facilitate the process. The observations and the conclusions presented in this case study are based on field experience and

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[42] U.S. Department of Agriculture, *Kentucky Water 2000: A Plan for Action* (Lexington, Ky.: USDA, Rural Development, 1997).

[43] Estimates provided to the author in 1999 by three water well drillers located in Harlan and Letcher counties ranged from $2,500 to $4,000 for a complete well installation, including pump and filtration systems.

personal interviews with both civic authorities and ordinary householders undertaken during fall 1999 and updated by more recent communications with concerned people.

Characteristics of McDowell and Letcher Counties

Both McDowell County (538 square miles) and Letcher County (339 square miles) are mountainous, heavily forested, and relatively isolated regions in their respective states. They have similar socioeconomic histories: characteristics of local topography and geology fostered a legacy of resource extraction—timber and coal—that left each county largely devoid of the most fundamental infrastructure and economic opportunities. Many of the present-day communities were once coal camps, whose amenities were supplied according to the whim or the conscience of the coal companies. Once the companies withdrew their patronage , the camps were left poorly equipped to fend for themselves.

The socioeconomic situation in McDowell and Letcher counties is more or less typical of distressed counties in central Appalachia. The two counties have persistently been categorized as distressed since the Appalachian Regional Commission (ARC) began its system of classification of counties by economic status. Unemployment exceeds 10 percent.[44] About one-third of the population lives in poverty.[45] Further, per capita market income is only $7,951 in McDowell County, $10,465 in Letcher County.[46] Paralleling the decline of employment in the coal industry, populations have steadily decreased, McDowell County's from

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[44] U.S. Department of Labor, Bureau of Labor Statistics, 1999–2001.

[45] Census Bureau, Census, 2000.

[46] U.S. Department of Commerce, Bureau of Economic Analysis, 2000. "Per capita market income" is per-capita income less transfer payments. Average per capita income for the United States in 2000 was $25,676.

nearly 100,000 fifty years ago to about 27,000 today, Letcher County's from nearly 50,000 to about 25,000.[47]

A declining population means a declining tax base, particularly when a lack of financial resources in the population discourages investment in maintenance of existing commercial and residential structures, let alone new business ventures and new construction. Accordingly, infrastructure development also has lagged. Although the coal companies often provided minimal environmental services such as water supply systems and rarely provided wastewater treatment facilities, physical facilities in many cases are generations old and deteriorating. The greater part of the population, however, has never had access to such amenities and today still follows traditional ways, obtaining water wherever possible from local sources and discharging untreated waste into rivers and streams.

Water and Wastewater Services in McDowell County

Framed in a box at the top-left corner of the *Welch Daily News* is the perennial appeal:

McDowell County Needs

Jobs

Modern Highways

Affordable Sewage Facilities

Affordable Quality Water Systems

In March 1999, Shirley Auville, resident of Iaeger and proprietor of the automobile junkyard south of the community, ticked off the local water supply

[47] Census Bureau, Census 2000.

problems on his fingers: “Starting at Long Bottom and following the road, all the wells are salt water—can’t drink it. The new middle school has to treat for salt water from their well. About two miles from here, iron water starts. There is iron water in the wells at Johnnycake, Mohawk, Panther, Mile Branch, Ritter, Long Pole, Short Pole, Roderfield, and Redbird. From Bradshaw down to Virginia is iron water. On Coon Branch Mountain they don’t have any water at all; they have to catch water in cisterns.”

Auville continued his assessment, moving from the rural sections to the town systems: “Bradshaw has good water; so does Welch (the county seat)—the water has a good taste. Davy has iron water; it has a bad water system . . . Iaeger has real bad water. It has a nasty taste. There is iron and barium in it, and the pressure is always weak.”

About Brushy Fork Mountain, near the county’s southern boundary with Virginia, Kirk Easterling observed, “Everybody . . . has water problems. Most folks have cisterns; they catch rain water or haul water. The wells don’t yield much, but the water quality is okay. A few people have springs out of the sandstone.” His neighbor, David Hughes, uses water from a spring that flows from the opening of an abandoned drift mine, is collected in a 2,500-gallon tank, and is pumped uphill to his mobile home. Last year Hughes had to purchase three loads of water in the summer because the spring flow had dwindled to a trickle.

Water is literally precious up on the mountain. Easterling estimated that about a dozen families on his road purchase water, paying as much as $60 per load for two or three 2,000-gallon loads per month from a private hauler. The Bradshaw Fire Department hauls water for people in need, accepting “donations” of about $40 per load to offset vehicle maintenance costs.

Al Corolla of the Bradshaw Fire Department confirmed that the department receives as many as fifteen calls per week during the dry months, July through October. Using two trucks, it can transport two or three loads in the evening after regular work hours. “We tell people that the water is to be used only for washing, not drinking, but we have no control over what they do after the delivery,” said Corolla. The department received about $4,500 in water-hauling donations in the previous year—just “barely enough to pay for vehicle maintenance,” Corolla noted. He would like to end the program of hauling water because it is too hard on the vehicles, but “we probably won’t because people have no other way to get water.” Bradshaw has good water and wastewater facilities. Its system is small, serving a population of about 280, but all the main lines are new, installed in 1985, and the wastewater system is only nine years old.[48]

Municipal wastewater treatment is a relatively new development in McDowell County. Onsite disposal of waste has been the prevailing mode, at best through septic systems that often are inadequate for the terrain, but more commonly discharged in raw form through straight pipes into the nearest stream. Until the mid-1990s, only the town of Gary, with a population of 900, was equipped with a wastewater system. Like so many other communities in McDowell and other coalfield counties, Gary was a company town. Gary’s former patron, the United States Steel Corporation, was more concerned with community welfare than many mining companies, and it equipped the town with a wastewater treatment plant. In the county seat of Welch, with a population of about 2,600, wastewater treatment did not begin until a $13.5 million plant came on line in November

[48] Population figures for communities in McDowell and Letcher counties are from Census Bureau, Census 2000,

1997, mandated by court order. Previously, all wastewater was piped straight into the Tug Fork River that runs through the town.

An $8.7 million treatment plant was constructed for War (population 780) and the nearby village of Warriormine in 2000. Funded by the U.S. Department of Housing and Urban Development (HUD), the grant was unique in West Virginia in allocating funds for household connections. The innovation was necessitated by the extreme poverty of the county. Furthermore, a special dispensation allowed the work to be performed by local rather than outside contractors.[49]

Despite such infrastructure gains, in all of McDowell County in 2004, only these four communities—Bradshaw, Gary, Welch, and War, representing about 21 percent of the total population—treated wastewater.[50]

Many community systems supplying drinking water in McDowell County are aging legacies of the boom years of coal mining, built and operated by the coal companies to serve the workers in company towns. When the markets for coal collapsed and companies pulled out, private operators took over the water systems. For a time, operations were profitable. However, constant erosion of the customer base, the result of long-term population decline in the county, has put most of these systems in the red.

The situation in War reflects the larger predicament of the county. At a public hearing in March 1999, officials of the community sat down with the owner of the privately owned War Water Works and a representative of the West Virginia Planning and Development Council to resolve the community's water-supply

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[49] Dr. Thomas C. Hatcher, mayor of War, personal conversation, 14 June 2004.

[50] West Virginia Infrastructure and Jobs Development Council, *Public Water Systems and Public Wastewater Systems Inventory And Needs Assessment Report* (Charleston: the Council, 2002).

problems.[51] In October 1998 the city had filed a grievance against War Water Works with the West Virginia Public Service Commission. In response, War Water Works offered to sell the business to the city. The city, then constructing its first wastewater system to replace straight-pipe discharges, considered the proposal. The water lines were seventy-five years old, and the company had virtually no other physical assets, not even an office building. It had made no improvements or upgrades in the infrastructure in decades. There were only two 6-inch main lines in town; all others were 4- or 2-inch lines. "Any house that catches fire in War burns to the ground," said Mayor Thomas C. Hatcher, " because there is not enough water to fight [fires]." Two sections within the city limits, had no water service at all, after more than forty years of resolute petitioning. One of the sections, Middleton, threatened to secede from the city over this issue.

War had three options: (1) purchase the waterworks for a sum that would burden the city with debt for years to come; (2) allow the water system to remain in private hands; or (3) negotiate purchase of the system by the McDowell County Public Service District (PSD), an agency that had been acquiring and upgrading local community water systems for several years.

Of the 294 nonprivate water systems in West Virginia, 143 are PSDs, operated on a county level by county governments.[52] Since its inception in 1990, the McDowell PSD had been taking over and upgrading small private community systems in trouble, one or two at a time, and building new treatment plants as

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51 The following account is derived from notes taken by the author at the hearing, 22 March 1999, and in a prehearing interview with Mayor Hatcher, 22 March 1999.

52 , D. Jarrett, Annual Statistical Report: Statistical Data on Public Utilities in West Virginia (Charleston: Public Service Commission of West Virginia, 2003).

needed. Typically these small plants, often using groundwater extracted from deep abandoned mines, had cost $1.5 million–$3.5 million each, with funding provided by loans and grants from ARC and the Rural Utilities Service of the U.S. Department of Agriculture (USDA–RUS). Funding of this sort is generally unavailable to operators of private systems. Currently the McDowell PSD systems serve about 1,700 households in sixteen small communities. Planning is concerned with upgrading or extending service to the small but relatively dense settlements represented by the former mining camps. Any provisions for addressing the needs of the dispersed rural population remain in the distant future.

One of the PSD's acquisitions, in March 1999, was City Water Inc., of Iaeger. If ever a community had severe water problems, Iaeger fit the profile. Not only was the physical infrastructure in terrible shape, but the health hazard from a high natural barium content in the water source prohibited its use for any domestic purpose but flushing toilets. The citizens of Iaeger had a water system in name only, for they could not use the water. Following the acquisition, a new well solved the barium problem, and replacement of the distribution system will soon be made possible through USDA–RUS funding and a pending community development block grant from HUD.[53]

Another high-priority area for future PSD activity is Gary. The municipal system of this town pumps more than a million gallons per day, but more than 95 percent of the water is lost through line leakage. Gary and the county PSD plan a joint renovation of the water system and expansion of coverage to communities eastward.

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[53] David Cole, West Virginia's Region One Planning and Development Council, personal conversation, 23 April 2004.

Consequently, purchase of the War Water Works by the PSD was a viable option. Yet no matter who came into possession of the water system in War, water rates were projected to more than double. At the March 1999 hearing, the water plant operator presented a plan for a "vigorous" renovation and upgrade of the existing system. According to his calculations, an incremental expenditure of nearly a million dollars would be required to refurbish the plant and replace the main lines. The rate increases necessary to pay for the improvements would result in an almost immediate doubling of the then-current $18.55 monthly base to reach a level of more than $44 by the tenth year succeeding.

As the hearing proceeded, it became increasingly clear that the city was not, at that time, inclined to acquire the water system. "We are willing to work with either the water system owner or the PSD," Mayor stated. "All we want is drinkable water." The hearing concluded without a definite plan of action being established.

Inertia of this sort can sometimes be overcome by the influence of a third party, a nongovernment entity that can act as a negotiator, a motivator, and an organizer of resources. In February 1999, West Virginia Governor Cecil H. Underwood, specifically acknowledging the magnitude and the severity of McDowell County's problems in developing infrastructure, announced the initiation of a program to engage the local population in solving the problems. With financial assistance from ARC, the state engaged the Rensselaerville Institute, of New York, to implement leadership programs in McDowell County directed toward self-help and community development activism.[54]

The Rensselaerville Institute, which refers to itself as "the think tank with muddy boots," is a nonprofit, independent organization dedicated to helping

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[54] West Virginia Development Office, 9 February 1999.

low-income communities achieve concrete results with limited resources, using self-help and volunteerism. The institute's outcomes-focused development philosophy is based on the premise that local knowledge and grassroots initiatives often provide better, faster, and less expensive solutions than the conventional dependence on outside experts and millions of state and federal dollars ineffectively applied. The institute seeks out "human sparkplugs"—motivated residents with ideas and leadership potential—to build community capacity and make local improvements with volunteer help from citizens. Such improvements may be small projects that can have a large impact on a community, or large efforts, such as solving drinking water and wastewater problems. Nationwide the institute has assisted more than 300 towns and neighborhoods in obtaining or upgrading water and wastewater systems using the self-help approach.[55]

Collective action in McDowell County was made even more difficult by an ingrained sense of dependency, the product of a historic tradition of coal company paternalism and the physical and cultural isolation of McDowell County from the state administrative center in Charleston. Water and wastewater development in the county, as in most of the nation, progressed through a strictly top-down approach. Government officials and technical experts at the state level decide on priorities and procedures for implementation. This approach fostered in citizens a perception of detachment from the decisions that affect their lives. Although citizen involvement was officially encouraged, primarily through hearings, there was little evidence of grassroots participation. The March 1999 hearing in War, for example, was attended by only two persons from the community other than the local officials involved. Many people in the

[55] Rensselaerville Institute website, at www.rinstitute.org

county were concerned about water quality and availability, but they had little faith in either the solicitude of the state government or its ability to provide solutions.

At the governor's behest, the Rensselaerville Institute began by presenting a series of countywide workshops on leadership development and self-help.[56] Officials and citizens of War who attended were intrigued and decided to work first on two small-scale youth projects, involving local talent to stimulate young people's interest in science and music. The success of the youth projects encouraged citizens to tackle a larger undertaking, the longstanding problem of the Middleton neighborhood's lack of water supply. With funding provided by both the city and, somewhat reluctantly, the water company, during spring 2002 more than fifty residents of Middleton volunteered their time to dig ditches and lay new water lines to each household. By June the project was complete, and Middleton now is served by the city water supply for the first time in its history.

Success in this endeavor and the substantial cost savings achieved through citizen involvement encouraged optimism for a long-term solution to the city's water problems. In June 2000, War filed an another grievance against War Water Works to allow the purchase of the water system by the city, a plan that was opposed by the McDowell PSD. Hearings were held before the West Virginia Public Service Commission in 2003 to determine the ultimate fate of the War water system. At the hearing, strong citizen opposition to PSD acquisition became apparent. The perception was widespread among residents that the PSD had little concern for the needs of the people of War. Water rates charged to customers in other PSD–operated systems in the county were considered

[56] The following account of events in War and its involvement with the Rensselaerville Institute is derived from personal conversation with Mayor Hatcher and Jim Stutso, War director for Water Works, June–July 2004.

outrageous. War citizens had no desire to pay high rates for water provided to the community as a consequence of subsidizing water line extensions elsewhere in McDowell County.

The Public Service Commission ruled in the city's favor, and system ownership was transferred to the community in November 2003. An HUD block grant of $20,000 provided a down payment on the total purchase price of $250,000. War is currently conducting an engineering study to determine the cost of installing an entirely new water system to replace the ancient, undersized, and deteriorated plant and lines. Funding will be provided by a combination of sources, most likely HUD, ARC, and the state's Abandoned Mine Lands program. Civic participation in the project with encouragement and coordination by the Rensselaerville Institute will save an estimated 25 percent in costs relative to the price tag if the project was presented for bids. As Mayor Hatcher observed, "We have a lot of retired miners here, an able-bodied labor pool."

Water and Wastewater in Letcher County

The late James McAuley, proprietor of a small store in Kona, Kentucky, liked to tell a story that he swore was true. Coal mining, he said, has damaged or destroyed many good water sources in Letcher County over the years. Extension of deep mine tunnels often "cut the bottom out" of drilled wells, so a person (or community) might have plenty of water one day and nothing but a dry empty hole the next. McAuley told of a man whose well went dry, and as he stood over the borehole bemoaning the fact that he no longer had any water, a voice issued from the bottom of the well saying, "We've got plenty down here!"

Whether this particular tale is true or not, many residents have reported hearing muted voices and machinery noises coming from the underground mines that intersected their now-destroyed water wells. Kentucky law currently requires that mining companies replace a damaged water supply within forty-eight hours.

At the end of the twentieth century, only about one in four Letcher County households had access to a community water supply or connection to a sewer line. Letcher County contains six municipal water systems: Whitesburg, the county seat (population 1,600), Fleming-Neon (population 840), Jenkins (population 2,400), Jackhorn (population 200), and Blackey (population 150). Also, there are several water districts in the county, which purchase water from these systems. Public sewers serve only Whitesburg, Fleming-Neon, and Jenkins.[57] Jenkins, like Gary in McDowell County, was a model coal camp, where a civic-minded company provided basic environmental services.

Across the county, however, many rural residents cope with marginal water supplies often tainted by iron and sulfur that leave fixtures and clothing indelibly stained and reeking of rotten egg, while thousands of straight pipes discharge wastewater to rivers and creeks. For years, local and regional newspapers have regularly featured stories with headlines that typically read as follows:

- Officials Investigate Sources of Sewage in Kentucky River[58]
- Sewage Going into Streams Draws Concern[59]
- Sewage Problems Hurt Health, Growth in Eastern Kentucky[60]
- County Men Study Water, Sewer Needs[61]

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[57] Governor's Water Resource Development Commission, *Water Resource Development: A Strategic Plan* (Frankfort, Ky.: the Commission, 1999). Available at http://wris.ky.gov/wrdc_plan .

[58] *Letcher County News Press*, 16 June 1993.

[59] *Whitesburg Mountain Eagle*, 30 June 1993.

[60] *Louisville Courier-Journal*, 2 December 1996.

- Lack of Clean Water Hampers Letcher County Development[62]

The North Fork of the Kentucky River originates in Letcher County and supplies water to Whitesburg and many downstream communities in the state. Advisories against swimming in the river, prompted by high levels of fecal coliform bacteria, have been in place since intensive testing began in 1991. Even simple contact with the river water is considered a health hazard.[63] Health statistics indicate that the average annual incidence of hepatitis A, a waterborne disease, is significantly higher in Letcher County than in Kentucky and nearly double the national incidence.[64] The leading sources of the bacterial contamination are defective septic systems and illegal straight pipes.

In 1992 in part of Letcher County, employees of the state Division of Water and the Kentucky River District Health Department conduction an inspection, walking many miles of river and streams. Straight pipes counted during the inspection ranged from 1 per stream mile to as many as 16, for a total of more than 1,000 in the areas surveyed. Various estimates have since placed the total number of illegal straight-pipe discharges in Letcher County at 3,000 –6,000.[65] According to Dr. Rice Leach, commissioner of the Kentucky Department for Public Health, the prevalence of straight pipes is attributable to several factors.[66]

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[61] *Whitesburg Mountain Eagle*, 15 May 1996.

[62] *Whitesburg Mountain Eagle*, 12 March 1997.

[63] Swimming Advisories in Kentucky (last updated 2 July 2004), Kentucky Division of Water website, available at www.water.ky.gov/sw/advisories/swim.htm.

[64] *Whitesburg Mountain Eagle,* 6 March 1996.

[65] *Whitesburg Mountain Eagle*, 18 November 1992, 24 July 1994, (author not identified), *Lexington Herald-Leader*, 30 June 1997.

[66] *Whitesburg Mountain Eagle*, 30 June 1993.

A 1993 survey determined that more than 90 percent of all new homes in Letcher County are mobile homes. Available financing packages do not include septic and drain field systems, which must be financed separately. The average cost of a septic system installation in Letcher County at the time was estimated at $1,700. Also, mobile home lots often are very small, with little room for a drain field. Further, there is a regional tendency toward “do-it-yourself” undertakings without benefit of a licensed plumber. It is complemented by the lack of zoning and building codes.

The situation regarding water supply and wastewater disposal in Letcher County had become of great concern to local and state officials. Water supply planning was addressed first, as part of a state-coordinated, county-based planning process implemented through the local ADDs. The County Water Supply Program grew out of the 1988 drought, when many communities across the state were forced to ration water. Responding to this emergency, then-governor Wallace Wilkinson issued an executive order creating a Water Supply Task Force. Building on task force recommendations, in 1990 the Kentucky legislature passed a law mandating development of long-range plans for county water supplies.

Each county plan was submitted to the Kentucky Division of Water in two phases. Phase I involved data collection and analysis to project which water systems would be adequate for the next twenty years. Phase II included (1) quantity of water plans (2) plans to prevent contamination from impacting the water source, (3) emergency response plans if contamination should occur, and (4) plans to manage drought. The deadline for completion of these plans, originally in 1998, was extended to July 15, 1999. As of April 1999, all ten counties in the Kentucky River ADD, including Letcher, had completed both Phase I and Phase II. Clearly the concern for water supply in this area was strong: on the same date, 75 percent of the counties in other ADDs had not reached this stage; fifteen counties had yet to submit even their Phase I plans.[67]

The resulting planning document, submitted in projected water supply development in Letcher County as a gradual process of extending lines outward from existing suppliers to certain adjacent and relatively dense population concentrations over the next two decades. The water sources for both Whitesburg, the largest water utility in the county, and Jenkins, were deemed inadequate for expansion, so alternative sources had to be located. The plan recommended that Jenkins (then dependent on a small reservoir) seek connection to a Pike County system and that Whitesburg (then withdrawing water from the North Fork of the Kentucky River) develop nearby flooded mines. Under the plan the needs of the dispersed rural population would remain unsatisfied indefinitely.[68]

Up to this point, the planning process had proceeded according to a typical bureaucratic model in which regulatory officials imposed mandates on local officials, who then hired technical experts to meet those requirements. In this traditional top-down approach, there is little direct input from those who will be most affected by implementation of the plans—ordinary citizens. The Letcher Water Supply Planning Commission consisted of 4 community mayors, 1 representative from a minor water supplier, 1 county-judge executive, and 1 representative of the District Health Department. Limitation of citizen participation was not a matter of intent on the part of the planners, but a

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[67] Information obtained from Water Resources Branch, Kentucky Division of Water.

[68] Kentucky River Development District and Commonwealth Technology, Inc., *Final Plan Document and Plan Formulation Document Long-Range Water Supply Plan, Letcher County, Kentucky* (Hazard, Ky.: the District, 1996).

consequence of the way in which traditional planning is conducted. First, many officials proceed on the assumption that they are the elected representatives of the people and their views of the official are *de facto* the views of the people. Such an assumption overlooks the creative potential inherent in local knowledge and expertise and a diversity of opinions. Public input is officially encouraged only through public hearings, which in the case of the water supply planning agenda were held at the ADD offices in Hazard, a location sufficiently distant to preclude participation by people of limited resources.

Ultimately, Letcher County chose not to follow the traditional planning process. It took a different path, with the goal of providing water and wastewater services to a greater proportion of the county within a shorter span of time. It accomplished the planning and initial implementation stages by working from the bottom up—that is, from the grassroots level of ordinary people and local officials creating a shared vision rather than responding to an external mandate. The people of Letcher County were a fertile soil in which ideas of empowerment sprouted fruitfully.

The seeds of civic capacity were planted and nourished by a regional nongovernment organization, the Mountain Association for Community Economic Development (MACED), headquartered in Berea, Kentucky. In fall 1995, MACED, equipped with matching funds from the state Division of Water, sponsored a program in Letcher County to find ways to deal with the local problems of wastewater disposal. Brady Deaton became the coordinator of a group of interested local citizens in Letcher County, known as the North Fork Clean Water Project, and began working to convince rural homeowners to upgrade existing systems or install some alternative methods of wastewater treatment, such as constructed wetlands or peat systems. Incentive was provided in the form of cost-sharing by MACED, through which eligible people could obtain up to 75 percent of the money necessary to install a system or make repairs. Another organization, Homes, Inc., helped owners finance their part of the cost with low-interest loans and low monthly payments.[69]

The North Fork Clean Water Project was originally intended to deal only with the wastewater problem, but it soon took on a life of its own and a greatly expanded mission because of the many needs of the local population. From the original organization, another citizens group formed in 1996, called the Letcher County Action Team, to address a wider range of social issues in the county. Subsequently the North Fork Clean Water Project operated as a subsidiary of the Letcher County Action Team. Much interest and energy was generated in Letcher County as a result of the activities of the North Fork Clean Water Project and the attention from state officials and the media concerning the unwholesome condition of the county's water.

Two other developments, which occurred early in 1996, were to have profound and lasting effects on Letcher County's water and wastewater situation. First, the Letcher Fiscal Court passed an ordinance requiring all certified electrical inspectors to receive a notice of release from the local health department before approving the electrical wiring in any new structures. This simple measure allowed the health department to ensure that all new construction in the county had adequate wastewater disposal.[70] Second, County Judge-Executive Carroll Smith appointed a study group of six people to examine the county's water and wastewater problems and make recommendations. Two members were chosen

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[69] *Whitesburg Mountain Eagle*, 6 December 1995.

[70] *Whitesburg Mountain Eagle,* 13 November 1996.

from the North Fork Clean Water Project sewer grant committee, one of whom, Kona storekeeper McAuley, became chair.[71]

The ordinance requiring inspectors to obtain a release from the health department before approving electrical work proved tremendously successful. Septic system permits doubled after the ordinance went into effect.[72] Impressed, State Senator Barry Metcalf introduced legislation modeled after the Letcher ordinance that was passed by the 1998 Kentucky General Assembly, mandating health department approval before electricity is provided to new construction.

In mid-May 1996 the study group presented its conclusions to Judge-Executive Smith, recommending the formation of a countywide water and wastewater district. In the countywide district, communities with existing systems would retain control of their own systems, including revenues, contracting with the district to supply service to outlying areas. A county system would eliminate much of the resistance to community system connection expressed by rural residents who feared that annexation would increase their tax burden. Later that month the Letcher Fiscal Court passed a resolution authorizing the county attorney to work with the citizens group to lay a framework for a countywide water and wastewater district. The real work was ahead: formalizing the details of the plan and persuading the state Public Service Commission to allow the district to be created.[73]

At the initial Public Service Commission hearing in March 1997, the application was denied. The commission operates under a mandate to prevent proliferation of water utilities if preexisting water suppliers can serve the

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[71] *Whitesburg Mountain Eagle*, 15 May 1996.

[72] *Whitesburg Mountain Eagle*, 16 July 1997.

[73] *Whitesburg Mountain Eagle*, 15, 29 May 1996.

proposed area. A feasibility study by commission staff had concluded that an expanded Whitesburg system could serve a larger population.

The ruling was appealed on the basis that the Whitesburg expansion postulated by commission staff would serve only a small portion of the area proposed for the countywide district. At a second hearing, in April 1997, the commission reversed its findings and ordered the creation of the Letcher countywide water and wastewater district, the first of its kind in Kentucky.[74] In June, responsibility for the proposed new district was formally transferred from the study group to a commission. McAuley was elected chair and served in that capacity until his death in February 2004.[75]

According to the plan developed by the Letcher study group with some expert assistance from numerous professionals, the district will expand in phases based on identified priorities. First, it will extend wastewater service to areas that receive their water supply from municipal systems but not wastewater service because of lack of funds, staff, and resources. The district will use the excess capacity of wastewater treatment plants in Whitesburg and Fleming-Neon. Second, because the flow of the North Fork of the Kentucky River is insufficient during the summer months, the district will develop a separate water source with a capacity of 4 million gallons per day and a storage capacity of 600 million–800 million gallons to provide a 200-day supply. Third, the district will extend water and wastewater service to densely populated regions of the county such as Mayking and Millstone.

These three initial phases would provide water to 56 percent of the county and wastewater to 53 percent, including the currently served population. The fourth

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[74] *Whitesburg Mountain Eagle*, 18 May 1997.

[75] *Whitesburg Mountain Eagle*, 2, 16 July 1997; Don Profitt, current chair of the Letcher County Water and Sewer District, personal conversation.

priority will be to provide service to parts of the county where the housing density is 10 per mile or greater. Finally, the district will construct alternative wastewater plants for settlements in small valleys containing 15–40 houses. This phased approach was deemed necessary because it is unlikely that all of the money needed will be available at one time. Construction priority is based on "the greatest need of the people and the environment." Should sufficient funds become available, phases might be constructed simultaneously.[76] The primary guiding philosophy of the district is to share county resources so that local excess capacity does not go unused.

Thus the Letcher County Water and Sewer District came into being. The new district had scarcely a dime in financial resources, yet the projected cost of the project exceeded $55 million. Funding began to trickle in, some from traditional sources, some from quite unexpected directions. Blackey received funding from ARC and USDA–RUS to build a $2.87 million water plant to replace the town's reliance on wells, many of which were found to be contaminated. The Kentucky PRIDE project was launched in June 1997, the creation of U.S. Representative Hal Rogers from Somerset, Kentucky. PRIDE stands for Personal Responsibility in a Desirable Environment and is tackling the problems of wastewater and open dumps in eastern Kentucky.[77] The North Fork Clean Water Project was phased out, and PRIDE adopted its goals for Letcher County. The county received two grants from PRIDE: $568,000 to Whitesburg to extend wastewater lines to twenty-two homes outside the city with adequate water but faulty septic systems or straight-pipe discharges, and $328,000 for an alternative wastewater disposal system for a cluster of thirty homes at Millstone. Recently the Kentucky River

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[76] *Whitesburg Mountain Eagle*, 28 August 1997.

[77] *Lexington Herald-Leader*, 30 June 1997.

Authority approved funding for the required match ($109,000) for the Millstone Demonstration Project. Further, Representative Rogers worked hard—and successfully—in Washington to secure more funds, obtaining an additional $1.5 million for Letcher County (attached to the bill that renews funding for EPA).[78]

The district had a bold plan, but it faced a great obstacle: locating a water source sufficient for the needs of an entire county. Letcher County is headwaters for many streams but has no large bodies of water. Existing water supplies are nearly strained to capacity. For a time, opinion favored tapping the supposedly vast water reserves in some local underground coal mines that were flooded, but the idea was discarded after some disappointing pumping tests and the objection of the state Division of Water. Consequently, sources external to the county had to be secured. The most abundant supply will be obtained from a proposed surface-water impoundment in adjacent Knott County. The new Carr Creek Water Commission, of which the Letcher Water and Sewer District is a member, will serve communities in three eastern Kentucky counties. Funding for the $7 million project has been obtained from ARC, USDA–RUS, EPA, and an HUD block grant.

The district has jurisdiction over the entire county outside the four municipalities of Whitesburg, Jenkins, Fleming-Neon, and Blackey. As of this 2004, the Letcher County Water and Sewer District provides water to fewer than 200 households but is extending water lines along the highway from Blackey, which has excess capacity, through the rural neighborhood of Isom. This will add about 750 households initially, and when feeder lines are extended up the mountain hollows from the main line, the system will provide service to an additional 750 rural homes. Current district chair Don Profitt estimates that the

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[78] *Whitesburg Mountain Eagle*, 1 April, 28 October 1998.

district will be able to provide water to nearly 4,000 households within five years.[79]

So through a combination of efforts at the lowest and highest levels, Letcher County's vision of a countywide, unified water and wastewater system is becoming a reality. There are still obstacles, but the grassroots energy and creativity that brought about the district is finding innovative ways to get around them. Christel Blackburn, who served as coordinator of the North Fork Clean Water Project from 1997 until the organization disbanded, observed, "Our mission here was to build citizen capacity to get good water and sewer," she says, "not specifically to form a countywide district. You can't cookie-cut what happened in Letcher; it was driven by personalities."[80]

Yet others have observed the Letcher experience and applied the lessons. Other county action teams, sponsored by MACED, have been formed in eastern Kentucky, and at least one action team, in Breathitt County, wants to emulate the Letcher County model and form a countywide system. The state continues to encourage regionalization of water and wastewater systems. Blackburn notes, "The Division of Water has the attitude of being very responsive to citizen participation."[81]

Implications for the Future

In McDowell and Letcher counties, the goals are the same: safe drinking water and proper wastewater treatment for all citizens. Citizen activism in McDowell

[79] Don Profitt and Jack Martin, Letcher Water and Sewer District, personal conversation, July 2004

[80] Christel Blackburn, North Fork Clean Water Project, personal conversation, 3 April 1999.

[81] *Ibid.*

County is community-based, whereas in Letcher County, grassroots involvement is county-based and has involved a more holistic approach of cooperative needs assessment and resource sharing. In both cases the harnessed energy and enthusiasm of citizen volunteers appear likely to achieve the ends. In Letcher County, though, they may be accomplished sooner because the novelty of intercommunity cooperative infrastructure development attracts attention. The Letcher County approach has served as a stimulus to the brokers of political and economic power to find innovative ways to make development happen.

As Letcher County activist Blackburn noted, there is no “cookie-cutter” solution; no one-size-fits-all model for infrastructure development in Appalachia’s distressed counties. Although an outsider might perceive all these counties to be alike in their rugged topography, their legacies of physical isolation and their social and economic impoverishment, they vary considerably in these and many other aspects. The lessons from Letcher and McDowell counties are intended not to provide templates for indiscriminate application elsewhere but to show what can be accomplished when a sufficiently motivated citizenry evaluates local circumstances to produce locally based solutions.

What does this mean in practical terms to policy makers? If no single model can or should be used, how can the experience of McDowell and Letcher counties be applied? One framework that may be useful for integrating the two approaches is to consider them in terms of scale: micro versus macro, or local versus regional. The micro approach addresses the specific local needs of a community or neighborhood, such as motivating volunteers to help install water lines in the Millville neighborhood of War. The macro approach undertakes to build infrastructure for a region, which may be a single county, as the Letcher County Water and Sewer District is doing, or a larger unit, as the multicounty Carr Creek Water Commission is doing. Governments, of course, employ both micro and macro solutions in development. A more desirable alternative to top-down development is to encourage and integrate citizen participation at both micro and macro levels.

From the McDowell and Letcher county experiences, therefore, certain key concepts can be extracted that may be used elsewhere as a foundation on which local solutions to local problems, not limited to water and wastewater issues, may be constructed. The first and most important concept is citizen participation at all levels in assessing, planning, and implementing development projects. This goes far beyond the traditional process in which citizen participation is adjunct rather than integral, limited to comments solicited at hearings and aired in the media after plans already have been made by groups of experts. The professionals, representing such areas as public health, law, engineering, geology, and the environment, have a significant and necessary role but should serve as advisers who work directly with citizen representatives to plan achievable goals. Experts may suggest options and alternatives but should remain receptive to ideas generated from the local populace. In other words, they should facilitate, not dominate.

Motivating citizens to participate in the decisions that affect their own lives and welfare can be a challenging task in any part of America. It may be particularly daunting in parts of Appalachia where paternalistic coal companies dominated social and economic life for so long. In such a situation, an outside, nongovernment organization such as the Rensselaerville Institute or MACED's North Fork Clean Water Project may serve as a catalyst, providing the impetus and the means for people to get together and begin the process of evaluating their needs and making decisions about solutions. As in the case of the Letcher County Action Team, the effort may grow to address concerns that far outrange the original area of interest.

A key element of Letcher County's long-range plan for water and wastewater services is its pooling of resources among the communities for the betterment of the general population, while allowing the communities to retain autonomy. The problems of water supply and wastewater disposal were of such great concern to all that communities were able to overcome traditional rivalries and isolationist attitudes. Each community system became a link in a larger complex of resource sharing. At the same time, support was gained from rural residents who, fearing the consequences of annexation if they were to connect to a city water system, were far more willing to participate in a county-based system.

Another important benefit associated with a grassroots citizen movement is that the local community in effect takes ownership of the developed infrastructure and is willing to provide the necessary continuing resources to operate and maintain its significant initial investment.

Citizen-based planning does not guarantee success, of course. The huge cost of building water and wastewater infrastructure remains a primary hurdle when these basic services are lacking for large areas in which construction costs are high and funding sources are limited. Moreover, areas that completely lack water and wastewater are not the only ones in need. Many Appalachian communities with a public water system are poorly served by aging and inadequate facilities. The solution is likely to require an approach that at first seems contradictory: not only regionalization of water supplies to take advantage of efficiencies of scale in the pooling of resources, but also funding and support of small-scale, strictly local, often nontraditional methods of supplying safe drinking water and treating wastewater. By this two-pronged approach, the majority of citizens—those living in communities and in the most densely populated rural areas—can be served by a large public system, and the more isolated residents, living in dispersed mountain hollows where pipeline construction costs are prohibitive, can be served by small local facilities under the management of the regional system.

These small systems would provide water and wastewater treatment for clusters of perhaps a few dozen homes. Rather than attempting to build pipelines into every hollow and pump water hundreds of feet vertically up mountainsides, existing water resources of good quality might be tapped through the construction of well fields or the use of flooded mines. In some cases, funding for individual home wells might be the best solution, for field evidence indicates that many water-quality problems derive from shallow, hand-dug wells or improperly constructed ones.[82] Wastewater treatment might be accomplished through the use of properly built and maintained septic systems, on a community or an individual scale, or by alternative methods, such as constructed wetlands or peat filters.

In sum, one size does not fit all in delivery of water and wastewater, even in similar parts of the ARC region. There are however, four primary conclusions can be derived from the investigations in McDowell and Letcher counties:

- Water supply and wastewater disposal must be addressed simultaneously. In the absence of proper wastewater treatment, an increase in the number of people served by a water system dramatically increases the volume of raw wastewater released into rivers and streams.
- Water and wastewater planning should be conducted on a regional basis, although many small communities may require strictly local solutions because of economic considerations. A regional system can incorporate many water supply sources and methods of wastewater treatment under one umbrella.

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[82] Kentucky Division of Water, *Gateway Area Development District Water Well Study* (Frankfort: Natural Resources and Environmental Protection Cabinet, 1988).

- Direct and continuous citizen involvement in the planning, implementation, and administration of infrastructure improvements provides benefits in the form of local knowledge, innovative solutions, and morale building through empowerment. Further, it may generate a willingness to tackle other local issues.
- Stimulating grassroots participation may require a catalyst—an individual or an organization that can provide encouragement and coordination in the early stages.

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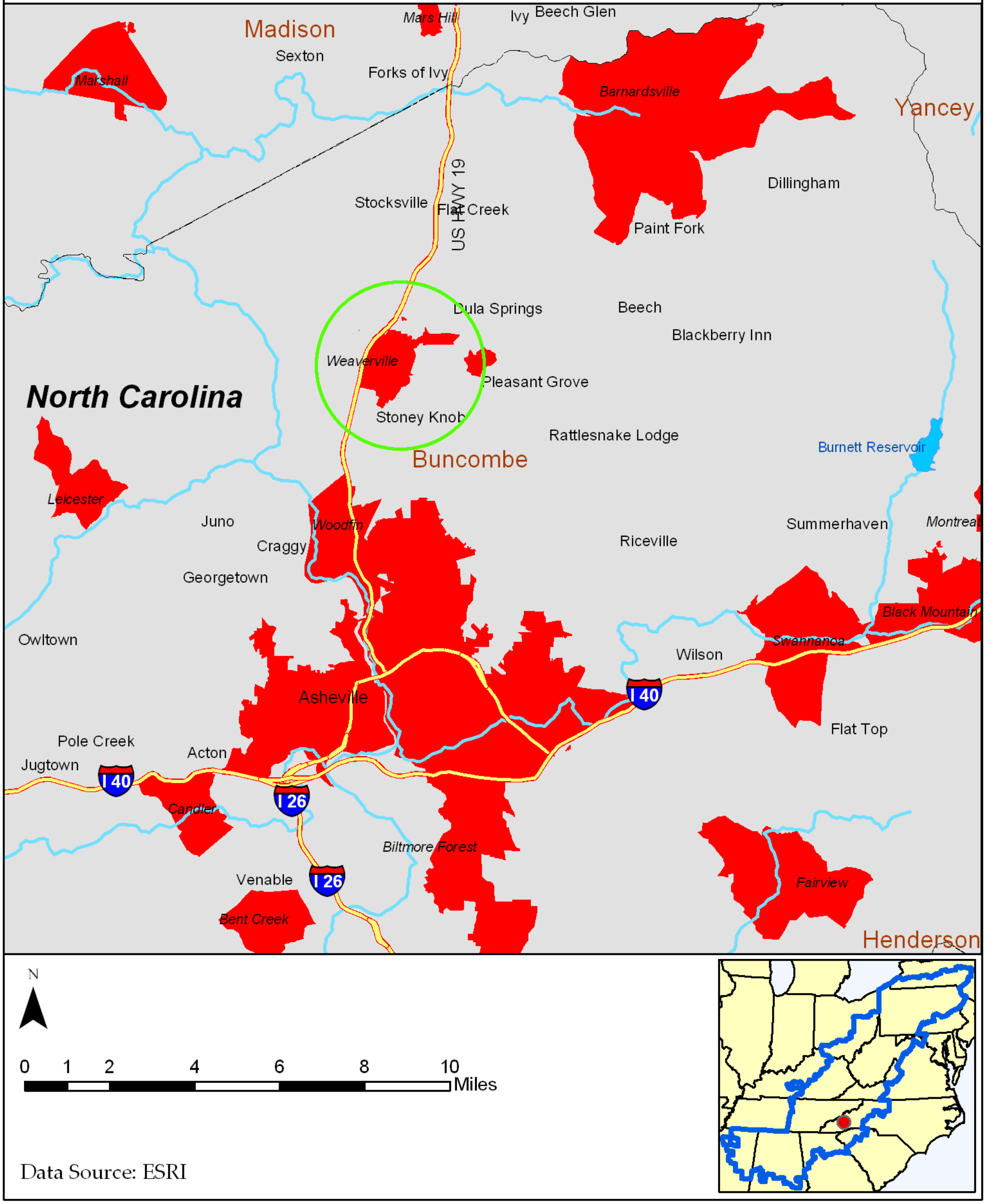
Case Study:
Weaverville, North Carolina

Weaverville, a town in western North Carolina, is just north of Asheville, in Buncombe County near the Madison County line (refer to Figure E-6). This part of the Appalachians is growing relatively rapidly. Newcomers are lured to the Asheville area from both the northern cities and the deeper parts of the southern United States. They come for the mild climate and the rare combination of a beautiful natural setting and vibrant urban amenities. Many settle outside Asheville, in Weaverville and its neighboring communities, Woodfin (a sanitary district) and Mars Hill (a town in Madison County), home of Mars Hill College. Weaverville has grown from 1,495 residents in 1980 to 2,107 in 1990 (a 40.9 percent increase) to 2,416 in 2000 (a 14.7 percent increase).[83] Adding to the pressure of growth is a new interstate highway segment, I-26, which will provide an alternative to the trip to Tennessee on I-40 through the Pigeon River gorge.

As a result of the population influx, there are many well-to-do residents in and around Asheville, and Buncombe County was a competitive county in 2004, in the typology of the Appalachian Regional Commission (ARC) (for a definition of "competitive," see chapter 1). At the same time, Madison County, like the other counties just outside the metropolitan area, is among the poorest counties in the state—"distressed" in ARC's typology.

[83] Census Bureau, Census 1980 Census of Population; Census 1990 Summary Tape File 1; and Census 2000 Summary File 1.

Figure E-6. Location of Weaverville, NC, in Buncombe County



Data Source: ESRI

In the area around Asheville, there is much new construction of housing that meets building codes for water and wastewater services, but there also is much older, rural housing stock that has been handed down in families or is still inhabited by the now-elderly builders. Weaverville and several other municipalities in the area can look to the Metropolitan Sewerage District for wastewater collection and treatment. However, much of the older rural housing stock is plumbed directly into the streams via "straight pipes," or it has a poorly maintained or failed septic system.

Adding to the water problems is a long tradition of keeping livestock and giving them direct access to the creeks. This is an efficient way to water the cows but a problem for downstream water quality in terms of turbidity resulting from animal waste and eroded stream banks.

A few communities in the Appalachians have had the ability and the foresight to get a water supply high up, at the headwaters, and protect it through land use restrictions or conservation easements, thereby ensuring some quantity of high-quality water for the future. Asheville has done this (see the sidebar, "The Asheville Watershed"). But in many other communities in the Appalachians, the generations-old traditions of finding water as needed and of resisting planning and land use controls leave them at risk of problems when the time comes to expand the water supply. Water has a way of cutting across the gaps between new and old residents, between wealthy and poor, between new systems and old straight pipes. For the thriving community of Weaverville to solve its water supply needs, it had to find a way to handle the legacy of inadequate wastewater treatment in the upstream, rural communities: high turbidity and coliform counts in the source water.

The Asheville Watershed

Although Asheville is located along a major river, the French Broad, early town leaders decided to find and secure a water supply of more pristine quality. They found it in two reservoirs high in the Black Mountains, northeast of the city, over the ridge from Weaverville.

In 1996, to protect this high-quality supply, the city placed a conservation easement on all 18,000 acres of the watershed. William A. Campbell, a lawyer, a professor at the UNC at Chapel Hill's School of Government, and then president of the Conservation Trust for North Carolina, helped negotiate the easement. The easement is monitored annually by the trust representative site visits. The Conservation Trust for North Carolina views its relationship with Asheville as a partnership, and city officials take the monitoring and the easement conditions seriously.

The easement allows limited logging in the watershed, and in 2004 city leaders and citizens were engaged in a vigorous discussion about the terms of a forestry management plan designed to let the city harvest some timber from the watershed without compromising water quality. The easement helped structure the debate, and as long as the land trust is sustained, it helps assure Asheville residents of a safe, high-quality water supply.

Land trusts are active throughout Appalachia and can be useful partners for water systems seeking a higher level of protection for high-quality supplies. For more information, see www.ctnc.org and www.lta.org.

Weaverville, Woodfin, and Mars Hill, seeing the growth trends and the resulting needs for expanded water service, began planning in the late 1980s how to meet projected needs (see Table E-9). Weaverville has supplied water to its residents since voters approved the construction of a municipal water system in 1913. By the late 1980s, its needs were the most severe. Its existing sources, Ox

Creek and Eller Cove, supplied only a small fraction of the town's predicted twenty-year demand.

Table E-9. Water Demand Trends

Community	Existing Water Supply Safe Yield (in 1987)	2010 Demand	2040 Demand
Weaverville	130,000 GPD (from 3 sources)	990,275 GPD	1.4–2.6 MGD
Woodfin	1,289,150 GPD (from 3 sources)	0.2 MGD (set aside only)	0.5 MGD (set aside only)
Mars Hill	531,115 GPD	0.2 MGD (set aside only)	0.5 MGD (set aside only)

GPD = Gallons per Day
MGD = Million Gallons per Day
Set aside values are estimates for emergency use (additional data was not readily available)

Sources:

M. Keith Webb, "Preliminary Engineering Report" McGill Associates, Asheville, NC, January 1987.

M. Keibth Webb, "Preliminary Engineering Report" McGill Associates, Asheville, NC, November, 1992.

Town of Weaverville Files, "Projected Water Needs; Year 2040"April 1992.

Weaverville, and initially Woodfin and Mars Hill, were interested in the Ivy River, a watershed north of Weaverville, nearly midway to Mars Hill and just across the county line. One turn of the Ivy River lies within Buncombe County, but the majority of the watershed lies within Madison County. The two largest tributaries join to create the main stem of the river, less than six miles from Weaverville, to form the Forks of Ivy.

However, the Ivy River was not classified as a source of drinking water. In the late 1980s, while the three communities were planning for their water needs, North Carolina passed the Water Supply Watershed Protection Act, which added water supply categories to the state's existing stream classifications and specified accompanying requirements (e.g. land use restrictions) to limit residential density, handle stormwater, maintain vegetated buffers for streams, follow best management practices for agriculture and transportation improvements, and keep certain uses such as landfills out of the area designated as a water supply watershed. For the communities looking to the Ivy River, and other mountain communities in North Carolina, this act posed some political problems: it meant that one town's water supply, if located in another jurisdiction (as the Ivy River was, located in Madison County), would create limits to growth and impose land use restrictions on people living near that water but outside the town's water service area.

The Water Supply Watershed Protection Act proved to be a serious challenge for the proposed water supply on the Ivy River. By spring 1993, Madison county residents were concerned about the land use restrictions in the act, and they began writing their state legislators and seeking other ways to stop the drinking water intake for Weaverville. The letters expressed serious opposition to the Weaverville drinking-water expansion project into the Ivy River. An April 14, 1993 letter from the Madison County attorney to the North Carolina Department of Environment and Natural Resources (DENR) called the situation an "economic disaster . . . [that takes] land without compensation . . . [causing] depreciating the value of land …[that is] costing our citizens jobs . . . and substantially depressing the tax base."[84] Public notices were posed stating that lands had been "condemned without compensation to the owners." [85]

Land use restrictions were not the only problem. Reclassification of the stream as a water supply source required approval by DENR's Division of Water Quality and a sanitary survey and approval by DENR's Division of

[84] Larry Leake, Madison County Attorney, letter to DENR, 14 April 1993, on file with Town of Weaverville

[85] 1993 Public Notice "This Property Shown On This Map Has Been Condemned Without Compensation To The Owners" (no author), on file with NC DENR

Environmental Health. Tests done in association with the request for reclassification and the drinking water intake revealed that the water quality in the Ivy River was badly compromised from upstream wastes and agricultural practices. Turbidity was regularly as high as 2,000–3,000 Nephelometric Turbidity Units (NTUs), and coliform levels ranged up to 6,000 colonies per 100 milliliters.[86] Wide and rapid fluctuation in turbidity and bacteria indicated that there were serious runoff problems from nonpoint sources.

The Division of Water Quality felt that the elevated turbidity and fecal coliform levels should not prevent the reclassification of the stream. However, actual regulatory approval of the new water intake required permission from the Division of Environmental Health, and the health regulators felt that the water intake should not be approved until the pollution sources were identified, corrective actions were implemented, and water-quality standards were met. Also, in 1987 the Environmental Protection Agency (EPA) had passed the Surface Water Treatment Rules, which applied land use restrictions to all surface sources of drinking water and viral inactivation or viral removal requirements. The rules became effective June 30, 1993. All of this meant higher costs for the project.

In July 1991, Woodfin withdrew its interest in the new water intake. Weaverville and Mars Hill decided to evaluate relocation of the intake upstream, above the confluence of the Forks of the Ivy, hoping that this would improve the quality of the source water. However, there were two concerns with this modification. First, additional distribution lines and two intake locations would be required, resulting in an increase of approximately $600,000 in project cost. Weaverville claimed that this additional cost was unmanageable unless Mars Hill was willing to bear it. Second, because of biological and hydrological

[86] Review of DENR Public Water Supply (PWS) files, dated July 1994, by Matthew Richardson, July 2004.

limitations, the relocation would limit the amount of water available for withdrawal, to the point that potentially only half of the 2040 water demands would be met. A November 1992 “Long Term Water Supply Engineering Report” for Weaverville raised the costs associated with extending the Weaverville water supply to the Ivy River from $4.6 million to $5.4 million. The report also documented that 45.4 percent of the water in the Weaverville system was unaccounted for. This proportion was significantly greater than the generally accepted amount of 10 percent to 15 percent for a water system the size of Weaverville’s.

DENR pushed the towns to consider consolidation with the Asheville-Buncombe Water Authority (ABWA). Weaverville rejected this option on three counts. First, the ABWA had not yet developed its own source of long-term supply, and Weaverville, because of the immediate pressing need for additional water, could not wait for ABWA’s unknown timeframe to be resolved. Second, Weaverville did not want ABWA controlling Weaverville’s growth. Third, the fees that Weaverville residents would pay would be for the ABWA’s system, whereas these monies could be used for Weaverville’s own system.

By January 1993, Weaverville had set aside $100,000 in town funds, applied for $1.5 million from the Economic Development Administration, and applied for $200,000 from ARC. In April 1993, Mars Hill withdrew its interest in the project, leaving Weaverville on its own to face both the political opposition over the watershed restrictions and the problems with the quality of the source water. Opposition to the reclassification heated up, and with Mars Hill out of the picture, residents of Madison County felt that there was no benefit to placing restrictions on land use in the Ivy River basin. Following the discovery of bullet holes in the Weaverville town manager’s vehicle, Weaverville employees required personal security and protection in late spring 1993.[87] One citizen letter, dated June 23, 1993, to the Governor of North Carolina regarding the Water Supply Watershed Protection Act stated, "Both parties are sneaky, underhanded workers of the Devil, and should be removed from office."[88] Weaverville attempted to have the watershed removed from the Water Supply Watershed Protection Act through legislation. It succeeded in getting a bill passed, but the legislation was ultimately struck down by the North Carolina Supreme Court as unconstitutional.

Weaverville pushed ahead to find funding and to get help in overcoming the regulatory barriers. On June 1, 1993, the citizens of Weaverville approved (by nearly a 2 to 1 margin, with an 80 percent turnout) a forty-year general obligation bond of $4.6 million to extend Weaverville's drinking water supply to the Ivy River. The DENR Public Water Supply Section issued an annual permit for the Weaverville drinking water source in the Ivy River, conditioned on Weaverville's meeting all applicable federal and state regulations, with emphasis on protection of the watershed.

In June 1995, Weaverville submitted an application to the state for approval of $4.6 million in general obligation bonds. In North Carolina, all local general obligation indebtedness has to be approved not only by the voters in the government unit issuing the bonds but also by a state regulatory agency, the Local Government Commission. In November 1996 the bond series was issued. However, only about 85 percent ($3,904,000) of the approved general obligation bond was needed. The balance was not issued.

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[87] Mike Morgan, Weaverville town manager, interview with Matthew Richardson, July 2004.

[88] Ms. Carole Dee Shuford's letter to Jim Hunt (former) Governor of North Carolina, June 23 1993; on file with Town of Weaverville

The Farmers Home Administration of the U.S. Department of Agriculture (USDA–FHA) purchased all the general obligation bonds—$3.9 million worth. Additional project support was provided by a $1.5 million grant from USDA–FHA, a $200,000 grant from ARC, and $100,000 in Weaverville township funds. The application for $1.5 million from the Economic Development Administration was not approved. (The Drinking Water State Revolving Fund (DWSRF) did not begin until 1997. Therefore DWSRF monies were not available for this project.) Other potential sources of funding in Western North Carolina include the Clean Water Management Trust Fund and the Pigeon River Fund (refer to sidebar). A fairly significant jump in water rates was (accurately) projected for 1998 (see Table E-10).

Table E-10. Customer Water Rates in 1995 and Projected Rates after Project Completion

Location	Current (1995) (per 6,000 gallons residential)	Projected after Project Completion (1998) (per 6,000 gallons residential)	Percent Change
Within city limits	$23.25	$26.95	15.9
Beyond city limits	46.47	53.90	16.0

Source: "Application for Approval of GO Bonds; Town of Weaverville" by McGill Associates, Asheville, NC, June 1995.

In January 1995 the environmental health regulators reported to the water quality regulators that they had identified two likely sources of waste runoff: straight pipes for household sewage, and livestock watering and feeding areas and barn lots near streams. With the exception of one facility that had an operating treatment system for livestock waste, all the other livestock operations in the Ivy River watershed were exempt from animal waste registration rules because of the small number of animals (less than 100 head) on each property.

The Pigeon River Fund

The Pigeon River Fund was created to help support water quality and water-related projects in the Pigeon and French Broad river basins of North Carolina. It is a good example of how dedicated funds for environmental purposes can sometimes solve other problems. In the early 1990s, Carolina Power & Light Co. (CP&L, now Progress Energy) was renegotiating its federal license for the Walters Project, a dam on the Pigeon River near the North Carolina/Tennessee line. The negotiations were stalled; in fact, the case was in litigation at the Federal Energy Regulatory Commission (FERC) and had become the oldest case on the FERC docket. The issues were complicated by contaminated sediments behind the project dam, the result of decades of uncontrolled waste discharges from the Champion Paper Company mill in Canton, North Carolina. Tennessee absolutely refused to allow any of the sediments to be released through the dam. However, the thirteen-mile stretch of river immediately downstream from the dam received no water from the dammed upstream portions, a condition that was permitted under the power licenses of the Depression era but not under those of the modern era. If the license did not require CP&L to release water to provide minimum flows to the stretch not receiving water, the company would receive a windfall because it could use all the water in the reservoir for power generation. However, this was unacceptable to fishermen and environmentalists and under modern environmental law.

As a compromise, CP&L agreed to put money into a fund, the Pigeon River Fund, more or less equivalent to the value of the extra water it was allowed to keep in the reservoir, until the water quality in the reservoir matched the very high-quality conditions of the tributaries to the stretch. The initial capitalization was $1 million. The fund, begun in 1996, is overseen by a board of directors as set out in the FERC license. It has funded numerous projects in the region. Its grant amounts are much smaller than those of some other funders, such as the North Carolina Clean Water Management Trust Fund. However, according to Forrest Westall, Water Quality Supervisor for the Division of Water Quality and a fund board member, it has found a special niche in providing planning money for projects that then seek larger grants for implementation.1 For more information, refer to the website at www.pigeonriverfund.org.

In August 1995, DENR granted conditional approval for the water intake, provided that (1) a program for the elimination of unpermitted sources of fecal coliform contamination was established before plant startup and (2) an engineering report could demonstrate an effective mechanical substitute for a pretreatment reservoir to equalize fluctuations in turbidity, bacteriological concentrations, and chemical quantities. If these parameters were not met, DENR might require development of a new intake location.

The lead engineering firm helped meet the second condition by proposing to add an upstream clarifier with a 30- to 68-minute retention time to the packaged drinking-water plant to control the turbidity of water entering the plant. Similar processes constructed at two plants in Illinois and Kentucky had proved to be successful in removing turbidity and managing total coliform and fecal coliform.[89]

The first condition was more complicated because the sources of the water pollution were outside the jurisdiction of Weaverville. Indeed, they were primarily in another county. Helped in part by attention given in a 1995 Year of the Mountains summit that led then-Governor James B. Hunt to set a goal to eliminate straight pipes in western North Carolina by the end of the decade, in 1996 the legislature established the Wastewater Discharge Elimination (WaDE) Program to manage sources of fecal coliform operating without a permit (see the sidebar, “The Wastewater Discharge Elimination Program”).

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[89] December 19, 1994 Letter from McGill Associates to Mr. Harold Saylor NCDENR; on file with DENR PWS Division

The Wastewater Discharge Elimination Program

At its inception in 1996, the state's flagship program for eliminating straight piping and failing septic systems, the Wastewater Discharge Elimination (WaDE) program, consisted of one environmental health specialist and one data-entry person. WaDE was forced from the outset to seek partners, and it did so with great success. For example, for the 1998 residential surveys in the Ivy River watershed, it was assisted by the Land-of-Sky Regional Council (LOSRC), Madison County, ARC, and the North Carolina Clean Water Management Trust Fund. Keith Roland, onsite wastewater assessor with the Buncombe County Health Department, contracted with Madison County on a part-time basis to manage the survey and review its results.

In January 2000 the key partners in the WaDE program included the Buncombe County Health Center, Environmental Health Division; the North Carolina Rural Communities Assistance Project; the U.S. Department of Agriculture, Rural Development program; Mountain Housing Opportunities, Inc.; and LOSRC. LOSRC was the financial administrator for processing household loan requests. (For the monies allocated by these and other funders of the Buncombe county/Ivy River watershed WaDE surveys, see Table WaDE-1).

Table WaDE-1. WaDE Funding Sources

Source of Funds	Amount (FY 1999–2000)	Amount (FY 2000–2001)
Mountain Housing Opportunities, Inc,	$ 61,200	$ 62,400
WaDE	49,126	53,000
U.S. Department of Agriculture, Rural Development	46,200	2,400
Land-of-Sky Regional Council	8,563	2,000
North Carolina Rural Communities Assistance Project	6,648	–
N.C. Department of Environment and Natural Resources, Non Point Source Division	4,126	–
Western North Carolina Housing Partnership, Inc.	3,500	–
Buncombe County Health Center, Environmental Health Division	2,000	4,500
Total	$181,363	$124,300

Source: NCDENR WaDE's "Buncombe Environmental Survey Project Report," Asheville, NC, October 2000

WaDE began door-to-door surveys to determine the scope of the problems. Numerous partners supported it in this effort: the local health departments, the towns, the Land-of-Sky Regional Council, the North Carolina Rural

Communities Assistance Project (RCAP), the USDA Rural Development program, and a nonprofit entity called Mountain Housing Opportunities, Inc. During the surveys, the surveyors distributed educational materials on wastewater treatment and conducted dye tests (dropping dye tablets into sinks and toilets to see if colored water emerged into a stream or septic tank area). The number of violations discovered was roughly three times the number anticipated. WaDE's October 2000 report on Madison County cited 996 violations based on a survey of 5,360 homes. By the time of the report, 133 of the 996 violations had been corrected. The approximate cost of the survey per household was $50.98. In Buncombe County (a portion of which lies in the Ivy River watershed), in a survey of 1,243 homes, 161 violations were discovered, including 117 straight pipes, 35 failing septic systems, 4 unpermitted pit privies, and 2 homes with no waste facilities whatsoever. Forty-eight of the 161 violations had been corrected by October 2000. The approximate cost of the survey per household was $47.58.[90]

A welcome surprise from the survey was how well the inspectors were received. Surveyors documented 95.0 percent of the homeowners as extremely cooperative, 4.9 percent as hesitant, and only 0.1 percent as uncooperative. Almost all the people who were identified as having a violation or a problem cooperated with repairs.[91] Probably a major reason that they did so was the financial assistance that WaDE and its partners put together to help repair the problems. The Buncombe and Madison county health departments processed the

[90] NCDENR WaDE's "Buncombe Environmental Survey Project Report," Asheville, NC, October 2000

[91] Matthew Richardson, "North Carolina's Waste Discharge Elimination System" (paper submitted for Applied Environmental Finance Class, spring 2004; on file with author and professor).

violations resulting from the surveys and led property owners to the financial resources administered on behalf of WaDE and its partners through the Land-of-Sky Regional Council. In November 1999, USDA set aside $45,000 to finance corrective actions for residential wastewater elimination in the Ivy River watershed. Meanwhile, Mountain Housing Opportunity made $60,000 available for housing rehabilitation.

The small community of Stumptown was identified as the source of numerous straight pipes. With funding from the North Carolina Clean Water Management Trust Fund and matching town grants (which took nearly five years to negotiate), Stumptown was connected to the regional wastewater collection and treatment system.

It is easy to see why wastewater problems are costly to correct in Madison County. The roads wind up and down past rocky, fast-flowing streams and creeks that drain into the French Broad River. Houses are near streams and often far apart from each other, usually on back roads. A resident can install a conventional septic system for about $2,000 if he or she has enough land for a septic tank and a drainage field downhill from the home. However, if wastewater has to be pumped uphill, costs can easily reach $8,000 or more. Therefore, punitive measures against straight piping have been loosely enforced. Local officials are aware that even $2,000 may be beyond the means of many families. "Who would tell cash-strapped people—more often than not, elderly—that they had to sell or abandon their home or family farmstead because of a housing code violation?" wrote Fred D. Baldwin, freelance writer[92]

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[92] Fred D. Baldwin, "Cleaner Water: North Carolina's Straight-Pipe Elimination Project," *Appalachia Magazine* [online], September–December 1999, available at www.arc.gov/index.do?nodeId=1277.

To address agricultural practices, in 1999 the Nonpoint Source Management Program of DENR collaborated with the USDA's Natural Resources Conservation Service (NRCS), Madison County Soil and Water Conservation District, to secure $1,072,750 in funding from a combination of federal and state sources. The monies were allocated to work with forty animal operations in the Ivy River watershed to establish controlled grazing demonstrations, promote education, develop alternative watering systems, redistribute livestock, and restore vegetation. According to Russell Blevins, a conservationist with the USDA–NRCS district in Madison County, the agricultural community has accepted and supported the program, even though most grants require 25 percent cost-sharing by the farmer.[93]

Meanwhile, in 1998, Weaverville completed construction of the Ivy River Water Treatment Plant. The plant is working well, under the direction of an experienced operator, Tony Laughter, Weaverville's public works director, Larry Sprinkle, and the town manager, Michael JaVan Morgan. In 2000 the utility served about 1,125 customers in Weaverville and another 550 in the county along the water supply line from the Ivy River. The system was working well by March 1999, and the plant was meeting all state and EPA standards.[94] The plant also monitors stream conditions, giving the basis for future assessment of the upstream wastewater improvements. Coliform and turbidity levels vary greatly, so the plant will have to review data over a long period to determine just how effective all the work in the Ivy River watershed has been. The preliminary data look promising, though.

[93] Russell Blevins, district conservationist, USDA–NRCS, telephone interview with Matthew Richardson, 15 July 2004.

[94] Town of Weaverville Water System 1999 Water Quality Report, Weaverville, NC

A 1999 report by the Nonpoint Source Management Program rated the Ivy River as having the 5th and 11th worst water quality (depending on water quality metric) of the 130 streams in seven counties monitored by the citizen-based Volunteer Water Information Network. However, the 1999 raw data documentation file in DENR's Public Water Supply Section reports a 40- to 50-percent decrease in fecal coliform numbers (based on the number of days that have less than 300 fecal coliform colonies per 100 milliliters) from the same time period the previous year. [95] In addition, VWIN's statistical trend analysis of the Ivy River watershed for 1992–2002 reports some improvement. Measured fecal coliform concentrations in the Ivy River watershed have noticeably decreased in the past five to ten years.[96] This is primarily a result of alternative livestock feeding and watering operations coordinated by Blevins and the Madison County Soil and Water Conservation District.

The Weaverville water system recovers its costs through user charges (water sales, tap fees, reconnection fees, interest income, etc.). Water rates are based on meter size and location within or outside town limits. Rates were raised by about 25 percent from 1992 to 2000, about 43 percent from 2000 to 2004 (see Table E-11).

Table E-11. Weaverville Customer Water Rates 1992, 2000, and 2004

	Cost inside Town				**Cost outside Town**			
	2,000 gal./mo.	**4,000 gal./mo.**	**6,000 gal./mo.**	**10,000 gal./mo.**	**2,000 gal./mo.**	**4,000 gal./mo.**	**6,000 gal./mo.**	**10,000 gal./mo.**
1992	$5.90	$12.10	$18.59	$31.57	$11.80	$24.19	$37.17	$ 63.13
2000	7.38	15.13	23.25	39.49	14.76	30.25	46.47	78.91
2004	10.60	21.70	33.30	56.50	21.20	43.30	66.60	113.00

[95] Microbiological Operations Reports for Town of Weaverville's Ivy River WWTP, on file at NC DENR Public Water Systems (PWS) Division

[96] Ms. Marilyn Westphal, analytical chemist and VWIN coordinator, conversation with Matthew Richardson, July 20, 2004

Source: 1992, 2000, and 2004 Town of Weaverville Water Department, Ordinances to Establish a Schedule of Rates, Fees, Charges & Penalties

Weaverville's median household income in 2000 was $45,100 per year. In that year, water rates accounted for 0.20 percent to 1.10 percent of such income for people within the town limits, 0.39 percent to 2.10 percent for people outside the town limits (see Table E-12).

Table E-12. Weaverville Water Rates as Percentage of Median Household Income, 2000

Percent age of 2000 MHI inside Town				Percentage of 2000 MHI Outside Town			
2,000 gal./mo.	**4,000 gal./mo.**	**6,000 gal./mo.**	**10,000 gal./mo.**	**2,000 gal./mo.**	**4,000 gal./mo.**	**6,000 gal./mo.**	**10,000 gal./mo.**
0.20	0.40	0.62	1.10	0.39	0.80	1.20	2.10

Source: Census Bureau, Census 2000 Summary File1; Table P1

In 2002, Weaverville residential water cost more than water in 90 percent of North Carolina (based on the charge for 3,000 gallons per month for a residential account).[97]

The construction of I-26 has developed a growth corridor in the area. This is a benefit to some people (relative to economic growth) but a detriment to those who are opposed to "outsiders" in the area. Regardless, there is currently a general consensus by the parties involved that water quality in the Ivy River watershed has noticeably improved, and consequently the regional flora and fauna also have flourished.

As for Governor Hunt's call for eliminating straight piping in western North Carolina by the end of the decade, in July 2002, in a survey of 1,844 homes, the number of straight piping violations was down to 265, and 154 of them had been corrected through septic system replacement or were in the process of being

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[97] Review of the North Carolina League of Municipalities Survey "How Much Does Water Cost?" December 2002. Rpt#329. www.nclm.org.

resolved.[98] As of July 2004, there remained some homes in the watershed that were not in compliance with straight-pipe laws.[99] Funding for repairs and replacements was available to the homeowners but had not been used. Blevins identified three main reasons for this: (1) the funding was primarily in the form of low-interest loans, not grants, and homeowners were choosing not to go into debt; (2) some homeowners did not qualify for loans; and (3) some strong-willed homeowners were opposed to large organizations (such as DENR and the U.S. Government) instructing them in their actions on their own land.[100]

Future drinking-water needs are difficult to determine precisely. To estimate the national needs for drinking water infrastructure over the next twenty years, EPA conducts nationwide surveys every four years, the most recent survey for which results are available was in 1999. They are based on a methodology that samples a portion of the nation's drinking water systems and then draw additional information from the Safe Drinking Water Information System to extrapolate drinking water needs at the state and national levels. To determine needs for a specific geographical location such as Weaverville, one must re-extrapolate the needs to the local level on the basis of an inventory of water systems in that geographical area. Using the 1999 EPA methodology and working with the eight small and the two medium-sized drinking-water systems in Weaverville, the estimated twenty-year drinking-water needs for Weaverville are $13,927,340 (UNCEFC calculated estimate). Note that one of the two medium-sized systems was an EPA survey sampling point, therefore the

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[98] WaDE's "Buncombe Environmental Health Survey Project" status reports 1999 through 2002

[99] (however the documentation is unclear on the precise number); WaDE's "Buncombe Environmental Health Survey Project status reports 2002

[100] Blevins, interview.

proposed needs values are actual reported values, rather than modeled estimates for this single system. Given that EPA's survey is conducted on the national level, and estimation of Weaverville's needs is a community-level analysis with a series of extrapolations, a number of data limitations may be identified. Weaverville's town manager reported that over the next twenty years, with potentially two plant expansions, the $14 million estimate is a loose but reasonably accurate estimate.

Although Weaverville has a secure source of water for the future, Mars Hill is reaching capacity with its source. Mars Hill and Weaverville officials have been engaged in discussions regarding supplying Ivy River water to Mars Hill. Weaverville's town manager is open to the idea of selling treated water to Mars Hill but says the town cannot sell water more cheaply to Mars Hill residents than it does to Weaverville residents. Mars Hill officials think that the rates are unreasonable. However, given the projected growth rates in the region, it is likely only a matter of time before Mars Hill is supplied with Ivy River water.

Future regional issues include Weaverville's high water rates relative to the rest of North Carolina, growth associated with the recently completed segment of I-26, the remaining residential straight pipes, the quality of Ivy River water, and Mars Hill's drinking water capacity limitations.

Weaverville could never have foreseen the obstacles in its path when it set out to find a new water source in the 1980s. Through persistence and creativity, it overcame those obstacles. The community could not have secured the water supply it now has, without the outside help such as the ARC, USDA–RUS, and WaDE, potential funding sources including the N.C. Clean Water Management Trust Fund and the Pigeon River Fund, the state legislature, and many partners at the local and regional level that worked hard to address problems and calm fears.

The primary goals of WaDE are twofold: (1) identification and correction of violations from onsite wastewater systems through door-to-door surveys and (2) identification of sources of financial assistance for wastewater management, for low-income homeowners and communities.

Typical WaDE surveys discover that from 9 percent to 60 percent of the homes are in violation. Noncompliance involves straight piping of black or gray water, failing and overflowing systems, and outhouses. The WaDE Survey Manual familiarizes communities with wastewater treatment processes and assists them in successfully completing surveys aimed at eliminating straight piping. The manual includes sample letters, survey forms, sample notifications of violations, press releases, and a recommended list of stakeholders that should participate in the community effort. The eight basic components of a survey project include funding, administration, surveying, corrections, financial assistance, enforcement, education, and data gathering/reporting. During the surveys, educational information is disseminated, and where plumbing configurations are not self-evident, the surveyors drop dye tablets into sinks and toilets (different colors for each) to see if colored water emerges into a stream or septic tank area.

For more information on WaDE, visit the website of the Environmental Finance Center of the University of North Carolina at Chapel Hill, at www.efc.unc.edu/, and click on N.C. Onsite Wastewater Systems: Funding and Resources.

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Case Study:
West Virginia–American Water

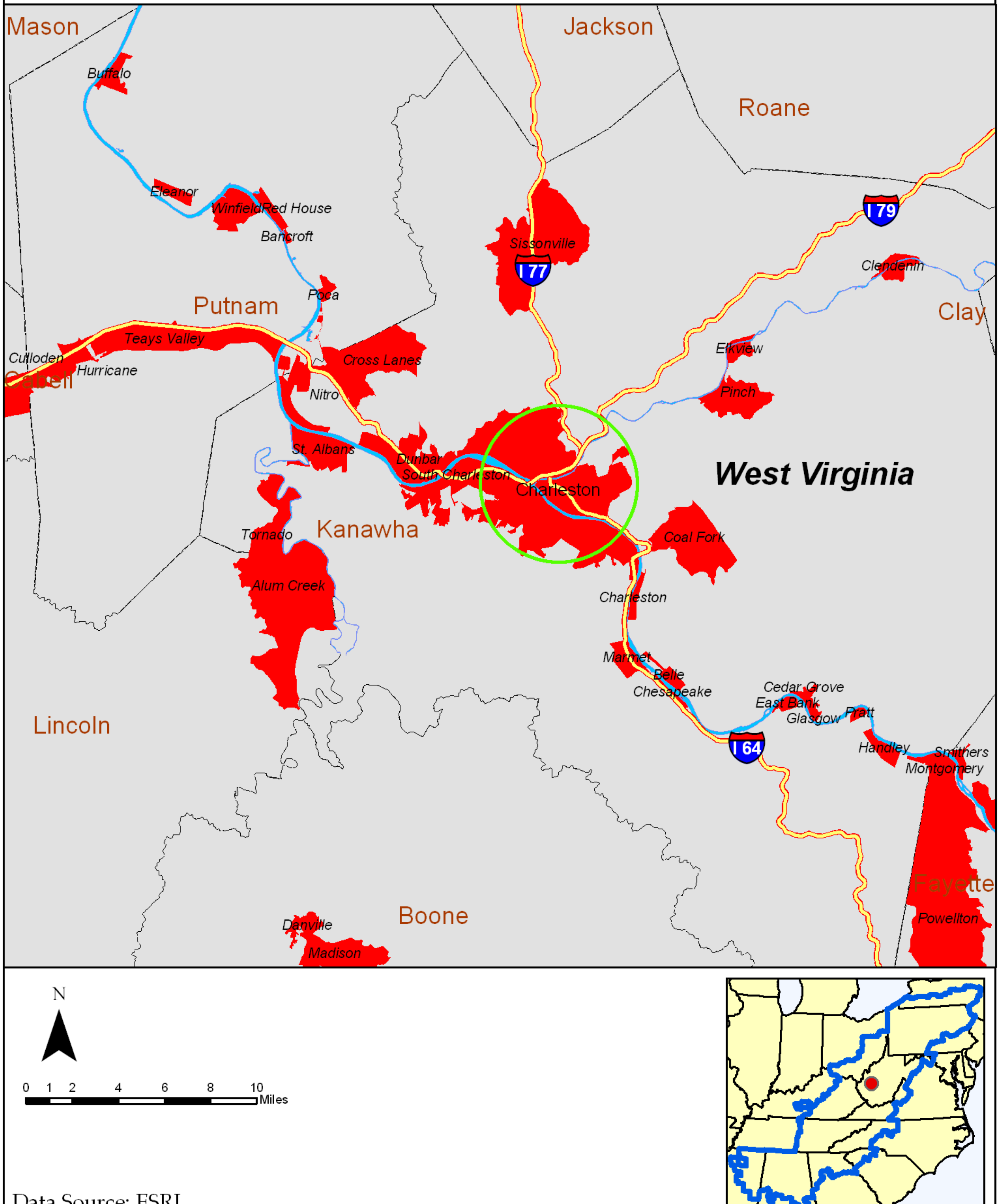
West Virginia–American Water (WVAW) follows many of the core strategies of financial sustainability promoted by the Environmental Protection Agency (EPA) and others.[101] It is a large, consolidated regional system that takes pride in its asset management and operational innovations. It practices meticulous cost accounting and has developed a pricing structure that it thinks accurately covers the full cost of providing water to its customers. WVAW also is a successful business that strives for efficiency and profits. This last point is an advantage or a detriment, depending on one's view about the privatization of water services.

West Virginia's largest drinking-water provider goes by different names depending on who is describing it. The official name, West Virginia–American Water Works, used by company officials and investors, reveals the company's relationship to one of the largest for-profit water companies operating in the United States, American Water Works.[102] State officials charged with regulating WVAW often refer to it simply as "the Company," a nickname that reflects its size and profile relative to other, smaller companies. (Refer to Figure E-7.)

[101] Environmental Protection Agency, "Sustainable Water Infrastructure for the 21st Century" (last updated 18 December 2003), available at www.epa.gov/water/infrastructure/.

[102] American Water Works itself is part of a larger, international water company, Thames Water, and Thames Water, in turn, is part of an even larger company, RWE, based in Germany.

Figure E-7. Location of Charleston, WV, in Kanawha County (West Virginia-American Water Headquarters Office)



Data Source: ESRI

The provision of drinking water by for-profit companies remains controversial, especially among government drinking-water providers, and WVAW has not escaped this controversy. So local officials will occasionally refer to WVAW simply as "the Spider," a water system that depends on pulling in other systems to survive and thrive. Gilbert Cross uses yet another image, "Dynasty of Water," to describe American Water Works and its affiliates in his 1991 company-commissioned corporate history.[103] Regardless of how the water provider is described, like its parent company, WVAW clearly is an ambitious and aggressively growth-oriented drinking-water provider that has a major influence in the areas where it operates.

WVAW provides drinking water to about 165,000 customers in eighteen counties in West Virginia and in several communities in Ohio and Virginia.[104] In terms of population served, approximately 500,000 West Virginians rely on WVAW water, more than 27 percent of the state's population and more than 35 percent of the state's population served by community water systems.[105] As of 2000, WVAW operated thirteen water treatment facilities and treated about 53.3 million gallons of water per day.[106]

Access to Capital

[103] Gilbert Cross, *A Dynasty of Water: The Story of American Water Works* (Voorhees, N.J.: American Water Works, 1991).

[104] Data from WVAW website (last visited 3 June 2005), at www.amwater.com/awpr/wvaw/start/index.html.

[105] Dan Bickerton and Chris Jarret, WVAW, interviews with author, June 2004.

[106] "Meeting Infrastructure Challenges" (compilation of WVAW presentations and reports, provided to author).

For-profit water and sewer providers often have difficulty gaining access to public capital funds. The two largest national programs providing infrastructure funding, the U.S. Department of Agriculture's Water and Waste Disposal Loans and Grants Program and the EPA's Clean Water State Revolving Fund, are prohibited by law from providing grants or loans directly to for-profit companies. EPA allows states to provide Drinking Water State Revolving Fund assistance to for-profit providers. However, the practice is fairly uncommon, and many states have imposed rules that make for-profit providers ineligible. Many state-specific programs have similar constraints.

WVAW has tapped a variety of capital sources and used some sophisticated financing strategies to maintain and expand its capital infrastructure. Despite the limitations and the difficulty in accessing public funds, it has developed a series of structured partnerships with local governments, with the result that millions of dollars in lower-cost public capital has helped develop the infrastructure that provides WVAW customers with their water.

WVAW's first large-scale partnership involved Mercer and Summers counties, state and federal government agencies, and the Oakvale Road Public Service District (PSD), a government-owned water utility. The project replaced two aging treatment facilities with a larger, regional facility capable of treating five million gallons of water per day. It also added 64 miles of pipeline that connected several communities and provided an additional 5,000 residents with public drinking water.[107]

The partnership behind the project was structured to provide a combination of private and public sources of capital. WVAW invested $23 million for the

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[107] "Mercer/Summers Water Project Overview" (November 1999) (summary report compiled by Oakvale Road PSD and West Virginia Region 1 Planning and Development Council, provided to author).

construction of a water treatment plant, a raw-water intake, and a water storage facility, all of which it now owns and operates. The Oakvale Road PSD took out approximately $15 million in low-interest loans from the West Virginia Infrastructure and Jobs Development Council to cover much of the cost of the line extensions. The lines are technically owned by the Oakvale Road PSD. However, they are operated and maintained by WVAW under an agreement that requires WVAW to pay the Oakvale Road PSD $670,000 per year. The PSD uses the payments to service its debt.

Grant financing also played a major role in the project. No single program was able to cover all the costs, so local officials sought assistance from a variety of funders, including the U.S. Economic Development Administration, the Appalachian Regional Commission, the U.S. Department of Housing and Urban Development's Community Development Block Grant program, and the U.S. Army Corps of Engineers.

Finally, local governments contributed about $1.3 million in capital funds.

Completing all the arrangements necessary to put this project together required considerable planning and political support from local, regional, state, and federal officials.[108] Preliminary planning meetings for the effort began in 1991. The water treatment facility was completed in 1996, and the main transmission mains were put into service in 1997.

Since perfecting the partnership model that led to the Mercer/Summers project, WVAW has completed a number of similar projects in the state. For example, the Fayette Plateau Regional Project, which included a new water treatment plant and 64 miles of pipeline, led to the consolidation of five smaller regional systems and the retirement of five obsolete treatment facilities. As with

[108] Dave Coles, West Virginia Region 1 Planning and Development Council, and Lyle Huntington, Oakvale Road PSD, interviews with author, July 2004.

the Mercer/Summers project, the Fayette Plateau project relied heavily on public funds, with about $18 million of the $47 million cost paid for from low-interest loans and grants. Assets paid for from grant and loan funds are essential parts of WVAW's system infrastructure, but they are not the property of WVAW and are not included in the company's capital rate base.

The primary difference between the financing of the Mercer/Summers project and the financing of the Fayette Plateau project was the use in the latter project of a capital-lease arrangement allowed under West Virginia's Industrial Development Bonds (IDBs) Act.[109] WVAW used an IDB capital-lease arrangement for its own capital contribution toward the project. It financed its share of the project with a blend of commercial debt and equity. After the facilities were constructed and put into service, WVAW transferred legal title to them to the *Fayette* County Commission, and the commission then leased the facilities back to WVAW. The facilities thus are considered to be public property and exempt from certain property taxes. Under the IDB statutes, the commission has no debt service or operational liability for the leased assets. WVAW uses the funds that it would have paid in taxes to pay a "use fee" to the county. The county uses the revenue to pay off its portion of the public loans for the project.

WVAW now depends on structured partnerships and creative financing as a tool for providing capital finance for many of its major facilities. Between 1994 and 2005, the company estimates, $492,322,803 went toward construction of new and expanded water facilities, $364,555,000 of which came from WVAW and $127,767,803 of which came from public-sector sources.[110] Much of this money went toward replacing thirty-five smaller facilities with nine regional facilities.

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[109] W.VA. CODE art. 2C, ch. 13 (1931).

[110] "West Virginia–American Water Analysis of Construction Expenditures, 1994 through 2004" (analysis included in "Meeting Infrastructure Challenges").

WVAW maintains a detailed database of potential service areas and line extensions to prioritize and plan its line investments. In some cases it uses 100 percent of its capital to reach unserved customers. In other cases it partners or shares costs with local governments and other utilities such as the Oakvale Road PSD.

The gap in funding capital takes on a new meaning in the context of small projects extending services into rural areas. In some instances a line extension from WVAW may be the only opportunity for a rural resident or community with failed wells, yet the costs per household may approach or exceed the value of the property to be served.[111] Some critics of for-profit utilities suggest that a concern for profit cannot help but impede the utilities' reaching these pockets, and that private systems are more likely to choose more profitable areas to serve, leaving less desirable areas to other providers.[112] WVAW's response is that it can invest only to a limit but is normally open to serving customers if a public body steps in. Asked about the financial incentives for expanding into high-cost, impoverished rural areas like McDowell County, company officials responded that those areas make a case for public systems.[113]

Completing projects with high per-unit costs is not alone a problem for private systems. Many public systems do not have the capital resources to carry out expensive extensions, even if they are not scared by the poor return on investment.

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[111] Bickerton and Jarret, interviews.

[112] Fred Stottlemyer, Putnam PSD, interview with author, July 2004.

[113] Jarret, interview.

Rates and Charges

Are customers who are served by private for-profit water providers better off? Answering the question is particularly difficult for multiple reasons. "Better off" means different things to different people and communities. To the director of the Oakvale Road PSD, one of WVAW's partners, the expanded service area, the economic development potential, and the modern facilities provided by WVAW far outweigh the added monthly cost to his customers.[114] However, a customer used to the intimacy of the customer service department of a local utility office might view having to address billing concerns to a regional call center representative in a different city (or state) as a major sacrifice.

In many states, North Carolina among them, for-profit providers tend to own very small systems that may not be appealing to public systems. Comparing a major urban drinking-water provider that serves 100,000 people from one major facility, with a for-profit provider that serves 20 small, isolated systems averaging 75 customers each is difficult. WVAW's average system size is quite large in comparison with many for-profit providers. In fact, WVAW operates many of the largest facilities in West Virginia.

Until last year, WVAW customers in downtown Charleston, the state's largest urban area, paid the same for water as customers in the most rural and remote WVAW service areas.[115] This "single tariff" strategy is one of the most important financial aspects of the WVAW system. Local governments and customers have mixed feelings about it, depending on their perception of the actual cost necessary to serve their community. For example, officials with the Putnam PSD have resisted becoming incorporated into the WVAW system, partially because

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[114] Huntington, interview.

[115] Under WVAW's newly approved tariff structure, all customers pay the same charge by volume, but several areas pay surcharges.

they think that the cost of serving the relatively dense (by West Virginia standards) Putnam service area is significantly below the price that WVAW would charge.[116] On the other hand, people in very rural service areas think that the economy of scale inherent in WVAW's system brings them lower costs and prices than they would otherwise have. WVAW officials stress that some of their most expensive investment projects have occurred to serve the needs of urban customers and that all the different communities in their service area benefit to some degree from their ability to spread costs across large geographic areas.[117]

WVAW rates are reviewed and approved by the West Virginia Public Service Commission. WVAW is permitted to recover various costs through its rate structure. For many in the public sector, the most controversial cost components relate to the rate of return that WVAW is allowed, to recover its capital investment and its taxes. Advocates of public provision of service often argue that allowance for return on capital and taxes makes private-sector provision inherently more expensive. WVAW recently reached an agreement regarding a rate increase, after it began a lawsuit based on an earlier ruling by the West Virginia Public Service Commission.[118] One of the key elements of the case involved the rate of return that WVAW was allowed on its capital.

The ability of for-profit companies to receive a return on the funds that they have invested in capital provides a clear financial incentive for capital investment that does not exist for many of their public counterparts. According to regulatory

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[116] Stottlemyer, interview.

[117] Bickerton and Jarrett, interviews.

[118] "West Virginia American Water Rate Case Settlement Reached" (27 December 2004), available at www.amwater.com/awpr1/wvaw/newsroom/press_releases/page5763.html.

officials, WVAW has invested more heavily than many government-owned public systems in the state.[119] In most cases the investment brings a higher level of service, but it also brings additional cost to customers. According to the annual report of the West Virginia Public Service Commission's Consumer Advocate Division, "West Virginia-American continues to be among the highest-cost suppliers of water in the state and nation."[120] The division's analysis of thirteen large water systems in West Virginia shows WVAW as having the most expensive water, with an average cost of just under $40 (see Table E-13 below).

Table E-13: Monthly Cost of Water Service for Residential Customers in West Virginia, Winter 2003–2004 vs. 2004–2005

Water Company or Municipality	2003–2004 Average Cost for 4,500 Gallons of Water	2004–2005 Average Cost for 4,500 Gallons of Water	Percent Change
Morgantown	$ 5.92	$ 7.65	29.2
Elkins	11.57	12.60	8.9
Wheeling	12.97	12.97	0.0
Weirton	17.37	17.87	2.9
Fairmont	17.96	17.96	0.0
Logan	20.20	20.20	0.0
Grafton	21.74	21.74	0.0
Clarksburg	22.50	23.72	5.4
Parkersburg	18.98	23.80	25.4
Beckley Water Co.	24.53	24.53	0.0
Martinsburg	28.33	28.33	0.0

[119] Amy Swan, West Virginia Public Service Commission, interview with author, July 2004.

[120] "Consumer Advocate Division's Annual Report for 2005 and Comparative Residential Rate Study" (last visited 6 June 2005), available at www.cad.state.wv.us/2005report.htm.

Water Company or Municipality	2003–2004 Average Cost for 4,500 Gallons of Water	2004–2005 Average Cost for 4,500 Gallons of Water	Percent Change
Lewisburg	32.45	32.45	0.0
WV–American Water	36.23	39.36	8.6

Source: Reprinted from West Virginia Public Service Commission, Consumer Advocate Division, www.cad.state.wv.us/2005Table1A.pdf.

Conclusion

WVAW officials and operators clearly are proud of their system and the service they provide to their customers. They argue that the level of service they provide and the assets they manage, and the management expertise they are able to provide system customers far exceed what other smaller systems can.

In summary, WVAW has put into place many of the financial strategies and policies cited as being essential for sustainable infrastructure. The company has found innovative ways to access public funds and reduce its tax burden, measures that reduce what it has to pass on to its customers. The inclusion of a rate of return and adherence to a "profit motive" continue to separate it from its public counterparts. The company has clearly gone a long way in meeting the infrastructure gap in many communities while illustrating that many of the strategies cited for bridging the capital gap ultimately carry a significant cost to the customer.

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APPENDIX F

Environmental Characteristics Influencing Service

Environmental characteristics can greatly affect the costs of water and wastewater service. 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, as are found in the unconsolidated and semi-consolidated sediments of the coastal plain. 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, which is costly both for subsistence fishing and for parts of the region that look to recreational angling as an economic asset.

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

On the positive side of the ledger, the region receives ample precipitation, and as the headwaters area for the entire eastern United States, it has fewer problems with upstream contamination than do communities in the lower Piedmont, coastal plain, and Mississippi River corridor. The corollary of this fact, though, is that the quality of Appalachian waste treatment is linked directly to the costs and 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 1871 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.

Topography, Geology, Soils, Precipitation, and Groundwater

The physiographic province map (Figure 1-2 in the report) includes shaded relief showing topography in Appalachia. The region includes all the mountain areas of the eastern United States 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 all 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. This appendix discusses these environmental factors in detail by physiographic province, except for precipitation.

Regarding precipitation, it suffices to say that the region as a whole receives an abundance. Average annual precipitation ranges from somewhat less than 36 inches in parts of Maryland, Pennsylvania, Virginia, and West Virginia to more than 80 inches in parts of southwestern North Carolina.[121] The high-precipitation

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[121] 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*

areas of the Blue Ridge Province in southwestern North Carolina are temperate rain forests, with annual precipitation exceeded in the mainland United States only by parts of the Pacific Northwest. These are the first mountainous areas to greet the warm moist air that blows in from the Gulf of Mexico, and that is why the rainfall is so high. Correspondingly, as one moves northward across the region in the rain shadows of the major ridges, there are areas of much lower precipitation. For example, the valley in which Asheville is located gets much less rain than the mountains just to Asheville's south and west.

There is a large gradient across Appalachia in the percentage of precipitation that falls as snow, from high-snowfall counties in western New York to a very low percentage of precipitation as snow south of North Carolina.

A similarly large gradient exists in the length of the growing period and the U.S. Department of Agriculture zone ratings for plant hardiness, which are based on average annual minimum temperatures. Appalachia runs from zone 4b through zone 7. Zone 4b includes a small area of Appalachia around Jasper, New York, which has an average annual minimum temperature of – 25°F to – 20°F. Zone 5 includes most of Pennsylvania's Appalachian region, with a further band running down the high mountains on the east side of West Virginia. This area has an average annual minimum temperature of – 20°F to – 10°F. Zone 6 includes the rest of the northern and central areas of Appalachia, as well as the North Carolina and Tennessee mountains down to north Georgia. Here the average annual minimum temperature is – 10°F to 0°F. Finally, Zone 7, encompassing

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United States: Delaware, Maryland, New Jersey, North Carolina, Pennsylvania, Virginia, West Virginia (Washington, D.C.: USGS, 1997) chapter 730-L (available on 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..

North Carolina's Piedmont, a small corner of upstate South Carolina, Georgia, the southernmost Tennessee mountains, and all of the Alabama and Mississippi Appalachian region, has average annual minimum temperatures of 0°F to 10°F.[122]

The Appalachian Plateaus

The Appalachian Plateaus province, especially in the Allegheny Mountain, Kanawha, Cumberland Plateau, and Cumberland Mountain sections, is characterized by high, sharp ridges, low mountains, and narrow valleys—in some places extremely narrow, where rivers have dissected the plateaus but remaining rock has resisted weathering and erosion. In the more southerly, Cumberland part of the province, folding, faulting, and uplift, followed by differential erosion, has 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, notably Spruce Knob (4,861 feet), the highest point in West Virginia. Local relief generally ranges from 1,000 to 2,500 feet. The bedrock, generally Devonian shale and siltstone, Mississippian carbonates and sandstones, and Pennsylvanian shale, sandstone, and coal, is overlaid 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.[123]

The Allegheny Mountain, Kanawha, and Cumberland Plateau sections are underlain by rocks that are continuous with those of the Valley and Ridge

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[122] United States Department of Agriculture, *Plant Hardiness Map of the United States* (Washington, D.C.: USDA, 1990).

[123] Chapter 18 of *Ecological Subregions of the United States*, W. Henry McNab and Peter E. Avers, comps. (Washington, D.C.: U.S. Forest Service, 1994).

province, but in the plateaus the layered rocks are nearly flat-lying or gently tilted and warped, rather than intensively folded and faulted. The boundary between the two provinces is a prominent southeast-facing scarp called the Allegheny Front, or the Cumberland Escarpment in the southern part. The scarp faces the Valley and Ridge Province, and throughout most of the segment, the eastern edge of the Appalachian Plateaus Province is higher than the ridges in the Valley and Ridge.

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 in the Valley and Ridge Province.

The chemical quality of water in the freshwater parts of the bedrock aquifers of the Appalachian Plateaus province 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 the Appalachian Plateaus province. In much of the area, saline water or brine is not far below the land surface, with only a thin transition zone between freshwater and saltwater. Around Pittsburgh, Pennsylvania, for example, wells drilled deeper than 100 feet below the level of the nearest major stream often yield saline water. West Virginia developed a salt industry in the eighteenth century based on its saltwater springs. Daniel Boone and other explorers and settlers in Kentucky sought the salt licks at the western edge of the Appalachian plateaus and on into the Bluegrass (for example, the Licking River).

The origin of the brine is uncertain. One explanation is that salt has leached from deposits of rock salt found in rocks underlying much of western Pennsylvania, Maryland, Virginia as well as West Virginia. In southwestern Pennsylvania the consolidated rocks nearest the surface are mostly

Pennsylvanian in age. Pennsylvanian rocks are the principal coal-bearing formations and consist of cyclic sequences 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.

The Appalachian Plateaus Province in Maryland is only in Garrett County (home of the Accident case study—see appendix E) and the adjoining western one-third of Allegany County. Rocks of Pennsylvanian age cover most of the Plateaus area, but Mississippian and Devonian rocks are exposed along the crests of northeast-trending anticlines and in some of the deeper valleys. The Pennsylvanian and upper Mississippian geologic formations and their water-yielding characteristics are similar to those of Pennsylvania. Yields of wells completed in Pennsylvanian rocks range from 20 to 430 gallons per minute, but yields of wells completed in Mississippian strata range only from 20 to 180 gallons per minute. Devonian rocks in Maryland yield only small quantities of water.

The water-yielding geologic units of West Virginia are similar to those of Pennsylvania, except that the sandstones of the Mauch Chunk Groupyield little water, and the Mississippian Greenbrier Limestone locally is a productive aquifer. The Greenbrier Limestone is exposed primarily in parts of Tucker, Randolph, Pocohontas, Greenbrier, and Monroe counties in the southeastern part of the state. Yields of wells completed in Permian and Pennsylvanian sandstones range from 5 to 400 gallons per minute. Yields from wells in the Greenbrier Limestone range only from 5 to 100 gallons per minute, but some springs that issue from the Greenbrier, as in the White Sulphur Springs area, discharge 1,000 gallons per minute or more.

The Appalachian Plateaus province in Virginia covers Buchanan and Dickenson counties and small parts of several adjoining counties in the southwestern corner of the state. The principal water-yielding geologic units are sandstones of the Harlan, the Wise, and the Lee formations of Pennsylvanian age, and the Mississippian Greenbrier Limestone. Water from these aquifers is used mainly for domestic supply because well yields are generally less than 12 gallons per minute from the Pennsylvanian aquifers and less than 50 gallons per minute from the Greenbrier Limestone. Many of the sandstone beds in the Pennsylvanian rocks are tightly cemented and are less permeable than the coal beds, which tend to be highly fractured and thus yield water. Some deep coal mines in this area are reported to be dry. This suggests that water-bearing fractures in all the rocks extend only a few hundred feet below the land surface.[124]

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.

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[124] *Ibid.*

The Valley and Ridge Province

The Valley and Ridge province is a series of parallel, narrow valleys and mountain ranges (high ridges) trending southwest to northeast, created by differential erosion of tightly folded, intensely faulted bedrock. The Great Valley is its eastern edge, butting against the west side of the Blue Ridge province. On the west the province is bordered by the steep, high ridge of the Allegheny, Kanawha, and Cumberland escarpments. In the middle section, the alternating valleys and ridges trend northeastward from southwestern Virginia to east-central Pennsylvania and then eastward toward northern New Jersey. In the Tennessee section, the province extends southwestward through Tennessee into northern Georgia and Alabama. Elevation ranges from 300 to 4,000 feet. Local relief is 500 to 1,500 feet. As the result of repeated cycles of uplift and erosion, resistant layers of well-cemented sandstone and conglomerate form long, narrow mountain ridges and less-resistant, easily eroded layers of limestone, dolomite, and shale form valleys. The rocks of the province range in age from Cambrian to Pennsylvanian. Parts of this province from central Pennsylvania into New Jersey have been glaciated, and glacial deposits fill or partially fill some of the valleys.

The Great Valley itself is worth separate mention as the main historical pathway—from Native American times through the present—for humans through Appalachia from north to south. It is the most pronounced and persistent valley in the Valley and Ridge province, floored with easily eroded rock, such as shale, slate, and carbonate rocks. Generally it ranges from 10 to 20 miles wide, but it is much narrower in and near Roanoke County, Virginia. Part of the eastern boundary of the Great Valley is a zone of thrust faulting; crystalline rocks of the Blue Ridge province have been shoved northwestward tens of miles over Paleozoic sedimentary rocks in places. The western boundary of the valley is the first mountainous ridge of resistant sedimentary rock.

The part of the Valley and Ridge province northwest of the Great Valley consists of persistent mountain ridges underlain by resistant sandstone, conglomerate, and quartzite, which alternate with valleys floored with shale or slate and carbonate rocks. A relatively thick layer of soil has developed in this region, especially in the valleys. Drainage patterns generally follow the marked topography, which itself follows the pattern of resistant versus weak rocks, with a major stream down every valley. Such streams are called “subsequent streams.” Major streams and their tributaries intersect at right angles to form a rectangular stream network called a “trellis drainage pattern.”

For example, in the Shenandoah Valley, which is part of the Great Valley in Virginia and West Virginia, the Shenandoah River flows northward to join the Potomac River. The Shenandoah River follows a band of weak and soluble rocks as the course of least resistance, as do most of the other rivers in the Valley and Ridge province.

A few major rivers, however, such as the Lehigh and the Susquehanna rivers in Pennsylvania, the Delaware River between Pennsylvania and New Jersey, and part of the Potomac River in West Virginia, Maryland, and Virginia, cut directly across the ridges and valleys. Such streams are called “superimposed streams.” The Susquehanna River, for example, crosses six major ridges within 50 miles upstream from Harrisburg, Pennsylvania.

The principal aquifers in the Valley and Ridge Province from Virginia through New Jersey are carbonate rocks (mostly limestone) and sandstones that range in age from early to late Paleozoic. The sedimentary formations of the Valley and Ridge Province are commonly thick and steeply tilted. Thus a water well usually penetrates only the consolidated rock formation exposed at the surface. Therefore, geologic maps are good guides to the type of rock from which a well can withdraw water. The Valley and Ridge Province is widest in Pennsylvania and contains more geologic units there. The Great Valley in Pennsylvania is floored with lower Paleozoic carbonate rocks and shale. Principal water-yielding geologic units are limestone and dolomitic limestone of the Waynesboro Formation through the St. Paul Group (Cambrian and Ordovician ages), with well yields reported to range from 25 to 210 gallons per minute. Yields from sandstone of the Martinsburg Formation, by contrast, range only from 10 to 30 gallons per minute. Northwest of the Great Valley, the uppermost Paleozoic rocks in central to northeastern Pennsylvania are coal-bearing beds of Pennsylvanian age mostly associated with the anthracite coal fields, where deeply infolded beds of coal were preserved from erosion. The processes of folding and deep burial drove off most of the volatile content of the bituminous coal in the more intensely folded areas and converted it to anthracite.

The Valley and Ridge Province extends through most of the Maryland Panhandle, but the Great Valley part is restricted to Washington County. The Great Valley in Maryland is floored with predominately carbonate rock and shale of Cambrian and Ordovician ages. The principal water-yielding units are the Tomstown Formation through the Beekmantown. Well yields commonly range from 25 to 400 gallons per minute. West of the Great Valley, sandstones of Ordovician to Devonian age are the principal aquifers but commonly yield less than 120 gallons per minute. Locally, yields of as much as 100 gallons per minute are reported for wells in limestone of late Silurian and early Devonian age.

In West Virginia the Great Valley part of the Valley and Ridge Province is only in Jefferson and Berkeley counties and is underlain mostly by carbonate rocks of Cambrian and Ordovician ages (Tomstown Dolomite through Black River Limestone) that typically yield about 35 gallons per minute to wells. Locally, wells completed in these rocks yield as much as 600 gallons per minute, however, and some springs that issue from the rocks discharge from 1,000 to 5,000 gallons per minute.

The Valley and Ridge Province in western Virginia extends from Clark and Frederick counties almost to the North Carolina state line. The Great Valley in Virginia is floored primarily by carbonate rocks and shale of Cambrian and Ordovician ages, with well yields commonly from 150 to 1,000 gallons per minute.

The carbonate rocks that are mostly in the valleys receive recharge from precipitation that falls directly on the valley floors, as well as from runoff from the adjacent ridges. Highly permeable solution zones that have developed by the enlargement of joints and other openings collect and channel the water. "Sinkholes," which are closed depressions in the land surface that form where part of the roof of a solution cavity has collapsed, form a direct connection from the land surface to a carbonate aquifer. Surface runoff can move directly into a sinkhole, as can groundwater in the soil that overlies the carbonate rocks. Recharge to the aquifer through sinkholes takes place very quickly, and any contaminants at or near the land surface can move directly into the aquifer. Surface water that is channeled into small streams in the valleys can leak downward through the streambed to recharge the aquifer in places where the water table of the aquifer is lower than the water level in the stream.

Along with sinkholes, the water and the carbonate rocks produce caves. The Southeast has about two-thirds of all U.S. caves that are more than 3 kilometers long, and many of them are in Appalachia. Mammoth Cave, mostly in Edmonson County, Kentucky, at the eastern edge of Appalachia, is the world's largest recorded cave system.[125]

[125] Peter White et al., *Environments of the Southeast* (Delray Beach, Fla: St. Lucie Press) (online).

Although springs issue from some of the aquifers in all the physiographic provinces of Appalachia, large springs are most characteristic of the Valley and Ridge Province. Flow is particularly large for springs that issue from the carbonate rocks. Three types of springs are common, and all result from groundwater movement driven by the force of gravity. “Contact springs” form where water-saturated permeable material overlies less-permeable material. The water comes to the land surface at the contact of the two types of material, and the springs might issue where the contact intersects a sloping land surface. Contact springs are common in the Valley and Ridge Province, but generally they discharge only small volumes of water.

“Impermeable-rock springs” are fed by fractures, joints, or bedding planes in rocks that have low intergranular permeability. Small springs of this type that issue where a vertical joint intersects a bedding plane and that generally discharge only small volumes of water are typical of parts of the Appalachian Plateaus Province but exist also in the Valley and Ridge province.

“Tubular springs” issue from solution channelsin carbonate rocks. These are typically the largest flow springs because they can have extensive networks of tributaries underground and the large openings transmit large quantities of water. For example, in Pennsylvania, 90 percent of the springs that discharge 100 gallons or more per minute issue from Ordovician and Cambrian limestones and dolomites. Most of those that discharge more than 2,000 gallons per minute issue from limestone.

Water in the aquifers from which the springs issue can be either confined or unconfined. Springs that issue from aquifers containing confined water are called “artesian springs.” Springs that issue from aquifers containing unconfined water are called “gravity springs.” Some of the springs in the Valley and Ridge Province discharge water that is distinctly warmer than the average air temperature. Most of the thermal springs in the eastern United States are in the Valley and Ridge Province. The spring waters have become naturally heated by deep circulation of the water to levels where the rocks are substantially warmer than the average surface temperature of Earth.

The chemical quality of water varies in the aquifers of the Valley and Ridge Province but is generally suitable for municipal supplies and other purposes. Most of the water in the upper parts of the aquifers is not greatly mineralized and is suitable for drinking and other uses. However, the deep parts of the aquifers contain saline water in many places, and brackish water has been reported locally from zones as shallow as 90 feet below the land surface in valleys near the West Branch of the Susquehanna River in Pennsylvania.

The Blue Ridge Province

The long series of ridges that make up the Blue Ridge province consists of very old crystalline rock (Precambrian in parts, dating in places to 1.2 billion years) that is relatively resistant to weathering and erosion. The subsurface of the Blue Ridge province varies greatly in mineral composition, but the hydraulic characteristics are similar across the area: there are almost no pore spaces in which water can accumulate, so groundwater exists mainly in joints and fractures of the rock.

The Blue Ridge Province includes a narrow belt of rounded, gentle knobs of diverse altitude slightly higher than the adjacent Piedmont province running through Virginia and Maryland to Pennsylvania and northern New Jersey. This northern area of the Blue Ridge lies outside Appalachia, however, so this report views the province as running south from the Roanoke Gap into northern Georgia. The eastern boundary of the Blue Ridge province is the Blue Ridge front, or escarpment, which is a single, abrupt slope, commonly marked by faulting. The Blue Ridge front rises more than 1,700 feet above the Piedmont surface near the North Carolina/Virginia state line and reaches a maximum height above the Piedmont of nearly 2,500 feet in central North Carolina. The Blue Ridge Province contains the tallest mountains, the highest altitudes (greater than 6,000 feet), and the most rugged topography in eastern North America. The southern part of the province has steep, forest-covered slopes cut by numerous stream valleys. The valleys of the major rivers include broad, gently rolling areas as well as narrow gorges. The province reaches a maximum width of 70 miles in North Carolina. The province as a whole includes more than forty-six peaks higher than 6,000 feet in elevation. About 80 percent of the province is made up of low mountains.[126] Kephart, in his classic 1913 narrative, estimated that mountains with slopes of 20 percent to 40 percent covered 90 percent of western North Carolina.[127]

The quality of water from aquifers in the different rock types of the Piedmont and Blue Ridge provinces is similar. The water generally is suitable for drinking and other uses, but iron, manganese, and sulfate occur locally in objectionable concentrations. Concentrations of dissolved solids in water from these aquifers average about 120 milligrams per liter. The water is soft; hardness averages about 63 milligrams per liter. Also, the water is slightly acidic; the median hydrogen ion concentration, which is measured in pH units, is 6.7 (on a scale of 1–14, 7 being neutral). The median iron concentration is 0.1 milligram per liter, but concentrations as large as 25 milligrams per liter have been reported. Large iron concentrations can be caused by corrosion or the action of iron-fixing

[126] Chapter 18 of *Ecological Subregions of the United States*.

[127] Horace Kephart, *Our Southern Highlanders: A Narrative of Adventure in the Southern Appalachians and a Study of Life among the Mountaineers* (1913; reprint, Knoxville, Tenn.: University of Tennessee Press, 1976), 28–29.

bacteria on iron and steel casings and well fittings. Some crystalline rocks and some sedimentary rocks in early Mesozoic basins contain minerals that, when weathered, can contribute iron and manganese to groundwater, particularly if the water is slightly acidic. Treatment of the water usually will cure problems of excess iron and manganese.

Groundwater recharge is highly variable in the Blue Ridge and Piedmont provinces because it is determined by local precipitation and runoff, which themselves are highly variable, influenced by topographic relief and the capacity of the land surface to accept infiltrating water. Most of the recharge in the Piedmont and the Blue Ridge provinces takes place between streams. Almost all recharge is from precipitation that enters the aquifers through the porous regolith. Much of the recharge water moves laterally through the regolith and discharges to a nearby stream or depression during or shortly after a storm or another kind of precipitation. Some of the water, however, moves downward through the regolith until it reaches the bedrock, where it enters fractures in crystalline rocks and sandstones, or solution openings in carbonate rocks.

Well yields for all types of crystalline rocks generally are small. A recent study reported an average yield of 18 gallons per minute for wells completed in these rocks in North Carolina. Only about three percent of wells encounter no fractures and are either dry or will not have a sustained yield. Where the rock is fractured only near the surface, wells will yield from 10 to 20 gallons per minute until—in a short time—the fractures are drained. Then well yield suddenly declines. Where several fractures connected to the regolith are penetrated by a well, moderate sustained yields are possible, whereas a well that encounters numerous closely spaced fractures is most likely to have a high sustained yield. Wells in valleys, draws, and depressions tend to have higher-than-average yields. Draws on the sides of the valleys of perennial streams where a thick blanket of regolith underlies the adjacent ridges are the best sites for wells with large yields. A statistical analysis that related well yield to topographic setting in the Piedmont and the Blue Ridge provinces of North Carolina indicated that wells drilled in valleys or draws have average yields three times those of wells located on hills or ridges.

Groundwater discharge to a stream (base flow) is an indication of the maximum sustained groundwater yield. The percentage of stream flow composed of base flow is determined by the infiltration capacity of the soil and the capacity of the underlying aquifers to store and transmit water. In part of the Piedmont Province in southeastern Pennsylvania, base flow ranges from 57 percent to 66 percent of stream flow in drainage basins that are underlain predominately by crystalline rocks, and 77 percent in a typical basin that is underlain by carbonate rocks. It ranges from 33 percent to 67 percent of stream flow in three drainage basins that are underlain by crystalline rocks in the Piedmont and the Blue Ridge provinces of Maryland, and from 32 percent to 65 percent (average 44) in ten crystalline-rock drainage basins in the Piedmont of North Carolina.

The Piedmont Province

The Piedmont, literally "foot of the mountain," rises from the eastern coastal plain gradually to the Blue Ridge Mountain front. It has much the same bedrock as the Blue Ridge province: metamorphic and igneous rocks ranging in age from Precambrian to Paleozoic that have been sheared, fractured, and folded—but there also are sedimentary basins—such as the Richmond basin and the Dan River–Danville basin—that formed along rifts in Earth's crust and contain shale, sandstone, and conglomerate of early Mesozoic age, interbedded locally with basaltic lava flows and minor coal beds. The sedimentary rocks and basalt flows are intruded in places by diabase dikes and sills. Headward erosion by the streams draining to the east accounts for the area being in lower relief than the adjoining highlands. The eastern boundary of the Piedmont province, called the "fall line," where the harder crystalline bedrocks meet the semiconsolidated sediments of the coastal plain, is outside Appalachia. The western boundary ranges in altitude from 350 to 700 feet above sea level in Pennsylvania, rising to 700 or 800 feet above sea level in northern Virginia. Farther south, where Appalachia intersects the Piedmont near the Virginia/North Carolina line, it rises to about 1,500 feet above sea level.[128] In places, remnant structures have resisted erosion, leaving exposed granitic domes and outcroppings called "monadnocks." Examples are Hanging Rock, Sauratown Mountain, Pilot Mountain, Stone Mountain, Table Rock, along the eastern side of Linville Gorge in North Carolina, and Stone Mountain, in Georgia.

A general difference exists between Appalachian subsurface conditions from the Blue Ridge east and the entire eastern seaboard: fractured bedrock in the Highlands versus some sedimentary material in the Piedmont and extensive layers of sedimentary rock in the Coastal Plain. The harder, crystalline subsurface of Appalachia in the Blue Ridge is reflected in thinner soils, less certain availability of water for wells drilled in a given location, and greater complexity in assessing the source and the extent of contaminated groundwater .

The Atlantic Plain and Interior Plains Provinces

Part of Appalachia includes coastal plain topography: the southernmost Appalachian counties in Alabama and all the Appalachian counties in Mississippi. All but a portion of one county in Mississippi are classified as East

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[128] Chapter 18, *Ecological Subregions of the United States*.

Gulf Coastal Plain physiography. The counties on the far west of Appalachia, going as far north as south-central Ohio, are in the Interior Plains province.

The subsurface geology of the Coastal Plain counties is conceptually like that of the Atlantic Coastal Plain. That is, unlike the Appalachian Highlands, the Coastal Plain counties lie on relatively flat sedimentary rocks that form layer-cake-like layers, most of which are more permeable than the rocks of the Highlands and thus can serve as productive aquifers. The Appalachian Plateau and Interior Plain areas of Alabama, Tennessee, Kentucky, and southern Ohio have a cap of resistant sandstone that creates the large, undissected mesas of the Cumberland Plateau and the Interior Low Plateaus. These are bounded at the interface with the Coastal Plain by steep slopes where erosion has removed the sandstone cap and weathering has exposed the underlying sedimentary strata.

The most productive aquifers across the Atlantic Plain and Interior Plains are limestone layers that lie beneath the sandstone and other Pennsylvanian-age rock cap, and that are exposed in the Interior Plains in wide valley floors. Gaps and cracks in the limestone are expanded by slightly acidic water, producing the cave systems, large springs, and often complex Karst topography. Wells in the limestone of the region produce reported flows as high as 4,000 gallons per minute. Wells in the remaining sandstone cap layers may be adequate for domestic consumption but are unlikely to produce flows greater than 200 gallons per minute.

The rock layers throughout the region, as well as into the Valley and Ridge province, are fairly continuous, but in the Valley and Ridge province they have been folded dramatically, changing the hydrology. Because the rock units are continuous across broad regions, the aquifers are not generally named, as they are in the western United States and on the Atlantic Coastal Plain, but the water-bearing characteristics of particular layers is reasonably well known. Across much of the area, there are confining shales beneath the productive limestone, with further water-bearing layers under the shale aquitard, but these lower layers often have brackish water. The groundwater quality in the higher water-bearing layers across the regions is variable, with much of the water suitable after treatment for domestic purposes, but with many areas having high concentrations of sulfur compounds and iron.

Topographic relief in the Atlantic Plain is low, with maximum elevations typically ranging from 150 to 450 feet above sea level. Elevation in the Interior Low Plateaus is typically 900–1,000 feet above sea level.

Land Use and Land Cover

The fecund forest of Appalachia has been noted since the days of the earliest European visitors. John Banister, Oxford graduate, early botanist, and founder of the College of William and Mary, 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. But want of Peace, too much land & the great crops of Tobacco men strive to make hinder Virginia from improving.[129]

In 1797, Louis Philippe, who would become King of France in 1830, toured the region with his two brothers and noted,

> We rode through hilly, picturesque country in the foothills of the Montagnes Bleues, which run from southwest to northeast and are the first range in from the coast. They are not high. There is little or no bare rock to be seen.

[129] 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).

> The slope is not precipitous, and the forest stretches uninterruptedly to the summits . . . The view from the far slopes of the Blue Ridge Mountains would be very beautiful if only the trees did not obscure it . . . The banks of the [Shenandoah] River are charming, and this whole region looks like Switzerland.[130]

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 . . . The lumberman attacked this forest several decades ago when he began to penetrate it in search of the rarer and more valuable trees, such as the walnut and cherry. Later, as the railroads entered the region to some extent, he added to his list of trees for cutting the mountain birch, locust, and tulip poplar, and successively other valuable species. During the past few years he has cut everything merchantable . . . In these operations there has naturally been no thought for the future . . . The hope and permanent interests of the lumberman are generally in another State or region, and his interest in these mountains begins and ends with the hope of profit. There is, however, no evidence that the native lumberman has in the past exhibited any different spirit.[131]

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[130] Louis Phillipe, King of France, Diary of My Travels in America (1797), reprinted in *The Height of Our Mountains*.

[131] 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*. 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.

Wilson's observations were prescient: with the coming of the railroads from 1870 to 1930, the forests of the region were nearly all cut. Ronald Eller, Ronald Lewis, and John Alexander Williams have written histories of the deforestation of Appalachia.[132] This clear-cutting of the region had profound negative effects on water quality and quantity—namely, huge losses of already rare topsoil, and devastating floods.

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.[133] Timber is both a source of economic opportunity for many in the region and an integral component of the region's water-quality system.

Ambient Water Quality

The adage "What goes in, comes out" has enormous public health repercussions in the context of the quality of water used for drinking water. The connection between wastewater services and water quality is equally strong. 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

[132] See Ronald D. Eller, *Miners, Millhands, and Mountaineers: Industrialization of the Appalachian South, 1880-1882* (Knoxville: University of Tennessee Press, 1982); Ronald L. Lewis, *Transforming the Appalchian 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), 246–259.

[133] White et al., *Environments*.

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. Fly fishing in Virginia's highlands dates back at least to 1851.[134] The New River and its tributaries have world-class fishing for smallmouth bass. Recreational paddlers also revere Appalachian waters, including the Youghiogheny, the Cheat, the Gauley, the Pigeon, the Obed-Emory system, the Ocoee (site of the 1996 Summer Olympics whitewater venue), the Nantahala, the Chattooga, and the New River gorge itself, a national park. Steep creek headwaters draw the sport's elite and deranged. The Greenbrier and New rivers provide experiences that are extremely rare in the eastern United States: multi-day raft trips with excellent float fishing. Commercial guides and companies renting recreational equipment, as well as people able and willing to offer shuttles and advice, have benefited from this water-centered market. The outdoor-adventure business is the biggest employer in several jurisdictions in the region.

High-quality, high-quantity water also 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," writes Peter White and colleagues.[135] Appalachia is a major contributor to the southeastern United States' status as the richest region for

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[134] See Philip Pendleton Kennedy, *The Blackwater Chronicle* (1853; 2d ed., Morgantown, W.Va.: West Virginia University Press, 2002). The Blackwater River, now in West Virginia, was the site of a fishing expedition in 1851 by Kennedy, David Hunter Strother, and other anglers.

[135] White et al, *Environments*

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diversity of freshwater fish of any temperate area of comparable size in the world. [136]

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 F-1).

Table F-1. 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: Peter White et al., *Environments of the Southeast* (Delray Beach, Fla.: St. Lucie Press).

Some writers, Harry M. Caudill among them, have viewed Appalachia's abundance and high quality of water as great assets.[137]Federal policy makers

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

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

should realize that Appalachia is home to the headwaters of almost all the important rivers of the eastern United States and thus whatever happens for better or worse to Appalachian waters has major consequences for the nation as a whole.

Appalachia also is home to some serious problems with ambient water quality. Recent reports submitted by the Appalachian states to the Environmental Protection Agency (EPA), as required by Section 305(b) of the Clean Water Act of 1972, contain lists [required by the 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 lists and their associated narratives in the Section 305(b) reports give a snapshot of ambient water quality in the Appalachians at the start of the twenty-first century. Most states in the United States began assessing their stream quality by or before the 1950s, but the evaluations were not systematic in method or universal in coverage. 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.

Some particularly important qualifications regarding the Section 305(b) reports are that (1) they provide a snapshot only of waters actually sampled during a certain period of record; (2) the sampling in every state is far from being any kind of full monitoring system; (3) states differ in how they interpret "impairment" of waters; (4) states in the region rarely do much biological monitoring in the uppermost reaches, the ones that are most characteristic of Appalachia and provide much of the habitat for threatened and endangered species; and (5) the ephemeral and intermittent segments, and the remaining wetlands, which contribute disproportionately to ultimate, downstream water quality, are rarely assessed or discussed in these reports.

There also has been criticism of recent state assessments of impaired waters because the stakes have changed for the states in light of EPA's and the courts' recent push for development of total maximum daily loads (TMDLs) for impaired waters. Some critics claim that the need to generate TMDLs is leading states to undercount their impaired waters. Undoubtedly, TMDL development is a difficult, resource-intensive effort for each of the states in Appalachia, one that poses real administrative challenges for the its water-quality regulators. The requirement to develop TMDLs has not generally been coupled with a significant commitment of new resources. Undoubtedly also, states exercise much discretion in how they use attainment determinations. Sampling locations and times; the actual standards; the approach to biological, metals, and other types of testing; and accounting for drought and other unusual conditions all differ somewhat across the states. Thus it is not possible to make a meaningful comparison of the number of stream miles considered impaired in one state versus the number considered impaired in another state, and this report does not attempt such a comparison.

Nonetheless, the Section 305(b) reports constitute the best extant data sets across all the states in Appalachia for assessing ambient water quality. If a state deems a water body to be impaired and includes it in its Section 303(d) list, that water body certainly has some significant water-quality problems.

The physiographic subregions of Appalachia correspond in most ways to the major divisions between river basins. By grouping the U.S. Geological Survey's hydrologic unit classifications at the fairly general four-digit level, one can begin to see how the river systems of the region map onto the physiographic regions.

Water Quality of the Appalachian Plateaus and Interior Plains

All the river basins in West Virginia are in Appalachia, and they drain the Appalachian Plateaus province, except for rivers on the eastern and northern borders of the state, such as the Upper James and the Upper Potomac. West Virginia's 2004 Section 303(d) list identifies 878 impaired streams, covering about 6,170 stream miles. This is an increase from the 2002 list (667 streams, covering 4,374 miles), due in large part to increased monitoring.

The most common numeric water-quality criteria impairments still are those related to mine drainage, bacterial contamination, and acid rain. As with streams in Kentucky, Pennsylvania, and Virginia, there are substantial water-quality problems with legacy mine-drainage-impaired in West Virginia. 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). West Virginia's 1998 Section 303(d) list included 488 streams affected by mine drainage, and the 2002 list contained 128. TMDLs have been developed for streams impaired by mine drainage in the Cheat River, the Tygart Valley River, Paint Creek, the Elk River, the Buckhannon River, Ten Mile Creek, the Monongahela River, Dunloup Creek, the Tug Fork River, the West Fork River, Guyandotte and Stony River watersheds. West Virginia plans to address the remaining mine-drainage impairments from the 1998 list with a TMDL before March 30, 2008. The 2004 list contains only 80 of the streams listed as impaired by mine drainage on the 1998 list. The 80 streams cover approximately 373 miles.

Pennsylvania has estimated the costs (in 2004) necessary to address the environmental impacts of acid mine drainage in Pennsylvania alone at $16 billion.[138] Most of these impaired waters are in Appalachia. This is a good example of a major water problem in Appalachia for which the costs do not make their way into most water and wastewater needs assessments.

Of its stream miles assessed for purposes of the latest Section 305(b) report, approximately half of which are in the Appalachian Plateaus and half in the Valley and Ridge province, Pennsylvania considers 84 percent to be attaining their designated uses for fish and aquatic life.[139] This means that the biological integrity of the stream and critical chemical parameters such as dissolved oxygen seem adequate for a healthy stream. It does not mean that the water is safe for human recreational contact, because these stream miles still could suffer from fecal coliform or other bacteriological impairments. It also does not take account of problems with contaminated fish tissue. Like most states, Pennsylvania issues advisories on consumption of freshwater fish, mostly because of mercury. Of the 10,762 miles (16 percent) of assessed and impaired stream miles, where causes are known, the major causes of impairment are drainage from abandoned mines, agriculture, and urban runoff. Pennsylvania's 2004 report shows few stream miles assessed for support of recreational use (140 miles) and human health use (1,944 miles).

Many Appalachian waters contain elevated levels of fecal coliform bacteria. Contributors to the problem include leaking or overflowing sewage collection systems, illegal sewage discharges by homeowners through straight pipes or failing septic systems, and runoff from urban or residential areas and agricultural lands. In its 305b report, West Virginia notes that its Section 303(d) list for waters impaired by fecal coliform almost certainly underestimates the number of

[138] State of Pennsylvania, *2004 Integrated 305(b) Report (Draft), Part I (Executive Summary)*.

[139] *Ibid*.

streams with this problem because intensive monitoring (especially of smaller waters higher in the watersheds) has only recently become a priority. This recent targeting effort has increased the number of fecal coliform listings from 29 on the 2002 Section 303(d) list to 185 on the 2004 list. The combined length of waters identified as impaired relative to the fecal coliform is approximately 1,490 miles. This underestimation of fecal coliform contamination is likely true of all the streams in Appalachia.

The headwater sections of many Appalachian Plateau waters are acidic, and this impairs the aquatic community. The impairment is most prevalent in watersheds with soils of low buffering capacity. Usually it is caused by acid precipitation. Some states, such as West Virginia, add limestone to impaired stream segments. This treatment has, in many instances, restored fisheries to some extent.

The following discussion of major river basins in the northern Appalachian Plateaus and their impairment status is based on West Virginia, Pennsylvania, Ohio, and New York Section 305(b) draft reports for 2004.

The Delaware River

Pennsylvania lists several of the Delaware River watersheds in its northeastern corner as impaired by PCBs, mercury, and siltation.

The Susquehanna River

New York's southern tier of counties in Appalachia includes part of the Susquehanna River basin. Broome County has Susquehanna waters impaired by nutrients (Whitney Point Lake) as well as for pathogens (Park Creek and its tributaries). The main stem of the river in Broome, Tioga, Otsego, and Chenango counties is listed as impaired by mercury. White Birch Lake and Beaver Lake in

Broome County are listed as possibly impaired by phosphorus from onsite wastewater systems.[140]

The Guyandotte River

Both the Upper Guyandotte (above the confluence of Island Creek) and the Lower Guyandotte watersheds are impaired by total iron and fecal coliform. The Upper Guyandotte watershed also is impaired by dissolved aluminum and biologically. Numerous Guyandotte River tributaries are affected by pollutants related to mine drainage.

The Kanawha River and Its Major Tributaries (the Gauley, Elk, Coal, New, and Greenbrier Rivers)

The main stem of the Upper Kanawha River (extending upstream to the confluence of the New and Gauley rivers) is impaired by dissolved aluminum. The Gauley River from its mouth to river mile 98.0, the Lower New River from its mouth to river mile 68.2, and the entire length of the Greenbrier River also are impaired by dissolved aluminum. The Lower New River is listed for fecal coliform impairment from river mile 1.2 upstream to river mile 58.2 (near Sandstone Falls, W.Va.), and the Bluestone River is impaired by fecal coliform for its entire length in West Virginia.

The Lower Kanawha River, downstream to its confluence with the Ohio River at Point Pleasant, is impaired by fecal coliform, as are the main stems of the Coal and Elk rivers. A TMDL for dioxin for the Lower Kanawha was completed in 2000.

[140] State of New York, *2004 Integrated 305(b) List (Draft)*.

The Monongahela River and Its Major Tributaries (the Cheat, Tygart Valley, and West Fork Rivers)

The main stem of the Monongahela River is impaired for total aluminum, total iron, total manganese, and pH. The entire length of the Monongahela River in West Virginia remains on the 2004 Section 303(d) list for violations of the fecal coliform criteria.

The three major tributaries of the Monongahela River—the Cheat, Tygart Valley, and West Fork rivers—all have undergone TMDL development for total iron, total aluminum, total manganese, and pH. Additionally a section of the Tygart Valley River is impaired by fecal coliform. Finally the main stem of the West Fork River is listed for biological and fecal coliform impairments from its mouth upstream to the Stonewall Jackson Lake tailwater.

Maryland's three counties in Appalachia—Garrett, Allegany, and Washington (Hagerstown)—have some water-quality problems, although perhaps no more, or none of higher priority, than in the more urbanized, downstream areas of the state. Garrett County and a part of Allegany County drain into the Monongahela River basin. The Youghiogheny River has some segments with excessive coliform. There are segments of the Little Youghiogheny impaired for fecal coliform and nutrients, and many of the tributaries in the "Yak" basin fail to meet tests of biological integrity. Some areas of Deep Creek Lake and the surrounding waters still suffer from acid mine drainage.

The Little Kanawha River

A TMDL was finalized in 2000 for the main stem of the Little Kanawha River and several tributaries, for total aluminum and total iron. A small headwater section of the river is impaired relative to pH. The impaired segment begins at river mile 162.1 and extends upstream to the headwaters.

The Ohio River

TMDLs for dioxin and PCB impairments in the Ohio River were developed in 2000 and 2002, respectively, by West Virginia. The 277 miles of the Ohio River passing through West Virginia are impaired from a variety of sources. For the Ohio River as a whole, the Ohio River Valley Water Sanitation Commission has encouraged consistent approaches to Sections 305(b) and 303(d) by jurisdictions with water-quality authority.

The Tug Fork River

A TMDL for main stem of the Tug Fork River was finalized in 2002 for total aluminum and total iron. Additionally, TMDL development for total iron, total aluminum, total manganese, and pH was finalized in 2002 for numerous tributaries of the Tug Fork River affected by mine drainage. The Tug Fork River remains on the Section 303(d) list for biological impairment from mile point 54.2 to its headwaters.

Kentucky Rivers

The main river basins in the Appalachian region of Kentucky are, from north to south, the upper Ohio River, the Little Sandy River–Tygart's Creek, the Big Sandy River, the upper Licking River, the upper Kentucky River, and the Upper Cumberland River. All of them drain the Appalachian Plateaus and the Interior Low Plateaus. Having moved in the mid-1990s to a watershed-based approach to water-quality assessment and issuance of permits, Kentucky completed its first round of systematic monitoring of all its watersheds in 2002, giving a snapshot of the conditions in the wadable streams of the Kentucky highlands. However, the assessment data for the Little Sandy–Tygart's Creek basin was not compiled in time for the 2004 Section 303(d) list.

In the Big Sandy River basin, entirely in Appalachia, Beaver Creek in Floyd County; Levisa Fork in Lawrence, Johnson, and Floyd counties; and the Tug Fork River all are impaired streams of first priority, with more than 128 miles that fail or partially fail to support aquatic life and are unsuitable for swimming. Causes include pathogens from septic systems and straight pipes, siltation, mining, lead, and municipal point-source disposal. In the Little Sandy River–Tygart's Creek basin, also entirely in Appalachian and not fully cataloged (as noted earlier), at least four top-priority streams do not support aquatic life: Hood Creek and the East Fork of the Little Sandy River in Boyd County, Newcombe Creek in Elliot County, and White Oak Creek in Greenup County. TMDLs are in place for the East Fork of the Little Sandy River and for Newcombe Creek.

In the Appalachian portion of the Licking River basin, major portions of the upper Licking River and its tributaries, as well as Fleming Creek do not support aquatic life or swimming. Seriously impaired streams include Burning Fork of the Licking River in Magoffin County, for pathogens from waste; Elk Fork of the Licking River in Morgan County, for siltation and turbidity from logging and mining; Flat Creek of the Licking River in Bath County, for pathogens; the Middle Fork of the Licking River in Magoffin County, for pathogens; Fleming Creek of the Licking River in Fleming and Nicholas counties, for pathogens and excess phosphorus from intensive animal feeding operations and grazing; Fox Creek of the Licking River in Fleming County, for siltation and low dissolved oxygen from logging; Hinkston Creek of the South Fork of the Licking River in Bath and Montgomery counties, for siltation and low dissolved oxygen; Johnson Creek of the Licking River in Magoffin County, for pathogens; Puncheon Camp Creek of the Licking River in Magoffin County, for pathogens; Slate Creek of the Licking River in Bath County, for pathogens; Triplett Creek of the Licking River in Rowan County, for pathogens and excess nutrients; and the Licking River of the Ohio River itself in Magoffin County, for siltation from logging and mining.

In the Fleming Creek basin, Allison Creek, Cassidy Creek, Craintown Branch, Doty Creek, Logan Run, Poplar Creek, Sleepy Run, Town Branch, Wilson Run, and other (unnamed) tributaries all are seriously impaired for pathogens and other pollutants. Little Stoner Creek of Stoner Creek in Clark County, Prickly Ash of Slate Creek in Bath County, Straight Creek and Williams Creek of Elk Fork in Morgan County, and Williams Creek of Elk Fork in Morgan County round out the list of high-priority, seriously impaired Appalachian waters in the upper Licking River basin.

In the upper reaches of the Kentucky River and its tributaries, more than 420 miles of streams are classed as first-priority waters not attaining their designated uses, including the entire 162.6 miles of the North Fork of the Kentucky River through Letcher, Perry, Breathitt, Wolfe, and Lee counties, none of which is safe for swimming because of pathogens from straight piping and other wastewater problems.

Similarly, many miles of the Upper Cumberland River and its tributaries, in Harlan, McCreary, Whitley, Knox, Rockcastle, Bell, Wayne, Cumberland, Laurel, and Pulaski (where mercury from acid rain threatens a federally listed species) counties, are polluted to the point of formal listing as top-priority streams not attaining their designated uses.

In short, every single river basin (and nearly every county) in the Appalachian area of Kentucky has some serious water-quality problems.

Tennessee Rivers Draining the Appalachian Plateaus

All of east Tennessee and a portion of central Tennessee lie in Appalachia, so many of the state’s river basins, including the watershed management areas centered in Johnson City, Knoxville, Cookeville, and Chattanooga, are Appalachian waters. However, Tennessee watersheds are not organized by river basins that correspond to the physiographic regions of Appalachia.

From a physiographic point of view, Tennessee rivers divide into those draining the Appalachian Plateaus, those in the Tennessee Valley (which is in the Valley and Ridge province—see the next section), and a small group of upper watersheds in the Blue Ridge province (see Water Quality in the Blue Ridge Province). There are numerous miles of impaired Appalachian streams in each of these regions.

Regarding the basins draining the Appalachian Plateaus, in the Upper Cumberland River basin, Pine Creek and its tributaries, Bear Creek and Roaring Paunch Creek in Scott County, all are impaired by pathogens, metals, and/or silt. To the west, in the Obey River basin, mining and abandoned mines have impaired streams in Clay, Overton, Cumberland, and Putnam counties, and municipal sources have impaired waters in Fentress and Pickett counties. Warren, Coffee, Grundy, and Sequatchie counties share impaired waters in the Collins River watershed, most often from sediment associated with grazing and other changes in riparian cover and use. Similar problems exist in the Smith, DeKalb, Van Buren, White, Bledsoe, Cumberland, and Warren county watersheds of the Caney Fork River.

Despite all these problems, the volume of water-quality problems in the Appalachian region of Tennessee probably is lower than in the urbanized areas, especially around Nashville.

Water Quality in the Valley and Ridge Province

The Tennessee Valley

Still in Tennessee but moving east to the Valley and Ridge province, there are even more substantial water-quality impairments than in the Appalachian Plateaus, as one would expect with the longer, more industrialized history of the Tennessee Valley. In the North and South forks of the Holston River, in Sullivan and Hawkins counties, the impairments vary from mercury historically discharged from industrial sources to sedimentation caused by stream-bank erosion related to grazing and bacteria from animal waste. The impaired stretches of the upper Clinch River in Hancock, Hawkins, and Campbell counties are similarly varied, from pathogens to excess nutrients and unknown toxins. The lower Clinch River, along with the Lower Tennessee River, is contaminated with almost all known pollutants. The Obed-Emory watersheds are greatly impaired by drainage from abandoned mines. The Watauga River basin, in Washington, Carter, and Johnson counties, has a variety of stream segments impaired by agricultural uses. In the Holston River basin, in Knox, Jefferson, Grainger, Hawkins, and Hamblen counties, there are waters impaired by pathogens, silt, and metals. The primary water problems in the Upper French Broad River basin of Cocke County are pathogens, although residents also complain about occasional color from the Blue Ridge (formerly Champion) paper mill upstream on the Pigeon River in North Carolina. Pathogens also mar many stream miles in the lower French Broad River basin of Sevier County. Impaired sections of the Nolichucky River basin in Cocke, Greene, Washington, and Unicoi counties are primarily polluted by siltation from agricultural uses. In Roane, Rhea, and Meigs counties, the main stem of the Tennessee River and some of its tributaries are impaired by contaminated sediments that have PCB, chlordane, hexavalent chrome, mercury, and a variety of other industrial-chemical legacies. The Ocoee River, despite its popularity as a recreational destination, is highly polluted with mill and mine tailings and contaminated sediments. Elsewhere in southeast Tennessee, the problems caused by livestock grazing in streams and breaking down stream banks are widespread.

Virginia Waters

Virginia waters in Appalachia span the Appalachian Plateaus, the Valley and Ridge province, and the Blue Ridge province, but the main region by area is the Valley and Ridge province. The Appalachian waters of Virginia have higher dissolved oxygen than the downstream waters do, but also relatively frequent problems with fecal coliform contamination.

The Potomac River and Its Tributaries (the Cacapon River, the South Branch, Opequon Creek, and the Shenandoah River)

In West Virginia's part of the Valley and Ridge province, several major tributaries are listed in 2004 for dissolved-aluminum violations, including the Cacapon River, the South Branch of the Potomac River, Opequon Creek, and the Shenandoah River. Each of these tributaries is listed for its entire length in West Virginia. In addition, Opequon Creek continues to be listed for impairments of the water-quality criteria for fecal coliform and biological integrity. A new segment of the South Branch of the Potomac River also is listed for fecal coliform, from mile point 14.2 to mile point 54.9. Fecal coliform impairment in segments and tributaries upstream of mile point 54.9 were addressed by a TMDL developed in 1998.

In Maryland many Casselman River basin waters are biologically impaired, as are parts of the Upper North Branch of the Potomac River. The Lower North Branch of the Potomac River is impaired by elevated fecal coliforms. Also, there are the usual mercury problems in fish tissue in Maryland headwater streams, resulting from acid rain.

The Pennsylvania Portion of the Valley and Ridge Province

The northern terminus of the Valley and Ridge province is the original heartland of the United States' coal mining industry. Thus many of the streams in the region are impaired by drainage problems from abandoned mines. Hazle Creek, Nesquehoning Creek, Buck Mountain Creek, Black Creek, the Lehigh River, and the Schuylkill and Little Schuylkill rivers are examples of Pennsylvania's estimated 4,036 miles of streams impaired by drainage from abandoned mines.[141]

Water Quality in the Blue Ridge Province

North Carolina has responsibility for the vast majority of Appalachian waters in the Blue Ridge province. North Carolina's water-quality program, in both issuance of permits and assessment, is based on a five-year cycle for each of the state's seventeen major river basins. This five-year, basinwide approach has been adopted recently by other states in the Appalachian area, but North Carolina has been following it since the late 1980s. Thus, although an integrated Section 305(b) and Section 303(d) report is available as of March 2004, the Appalachian river basins were not scheduled for intensive biological testing until summer 2004, and the 2004 report does not present the very latest findings on ambient water quality in the Appalachian region of North Carolina.

The Appalachian area covers all the rivers draining North Carolina to the west and the north, including the New, the Watauga, the French Broad, the Little Tennessee, and the Hiwassee, as well as the small portion of the Savannah River

[141] State of Pennsylvania, *2004 Integrated 305(b) Report, Narrative Summary*.

basin in North Carolina. The Appalachian area also covers portions of the Broad, Catawba, and Yadkin river basins, all draining to the Atlantic in South Carolina. Finally the Appalachian area of North Carolina includes a small portion (the Dan River and its tributaries in Stokes County) of the Roanoke River basin.

North Carolina, following recent EPA guidance, has ceased to list its impaired waters as high, medium, or low priorities. Instead it will reflect its prioritization for impaired waters in the TMDL schedule. Few stream segments in the Appalachian area of North Carolina are listed for near-term TMDL development. A substantial number of stream segments are included in category 6, meaning that they are considered to be impaired biologically but the cause of the biological impairment is not currently known. Without knowing the cause, North Carolina cannot develop a TMDL. Thus North Carolina intends to focus its efforts in the next several years on sorting out the causes of impairments in these category 6 waters.

Water Quality in the Piedmont

North Carolina, South Carolina, and Georgia share responsibility for water quality in the Piedmont part of Appalachia. The river basins of most interest in the Piedmont are the Roanoke, the Yadkin–Pee Dee, the Catawba, and the Broad.

South Carolina’s waters in Appalachia include small portions of the Savannah, Saluda, and Broad river basins in the upstate region. Through the long-term, Herculean efforts of Tommy Wyche, an attorney in Greenville, and his friends and associates, substantial parts of upstate South Carolina have been put into conservation-easement status for protection of views and watersheds. Perhaps in part as a result, the Highlands areas of South Carolina generally have fewer water-quality problems than do downstream reaches in the state, which tend to be more heavily affected by urbanization and discharger. Nonetheless, even in the area around Greenville, serious contamination problems exist, especially in sediments that have collected historical industrial discharges. This problem is pervasive in the Piedmont.

Georgia waters in Appalachia include the Tennessee, Coosa, and Tallapoosa river basins, along with parts of the Chattahoochee, Savannah, and Oconee river basins. Like Alabama, Georgia spans four physiographic regions in Appalachia.

There are impaired waters in the Appalachian area of Georgia, such as many Coosa River basin waters still affected by historic PCB contamination from a General Electric facility in Rome (Floyd County), PCB contamination of the Conassauga River in Murray and Gordon counties, and contaminated runoff into the Elijay and Etowah rivers in Gilmer and Bartow counties, respectively. However, the waters of upstate Georgia are relatively clean and apparently attain their designated uses in comparison with waters in more urban and downstream parts of the state.

The Atlantic Plain and the Southern Ends of the Highlands

Much of Alabama is located in Appalachia. River basins in this region include the Black Warrior, the Tennessee, the Coosa, and the Talipoosa. There also are several major lake systems: Wilson Lake, Wheeler Lake, Guntersville Lake, Lewis Smith Lake, Weiss Lake, Lake Martin, Lake Jordan, Mitchell Lake, and Logan Martin Lake. There are waters in all the Alabama river basins in Appalachia that do not support use: pathogen, nutrient, industrial, and abandoned mine pollutants in the Black Warrior, which includes Birmingham; contaminated sediments and urban runoff in the Coosa; pathogens, metals, and sediments in the Talipoosa; and pathogens, toxics, urban runoff, and sediments in the Tennessee.

Mississippi

Mississippi's basins wholly or partly within Appalachia are the North Independent Streams, the Tennessee River, the Tombigbee River, and small headwater segments of the Yazoo–Upper Mississippi rivers.

In the North Independent Streams basin, TMDLs are in effect for a significant part of the drainage. Other segments show impairment as a result of a mixture of pollutants, including nutrients, pesticides, sediment, and pathogens.

The Tennessee River basin in Mississippi is relatively unproblematic, although Seven Mile and Chambers creeks in Alcorn and Tishomingo counties are impaired by pathogens and for aquatic life support, and Bear, Chambers, Indian, and Little Yellow creeks fail tests for aquatic life support because of some combination of nutrients, low dissolved oxygen, pesticides, and sedimentation.

Many waters in the Tombigbee River basin are unsuitable for swimming because of pathogens. Many others are impaired for aquatic life support. There are similar problems in the Appalachian area of the Yazoo River basin, but in general, the water-quality problems in Mississippi's part of Appalachia are no greater and probably are lesser in magnitude than problems lower down in the Yazoo River basin and in the coastal and Mississippi delta areas.

The Mercury Problem

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 from a broad national sampling effort.[142] All the Appalachian states have

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[142] See EPA's study website for updated information at www.epa.gov/waterscience/fishstudy. The first two years of data are analyzed by the U.S. Public Interest Research Group in U.S. PIRG,

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.[143]

Conclusion

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 looks 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 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.

Reel Danger: Power Plant Mercury Pollution and the Fish We Eat (August 20004), available on cta.policy.net/reports/reel_danger/reel_danger_report.pdf

[143] Analysis of data from EPA's Toxics Release Inventory 2002, available at www.epa.gov/tri/tridata/tri02/, by University of North Carolina, Environmental Finance Center, July 2004.

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Appendix G

Methodology for Projection of Drinking Water Needs from the Drinking Water Needs Survey

The Environmental Protection Agency (EPA) conducts a survey of drinking water systems across the United States every four years in order to estimate the twenty-year nationwide and statewide needs for drinking water infrastructure. It publishes the results in reports to Congress. Congress uses the results to allocate the federal Drinking Water State Revolving Fund among the states. At the time of this writing, the latest report available was that of the 1999 survey, published in 2001.[144]

Unlike the Clean Watersheds Needs Survey, which attempts to collect needs data from all systems, the Drinking Water Needs Survey uses a stratified, random sample of the nation's drinking water systems. In 1999, EPA surveyed 100 percent of the nation's large community water systems (those serving more than 40,000 people), with a 100 percent response rate, and a 33 percent random sample of all medium-sized community water systems (those serving 3,301–40,000 people), with a 96 percent response rate. Further, EPA staff conducted site visits of 599 small community water systems (those serving 3,300 or fewer people) to estimate their needs and complete questionnaires, with a 98 percent response rate. The needs identified from the sample of small and medium-sized systems were then extrapolated using the Safe Drinking Water Information System (SWDIS), a continuously updated inventory of all drinking water systems in the United States, to estimate a total need for each state and for the nation.[145]

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

[145] *Ibid.*

To determine the needs for a specific geographical area, such as Appalachia, one must reextrapolate the needs to that level, on the basis of the inventory of water systems in the area. First, the research team of the University of North Carolina, Environmental Finance Center (UNCEFC) categorized Appalachian community water systems on the basis of the type of water treated and the size of the system (see Table G-1). It used type and size stratifications similar to those used by the Cadmus Group in analyzing the 1999 Drinking Water Needs Survey.[146]

The type of water treated is an important stratification variable. Surface water systems require more infrastructure and technology to treat drinking water than groundwater or purchased-water systems do. The Cadmus Group advised that the needs of purchased-surface-water systems were much more closely aligned to the needs of groundwater systems than to those of surface water systems.[147] So purchased-surface-water systems were counted as groundwater systems in the UNCEFC analysis.

The size of the system also is an important stratification variable. Large systems have greater needs than small systems, on average, and the infrastructure and the technology for small systems differ greatly from those for large systems.

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[146] Cadmus Group, telephone conversation and e-mail communication with author, May 2004. EPA contracted with the Cadmus Group to analyze the results of the 1999 Drinking Water Needs Survey

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[147] *Ibid.*

Table G-1. Categorization of Appalachian Drinking Water Systems

Community Water System Category*	Average Needs per System from 1999 DWNS†	Number of Appalachian Systems‡
Groundwater; serving through 500 people	$ 392,020	2,544
Groundwater; serving 501–1,000 people	877,865	533
Groundwater; serving 1,001–3,300 people	1,929,959	828
Groundwater; serving 3,301–10,000 people	3,298,835	386
Groundwater; serving 10,001–40,000 people	8,756,302	140
Surface water; serving through 1,000 people	877,030	129
Surface water; serving 1,001–3,300 people	2,609,281	173
Surface water; serving 3,301–10,000 people	5,395,590	258
Surface water; serving 10,001–40,000 people	10,341,854	173
All systems serving more than 40,000 people	Census needs used	70

*Purchased-surface-water systems are counted as groundwater systems.

†Data from Cadmus Group, e-mail communication to author, 21 May 2004.

‡ Data from EPA, SDWIS database for 4th quarter of fiscal year 2003 frozen in January 2004, downloaded from www.epa.gov/OGWDW/data/pivottables.html and compiled by UNCEFC.

Next, the research team downloaded the latest database of the SDWIS. It deleted all the non-community-water-systems and all the water systems from the non-Appalachian states. Of the remaining systems, a majority had a county assigned to them based on the location of their service. The research team assigned the rest to counties using information in the database, such as the name of the community water system, which often provided the name of the county or the city in which the system was located, or, as a final resort, the city of the contact person listed for the system.

Next, separating the systems by county, the research team separated the community water systems into Appalachian and non-Appalachian systems in the thirteen states. Then, using SDWIS data on the type of water treated by a system and the size of its service population, the team assigned each system to one of the ten categories listed in Table G-1. It then determined the number of Appalachian community water systems in each category in each state.

Finally, the team multiplied the number of systems in each of the first nine categories by the average per-system needs of corresponding community water systems nationwide (see Table G-1). These needs were provided by the Cadmus Group, using the results of the 1999 Drinking Water Needs Survey and the categories shown in Table G-1. The needs of systems in Appalachia serving more than 40,000, which were collected directly in the 1999 Drinking Water Needs Survey, were directly added to the extrapolated needs of the community water systems serving 40,000 or fewer in each county. On the basis of these results, each state's Appalachian drinking water infrastructure needs for twenty years were extrapolated.

APPENDIX H

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.[1]

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.[2]

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

[2] 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*

The ECOS data are the longest kept, most comprehensive, and most up-to-date. The NASBO report collected data from all states except Texas, but only for fiscal year 1998. Because of the huge problems in comparing categories of spending across states and because of the year-to-year variability in states' budgets for environmental programs, the NASBO report has limited usefulness for testing the hypothesis that Appalachian states' programs are underfunded. ASIWPCA used an interesting methodology in its report: it built a model to estimate the actual needs for a well-run water regulatory program, and then it compared actual expenditures using NASBO data with the estimated needs. However, at the time of the ASIWPCA report, only twenty-two states had submitted complete or near-complete information, and there is no indication that ASIWPCA intends to finalize its model or its comparison in the near future.

The problems of data quality aside, the ASIWPCA report estimated a large gap ($735 million–$960 million) between national water-quality regulatory needs and resources. The implication of the ASIWPCA analysis is that states are receiving less than half of the resources they need to implement fully the requirements of the federal Clean Water Act. Further, some particular categories of need, such as monitoring, appear to be grossly underfunded nationally. This finding again calls into question the ability to make judgments about ambient water quality in the nation as a whole or in a region such as Appalachia. What is not known and not being monitored dwarfs what is known and being monitored.[150]

The ASIWPCA report does not make its data for individual states available. In any event the percentage of states responding probably precludes drawing definitive conclusions about the relative gap in regulatory funding in

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Analysis: Interim Report on Results (Washington, D.C.: the Association, April 1, 2002), available on file at UNCEFC.

[150] ASIWPCA, *State Water Quality Management Resource Analysis*.

Appalachia. Furthermore, ASIWPCA relied primarily on NASBO spending data, which are limited to one fiscal year. The NASBO data are broken out regionally and by states, but what exactly is counted as a "water management program" in each state is unclear.

Taken at a glance, NASBO numbers for the Appalachian region do not look significantly lower than national averages, but the huge variance between states inside and states outside the region makes the comparison suspect. For example, Virginia is credited in the NASBO report with $100.6 million in total spending on water management programs, exceeding every other state except California ($757.4 million) and Illinois ($190.1 million). Most water-quality specialists would be surprised to find that Virginia is actually outspending Florida ($69.2 million in the NASBO report). Similarly, South Carolina is credited with $25.4 million in spending and North Carolina with $10.6 million, but North Carolina has a significantly larger water-quality staff and a significantly larger number of permits to handle. In short, the NASBO report does not appear to be a reliable way to compare state spending on environmental programs.

The UNCEFC research team has analyzed the ECOS data in some detail, but the answer to whether Appalachian states underfund water regulation compared with non-Appalachian states still is elusive. States categorize spending differently, so the numbers allocated to "drinking water," "water quality," and "water resources" (the categories used by ECOS) simply cannot be compared state to state. For example, Florida includes drinking water in its numbers for water quality, and West Virginia includes water quality in its numbers for water resources. Also, the West Virginia numbers for water resources are very high (relative to those in the NASBO report), suggesting that other programs (maybe coal mine rehabilitation) may be included. In the ECOS data, West Virginia (rather than Virginia, as in the NASBO data) is an outlier for spending.

The UNCEFC research team constructed two methods for interpolating missing data values for particular water programs. Method 1 used national averages for allocating expenditures among categories when a state chose to lump them, and method 2 excluded states that reported no spending in a particular category. Using method 1, per capita regulatory spending on drinking water, water quality, and water resources in the Appalachian states may or may not be significantly less than per capita spending in the non-Appalachian states (see Table H-1). It depends on whether one includes the (outlier) data from West Virginia. Using method 2 suggests that there is significantly less spending per capita on water regulation in Appalachia than elsewhere.

Table H-1. Per Capita Spending Using Methods for Interpolating Missing Data Values

Per Capita Spending for Drinking Water, Water Quality, and Water Resources, Fiscal Year 2003	**Method 1**	**Method 2**
Non-Appalachian states	$22.55	$ 24.08
Appalachian states, **including** West Virginia	22.15	14.14
Appalachian states, **excluding** West Virginia	12.49	13.05

Since the methodology drives the result, the UNCEFC research team cannot definitively say that Appalachian states' water programs are significantly underfunded relative to other states. Further research might tease out this relationship. A per capita measure may not be the appropriate measure. A better measure might be "per stream mile" or "per NPDES permit" (National Pollution Discharge Elimination System permit).

A final comparison from the ECOS data, however, suggests 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 (including West Virginia) spent $53.17, while non-Appalachian states spent $79.97. If West Virginia is excluded from this analysis, 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 other states of the nation.

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APPENDIX I

Methodology for Compilation of the Master Funding Database

In support of the ARC project, a Master Funding Database (MFDB) was developed that documents the source and the destination of all public funding for water and wastewater infrastructure in the thirteen Appalachian states over a four-year period (2000–2003). The data originate from forty-eight sources.

The database structure loosely parallels the EFC/ARC contacts database, which identifies each program by name, contact, and two identification numbers (fund and program). There are eight types of funds (subdivided by each state) and sixty-three types of programs, with some overlap.

The funding sources chosen were based a number of criteria and consulted resources, including previous water and wastewater infrastructure funding analyses and reports, if the program allocated greater than $1 million annually, Internet research, inquiries with funding personnel, and EFC personnel experiences. Data requests were submitted to fund managers, fund directors, and database personnel via e-mail, telephone, and Freedom of Information Act letters. The requests were for information that described the amount of funding allocated to each municipality or county in the state from January 1, 2000, through December 31, 2003, for projects related to drinking water and wastewater (refer to Table I-1: MFDB Data Sources).

All original raw data have been retained. The data were received, analyzed, and translated into the MFDB format based on fund (name and identification number), program (name and identification number), applicant name, and amount. Spatial information included state, EPA region, county name, county Federal Information Processing Standard (FIPS) number, county population (from the 2000 Census), county area, municipality name, and municipality FIPS number. (Although the database has fields for further analysis of municipalities, most data provided did not include this level of detail.) The year the funding was allocated is based on a commitment date, an award date, or an "unidentified" date. (Refer to Table I-2: MFDB Column Titles and Descriptions.)

Descriptive data for each record were tracked if provided by the original data source. Descriptive data included the subject (e.g. water line extension), a use designation (clean water, drinking water, mix, or not identified), and funding type (grant, loan, or mix). A loan interest rate and repayment period were tracked if provided. Additional fields included an ARC region confirmation (yes/no), the data source, and miscellaneous UNCEFC notes. Finally, a unique MFDB code for each funding record was applied (by which the data are sorted by fund identification, then program identification, and then applicant name).

Some data records indicated that a funding quantity was applied to multiple counties. In these situations the funding amount was divided equally by UNCEFC among the counties. For example, for a $400,000 loan provided to a utility system that serviced four counties, UNCEFC replaced the single $400,000 record with four separate records of $100,000 to each county the utility serviced.

Some of the programs included in this analysis provide funding for many aspects of economic development. For these programs a record-by-record review of the subject description was required, and professional judgment was used to confirm that the funding use was for water or wastewater infrastructure. Records that were not for water or wastewater infrastructure projects were not included in this analysis.

A per capita analysis was conducted through the development of a second database with 1,101 records (correlating to all 1,101 counties in the thirteen ARC states—not just the ARC region itself). This database has 194 possible fields for each of the 1,101 counties. The fields fall into four broad categories (total funding, average annual funding, total funding per capita over four years, and average annual funding per capita for each county) for each funding program. Virginia has both counties and independent cities. The spreadsheets track the independent cities as counties.

Data access is via Microsoft Excel. The MFDB database is most easily accessible via the pivot table function. To maintain database integrity, the pivot tables are not saved, but the resulting graphs and charts are saved as separate files.

There are a number of database limitations:

- The resolution is at the county (not the municipality or the state) level.
- Extensive reliance has been placed on the source data, and on communications with the funding personnel.
- Temporal issues arise from different fiscal years and from some programs trying to allocate lots of funding over a short time period. The MFDB uses a four-year calendar timeline to try to standardize time across programs. In addition, the year the funding was allocated is based on a commitment date, an award date, or an "unidentified" date.
- A portion of the HUD–CDBG funding data (from the Non-Entitlement Cities program) did not provide the name of the county, the community, and/or the municipality that received the funds—only the state. As a result, the county is not identified for these data and is not included in most analyses. This limitation applies only to four states (Maryland, Mississippi, New York, and Pennsylvania) and accounts for about 5 percent of the total CDBG funds in the 1,101-county region, 11 percent of the total CDBG funds in the ARC region.
- The CWSRF and DWSRF data for non–ARC New York counties were not available and are not included in this analysis.

- Data for calendar year 2003 from the Georgia Regional Assistance Program were not available and are not included in this analysis.
- Funding data from the U.S. Army Corps of Engineers were not researched. However, there are five Army Corps of Engineers records in the MFDB because it was determined that these were significant enough to be included (refer to the database for specific projects).

Data were verified throughout the data manipulation process by careful review and rechecking of manipulated and keyed-in data. In the final stages of database development, input from selected state funding personnel was used to confirm that the quantities looked appropriate. Each record that was split by UNCEFC into separate counties was checked and rechecked to confirm that the arithmetic was correct. The largest and smallest financial allocations were reviewed and confirmed based on the raw data received.

Future database management includes appropriate access (via pivot tables and charts saved as separate files). Annual updates from each program would be required to keep the database current.

Table I-1. MFDB Data Sources (Major Water and Wastewater Funding Programs in the Appalachian Region)

Program Name
Federal Programs
SRF—Clean Water Program
USDA—RUS Water and Wastewater Disposal Loans and Grants
SRF—Drinking Water Program
HUD–CDBG
STAG
ARC—Area Development, Economic Development, and Grant Programs
EDA—Public Works Program (Approx. 5% of EDA funds were not used in this analysis)
State-Specific Programs
West Virginia Infrastructure & Jobs Development Loan Program
Pennsylvania State Revolving Fund (Clean Water and Drinking Water—State Source)
West Virginia Water Development Authority
Georgia Fund Loan Program
West Virginia Infrastructure & Jobs Development Grant Program

Program Name
Tennessee Municipal Bond Fund
Ohio Water Development Authority
Ohio OPWC State Capital Improvements Program
New York Clean Water/Clean Air Bond Act—Safe DW Portion
Kentucky Coal and Tobacco Development Fund Program
North Carolina Revolving Loan & Grant Program: High Unit Cost Grants; Clean Water
Kentucky Wastewater Construction
Kentucky 2020 Water Services Account Program
Kentucky Single County Coal Program
North Carolina Revolving Loan & Grant Program: High Unit Cost Fund; Drinking Water
Virginia Pooled Financing Program
Kentucky Coal Severance Tax Receipts (KIA portion only)
Kentucky Flexible Term Finance Program
North Carolina Supplemental Grants Program
North Carolina Unsewered Communities Grants Program
North Carolina Clean Water Management Trust Fund
South Carolina Water and Wastewater Infrastructure Fund
Maryland Supplemental Assistance Program
Kentucky Infrastructure Revolving Loan (Fund B)
Maryland Drinking Water Supply Assistance Program
South Carolina Budget and Control Board Grant Program
New York Financial Assistance to Business—Water Program
Georgia Equity Fund Program
Mississippi Capital Improvements Revolving Loan Program
North Carolina Capacity Building Grants Program
US Army Corps of Engineers (only includes select records)
Georgia Regional Assistance Program (2003 data not included)

Table I-2. MFDB Column Titles and Descriptions

Col-umn	**Column Title**	**Example**	**Description**
A	MFDB ID	21234	A unique ID number for each record (based sorting first by Fund Keyword ID, then Program ID, then Applicant Name)
B	Fund Keyword ID	24	There are 8 different fund types, subdivided by each state; parallels the ARC Contacts Database
C	Fund Name	State Specific	There are 8 different fund types, subdivided by each state; parallels the ARC Contacts Database
D	Program ID	59	There are 63 different program types; parallels the ARC Contacts Database
E	Program Name	North Carolina Capacity Building Grants Program	There are 63 different program types; parallels the ARC Contacts Database

Col-umn	Column Title	Example	Description
F	Applicant Name	Nettleton	The destination of funds. Generated from original data source, (there are many inconsistencies with this field between programs)
G	Year	2003	The year the funding was allocated. Generated from original data source
H	Year (C)ommitted, (A)warded, (U)nknown	C	A qualifier for the year. Generated from original data source
I	ST	MD	Generated from original data source
J	Region	III	EPA Region
K	County	Washington	Generated from original data source, some manipulation may have been needed (refer to either 'EFC_Notes' and/or the original raw data files)
L	FIPS_txt	37100	County FIPS Number in text (not number) format
M	ARC Y/N	N	Determination if the county is within the ARC (based on ARC FY 2004 map)
N	PlaceName	Nettleton	The destination of funds. Generated from original data source, (there are many inconsistencies with this field between programs)
O	PlaceFIPS	100124	The Place FIPS Number, this field is pending for most records
P	All Programs ($)	40,000	Sum of SRF-CW, SRF-DW, EDA, USDA-Grant, USDA-Loan, CDBG, ARC, STAG & State Specific Columns
Q	All Progs Per Capita by Co.	3.09	Amount of Funding provided by All Programs divided by the county population (This field was NOT used for the County analysis, refer to MFDB by County.xls)
R	SRF-CW	10,000	Amount from SRF Clean Water records
S	SRF-DW	10,000	Amount from SRF Drinking Water records
T	EDA	10,000	Amount from EDA records
U	USDA-Grant	10,000	Amount from USDA Grant records
V	USDA-Loan	10,000	Amount from USDA Loan records
W	CDBG	10,000	Amount from CDBG records
X	ARC	10,000	Amount from ARC records
Y	STAG	10,000	Amount from STAG records
Z	State Specific Program ($)	40,000	Amount from the State Specific program records
AA	State Specific Program Name	North Carolina Capacity Building Grants Program	There are 63 different program types; parallels the ARC Contacts Database
AB	State Specific Program ID	59	There are 63 different program types; parallels the ARC Contacts Database
AC	Description_Subj	Install 800 LF	If provided by the original data source, included

Col-umn	Column Title	Example	Description
	ect	of 4 inch main on North Madison St.	these descriptions
AD	Description (CW, DW, Not ID'd)	Not Identified	If provided in the original data source (for drinking water versus clean water analyses)
AE	Description (Loan, Grant, Mix)	Grant	If provided in the original data source (for loan versus grant analyses)
AF	Loan Interest Rate	0.0464	From the original data source (Jeff H had strong opinions about NOT using this data)
AG	Loan Repayment Period (Years)	20	From the original data source (Jeff H had strong opinions about NOT using this data)
AH	EFC's DataSource	Mr. B. McClintock, Financial Analyst, New York State Environmental Facilities Corporation	Source of record
AI	Dataset includes All COs in State (Y/N)	Y	To identify a data qualifier used database QA/QC non-ARC counties analyses
AJ	EFC_Notes	Funding associated with this record originally applied to 2 counties. The funding was split evenly between the 2 counties.	Miscellaneous notes by EFC personnel
AK	CDBG_ENTITLEMENT_CITY	Non-Entitlement City	Applies only to the CDBG records, identifies from which CDBG funding sources the money originated from
AL	Co_Pop_2000	12934	County Population data from 2000 Census Long Form
AM	Co_AREA	321.8493	County Area Data in square miles; from 2000 Census Long Form

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APPENDIX J

Summaries of Selected Federal and State Funding Programs for Water and Wastewater Infrastructure

Selected Federal Programs

Clean Water State Revolving Fund

The Clean Water State Revolving Fund (CWSRF) is overseen by the Environmental Protection Agency (EPA), Office of Wastewater Management. The three primary targets of the program are funding for (1) centralized wastewater treatment, (2) control of nonpoint source[151] pollution, and (3) management of watersheds and estuaries. The SRF is a "revolving fund," meaning that monies deposited into it from federal and state sources are loaned (at low interest rates) to eligible borrowers, and the repayments of the loan principal and the revenues from interest are subsequently used to make new loans. The SRF thereby becomes a continuing source of funding.

With the Title IV amendments to the Clean Water Act in 1987, the CWSRF replaced the Construction Grants program that had been in effect through the 1970s and 1980s. Whereas the Construction Grants program largely provided grants, the CWSRF program uses a variety of options (e.g. direct loans, refinancing, and repurchasing). Interest rates ranges from 0 percent to market rate, and repayment periods are up to twenty years. Several states have used certain arrangements to extend repayment periods to thirty years. Loan repayments and interest earnings (net) have recycled more than $1 billion

[151] Nonpoint source pollution is pollution which cannot be traced back to a single origin; examples include stormwater runoff, water runoff from urban areas and failed septic systems, and agricultural water runoff.

annually into the program to fund new projects.[152] Some states administer the CWSRF and the Drinking Water State Revolving Fund (DWSRF) programs together while other states administer each program separately.

Communities, individuals, citizens groups, and nonprofit organizations are eligible recipients. The goal of the program is to improve watershed quality through a wide range of water-quality-related projects to protect water resources, including:[153]

- Control of agricultural runoff
- Management of soil erosion
- Development of zones to buffer stream banks
- Protection and restoration of wetlands, and management of estuaries (e.g. restocking of fish, restoration of wildlife habitats, and management of marine sewage pump-out)
- Planning, design, and construction of publicly owned treatment works (POTWs)
- Building or rehabilitation of wastewater collection systems
- Stormwater, sanitary sewer overflow (SSO), and combined sewer overflow (CSO) control measures
- Remedial activities from underground storage tank problems

Funding for private systems is not permitted.[154]

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152 Environmental Protection Agency, *Financing America's Clean Water since 1987: A Report of Progress and Innovations* (Washington, D.C.: EPA, May 2001), available at www.epa.gov/owm/cwfinance/cwsrf/progress.pdf
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153 Environmental Protection Agency, *The Clean Water State Revolving Fund Program* (Washington, D.C.: EPA, May 1999), available at www.epa.gov/owm/cwfinance/cwsrf/cwsrf.pdf.

Each of the states administers its own CWSRF program, and project eligibility varies according to each state's program and priorities. The CWSRF is generally touted as a successful permanent, state-operated financial assistance program. SRF regulations stipulate that state cost-sharing funds equal 20 percent of federal government grants.

States have the option of customizing their programs to meet the needs of small communities (populations less than 10,000) and impoverished communities. In 2003, sixty-seven percent of all loans (20 percent of the funding) were made to small communities.

Some state programs and innovative borrowers have used a variety of strategies to increase funding. Leveraging SRF funding with that of other sources has provided roughly twice as much as the federal grant contribution.

A few states use cross-program credit enhancements between the CWSRF and the Drinking Water SRF (DWSRF) programs, in which one SRF invests in the other to make up any shortfalls that could threaten the repayment of SRF–issued bonds. (New York is the only listed Appalachian state using these cross-collateralization strategies.)

"Linked-deposit loans," in which the CWSRF works with local banks, also are in use. Local governments act as conduits to homeowners; for example, local governments back local bank loans to farmers to finance nonpoint source pollution control and replacement of faulty septic systems. General obligation

[154] Environmental Protection Agency, Office of Water, *Paying for Water Quality: Managing Funding Programs to Achieve the Greatest Environmental Benefit. Report to Congress* (Washington, D.C.: EPA, July 2003), available at www.epa.gov/OW-OWM.html/cwfinance/cwsrf/rtc0703.pdf.

bonds or user fees are often used as the dedicated repayment guarantee for these linked-deposit loans.[155]

States are required to rank potential SRF projects in priority order. EPA does not require that states fund projects in strict priority order, but funding decisions must be consistent with the rankings.

States are not required to include nonpoint source and estuary projects on their priority lists. However, if they intend to fund nontraditional projects (projects with a primary purpose other than water quality), they must follow an integrated planning and priority-setting process that incorporates nonpoint source and estuary projects. As of 2001, seventeen states had implemented integrated planning and priority-setting systems; the states in Appalachia included Maryland, New York, and Ohio.[156]

Nationwide annual assistance from CWSRF averaged about $3.2 billion from 1996 through 2000, about $4.3 billion from 2001 through 2004. Of the approximately $4.6 billion in public monies allocated from 2000 through 2003 in Appalachia, the CWSRF program accounted for $1.418 billion (31 percent).[157] For the outlays from Congress and by CWSRF, including state contributions and recycled loans, see Table J-1.

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[155] Environmental Protection Agency, Office of Water, *Development, Selection, and Pilot Demonstration of Preliminary Environmental Indicators for the Clean Water State Revolving Loan Program* (Washington, D.C.: EPA, March 2001), available at http://www.epa.gov/owm/cwfinance/cwsrf/enhance/DocFiles/Other%20Docs/env_indicators-v1.pdf

[156] Environmental Protection Agency, Office of Water, *Integrated Planning and Priority Setting in the Clean Water State Revolving Fund Program* (Washington, D.C.: EPA, March 2001), available at www.epa.gov/owm/cwfinance/cwsrf/ipps_web.pdf.

[157] UNCEFC, Master Funding Database, 2004.

Table J-1. CWSRF Finances, 2000–2004

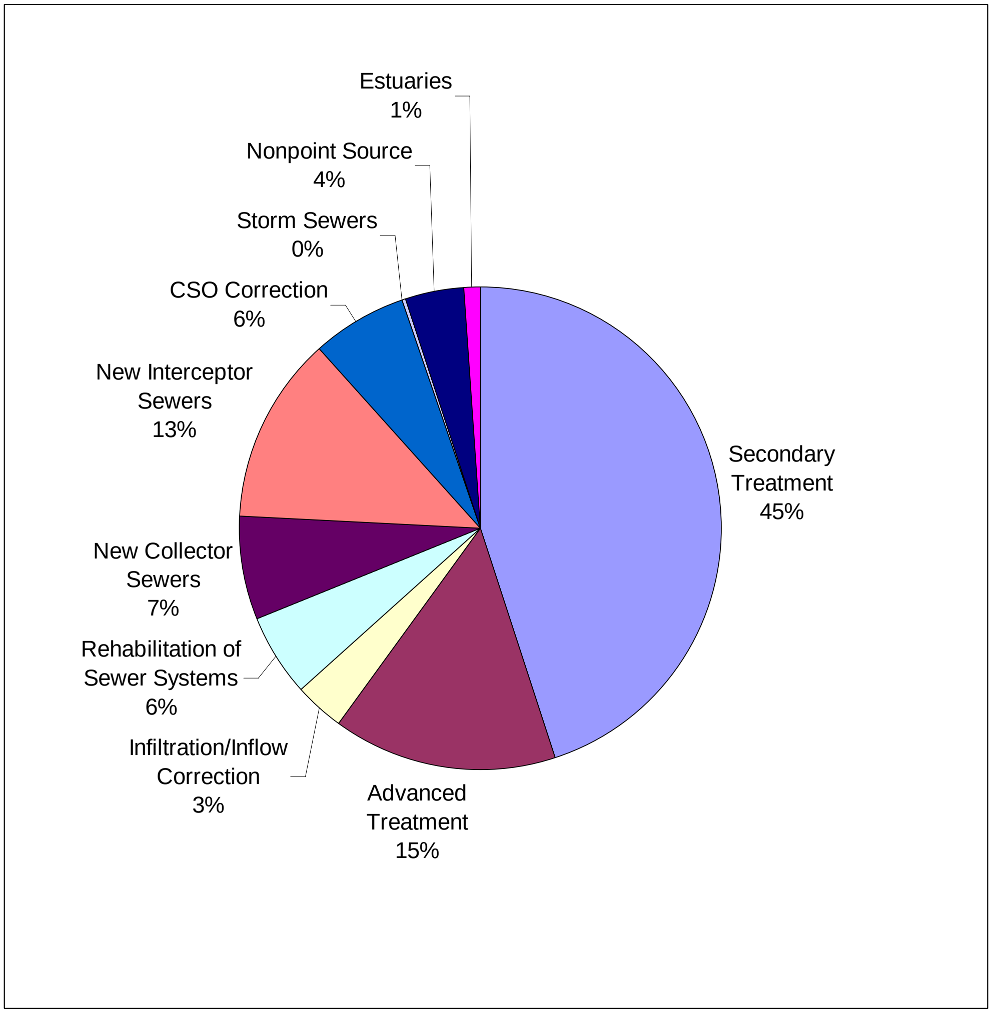
Year	Federal Capitalization Grants (Congressional Outlays)	CWSRF Disbursements
2000	$1,353,634,254	$4,318,954,889
2001	1,523,822,945	3,882,681,083
2002	1,268,292,766	4,436,943,560
2003	1,251,281,260	4,744,022,502
2004	1,092,800,000	4,308,800,000

Sources: Data for 2000–2003 from Environmental Protection Agency, *Clean Water SRF Program Information, National Summary* (Washington, D.C.: EPA, 23 October 2003), available at www.epa.gov/region5/water/cwsrf/pdf/us.pdf. Data for 2004 from Environmental Protection Agency, Office of Water, *Clean Water State Revolving Fund Programs/2004 Annual Report* (Washington, D.C.: EPA, April 2005), available at www.epa.gov/OW-OWM.html/cwfinance/cwsrf/cwsrf-annreport2004.pdf.

From 1988 to 1999, the CWSRF program mostly funded secondary treatment projects (45 percent). Nonpoint source and estuary projects constituted only 5 percent (refer to Figure J-1).[158]

[158] EPA, *Development, Selection, and Pilot Demonstration*.

Figure J-1. CWSRF Assistance, by Category, 1988–1999



Source: Reprinted from Environmental Protection Agency, Office of Water, *Development, Selection, and Pilot Demonstration of Preliminary Environmental Indicators for the Clean Water State Revolving Loan Program* (Washington, D.C.: EPA, March 2001), Page 1-3, available at www.epa.gov/owm/cwfinance/cwsrf/enhance/DocFiles/Other%20Docs/env_indicators-v1.pdf

Drinking Water State Revolving Fund

The Drinking Water State Revolving Fund (DWSRF) is overseen by EPA, Office of Ground Water and Drinking Water, Infrastructure Branch. Each state carries out its own SRF program. The DWSRF was established under the 1996 Safe Drinking Water Act Amendments. Its goal is to provide states with a financing mechanism for ensuring safe drinking water to the public. States may use the federal money awarded to them to develop an infrastructure funding account, from which they may make assistance available to water systems. States contribute to the capitalization of their DWSRF programs by depositing at least 20 percent of each grant into the fund.[159]

Like the CWSRF, the DWSRF is a revolving fund (see the explanation under CWSRF). Each state's eligibility for funding is based on the total eligible need determined by the EPA's Drinking Water Needs Survey (DWNS). The EPA conducted DWNSs in 1995 (results published in 1997) and 1999 (results published in 2001).

States are required to have programs that (1) ensure that water systems are sustainable, (2) improve the technical, financial, and managerial capacity of the systems, and (3) ensure that operators are adequately trained.[160] As indicated in the Safe Drinking Water Act, priority is given to projects that address (1) the most-serious risk to human health; (2) compliance with the Safe Drinking Water Act, and (3) systems most in need, on a per household basis, according to state-

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[159] Drinking Water State Revolving Funds; Interim Rule, 65 Fed. Reg. 48286 (2000) (to be codified at 40 C.F.R. pts. 9, 35), available at www.epa.gov/safewater/dwsrf/dwsrfrule.pdf.

[160] Environmental Protection Agency, Office of Water, *The Drinking Water State Revolving Fund Program: Financing America's Drinking Water from the Source to the Tap. Report to Congress*, (Washington, D.C.: EPA, May 2003), available at www.epa.gov/safewater/dwsrf/pdfs/dwsrf_congressreport-main.pdf.

determined affordability criteria. Eligible systems include both publicly and privately owned community water systems and nonprofit noncommunity water systems. Qualified projects are as follows:[161]

- Treatment (to maintain compliance with contaminant regulations)
- Transmission and distribution (installation or replacement of distribution mains)
- Source water (well rehabilitation or development of new sources to replace contaminated sources)
- Storage (installation or improvement)
- Consolidation (if a system is unable to manage contaminated sources or maintain capacity)
- Creation of new systems (to replace contaminated sources or to consolidate existing problem systems)

Each state develops a priority system for funding projects generally based on the aforementioned qualified project types. The projects are ranked by the state and then offered loans on the basis of their ranking. Each state develops its own specific criteria. Some states administer the CWSRF and the DWSRF programs together, others separately. The criteria are state-specific but generally follow the federal DWSRF guidelines. Transfers between the two SRF programs are allowed, up to 33 percent of the DWSRF amounts.

From 1997 through 2001, about $847 million was available annually to the states and territories via the DWSRF program.[162] Of the approximately $4.6

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[161] Environmental Protection Agency, Office of Water, *The Drinking Water State Revolving Fund: Financing America's Drinking Water. A Report of Progress* (Washington, D.C.: EPA, November 2000), available at www.epa.gov/safewater/dwsrf/progress.pdf.

[162] EPA, *The Drinking Water State Revolving Fund Program: Financing America's Drinking Water from the Source to the Tap.*

billion in public monies allocated from 2000 through 2003 in Appalachia, the DWSRF program accounted for about $467 million (10 percent).[163] Interest rates for loans made under the program may be between 0 percent and market rate, with repayment periods of up to thirty years. Weighted average interest rates for loans in the program have generally ranged from 2 to 4 percent.[164] Most DWSRF monies fund water treatment projects (43 percent), followed by transmission and distribution projects (32 percent).[165]

DWSRF focuses on smaller and disadvantaged communities and programs that "emphasize prevention as a tool for ensuring safe drinking water."[166] Congress requires that states provide a minimum of 15 percent of their funds to systems serving 10,000 people or less. State-defined disadvantaged communities are eligible for additional assistance, if the state has a program for disadvantaged communities. Assistance can take the form of lower interest rates, forgiveness of principal, negative interest rate loans, or extension of repayment terms up to thirty years. About 75 percent of loans have been disbursed to small systems.[167]

Each state may set aside portions of its EPA funds for certain purposes: up to 10 percent to support its own drinking-water program (e.g. administration, technical assistance, implementation of capacity development, or operator certification programs); up to 4 percent to administer its DWSRF program and

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[163] UNCEFC, Master Funding Database, 2004.

[164] EPA, *The Drinking Water State Revolving Fund Program: Financing America's Drinking Water from the Source to the Tap.*

[165] *Ibid*

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[166] EPA, DWSRF Home; Frequent Question Number 1; website (last visited 14 June 2005) at *http://www.epa.gov/safewater/dwsrf/frequentquestions.html*

[167] EPA, *The Drinking Water State Revolving Fund: Financing America's Drinking Water.*

provide technical assistance; and up to 2 percent for technical assistance to small systems. Further, with a 1:1 state-federal match, states may provide local assistance (develop new source waters, wellhead protection, land conservation and easements, and capacity development strategies).[168] The analysis of funding in this report is based on the funds actually distributed to communities, so it does not include the set-aside amounts.

The DWSRF program is generally considered more flexible than the CWSRF program.

United States Department of Agriculture, Rural Utilities Service, Water and Waste Disposal Loans and Grants Program

The rural development mission of the U. S. Department of Agriculture (USDA) consists of three programs, one of which is the Rural Utilities Service (RUS). USDA–RUS has been funding water and wastewater infrastructure in the United States since the 1903s.

The Water Programs Division of RUS has four programs that provide technical and financial assistance to operate and develop safe and affordable water supply and wastewater systems and other waste disposal facilities. The four programs include Water and Waste Disposal Loans and Grants (WWDLG), Emergency Community Water Assistance Grants, Technical Assistance and Training Grants, and Solid Waste Management Grants. This analysis incorporated the drinking-water- and wastewater-related projects which were largely from the WWDLG program.

[168] *Ibid.*

The purpose of the WWDLG program is to develop water and waste disposal (including solid waste disposal and storm drainage), infrastructure in rural areas and in small towns (those with populations of less than 10,000, based on Census Bureau data), and reducing costs to reasonable levels. The program is aimed toward improvements in drinking water, wastewater, and solid waste infrastructure. Solid waste projects are not included in this analysis. RUS also provides guarantees to banks and other eligible lenders for water and waste disposal loans.

The recipients of grants must be public entities—municipalities, counties, special purpose districts, Indian tribes, and corporations not operated for profit, including cooperatives. (If an appropriate entity does not already exist, a new entity may be formed to provide the needed service).[169] Funding has been used for three types of projects:[170]

- Construction, repair, modification, expansion, or other improvements of water supply and distribution systems and waste collection and treatment systems (also storm drainage and solid waste disposal facilities)
- Land acquisition for needed land, water source protection, and water rights
- Legal and engineering development fees

From 1991 through 2000, USDA allocated an average of $1.2 billion annually.[171] In fiscal year 2003, the following funds were available for the WWDGL program nationally:[172]

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[169] United States Department of Agriculture, Rural Development, "Water and Waste Programs" (last updated 11 May 2004), available at www.usda.gov/rus/water/programs.htm.

[170] *Ibid.*

[171] General Accounting Office, *Information on Federal and State Financial Assistance: Report to Congressional Requesters* (Washington D.C.: GAO, November 2001).

Direct loans	$ 797,567,000
Guaranteed loans	75,000,000
Grants	425,000,000
Total	$1,297,567,000

Of the approximately $4.6 billion in public monies allocated from 2000 through 2003 in Appalachia, the USDA–RUS program accounted for about $314 million (7 percent).[173]

The repayment period for loans is forty years at a maximum. However, the repayment period may not exceed the useful life of the facilities financed or other statutory borrowing authority limitations. Grants may be provided when necessary to reduce user costs to a reasonable level. Grants may cover a maximum of 75 percent of eligible facility development costs. As a result, cost-sharing by other governments (local, state, or federal) is required at varying rates, but at least at 25 percent of the project total.[174]

The three principal USDA eligibility criteria include: (1) the per capita income of the residents may not be more than 70 percent of the most recent national average per capita income (as determined by the U.S. Department of Commerce); (2) the unemployment rate of the residents may not be less than 125 percent of the most recent national average unemployment rate (as determined by the U.S. Department of Labor, Bureau of Labor Statistics); and (3) the residents to be served are to be challenged with significant health risks due to a significant

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[172] United States Department of Agriculture, Rural Utilities Service, *Water and Waste Disposal Programs, Fiscal Year 2003* (Washington, D.C.: USDA, 2003), available at www.usda.gov/rus/water/docs/wwfact.pdf.

[173] UNCEFC, Master Funding Database, 2004.

[174] USDA, Rural Development, “Water and Waste Programs.”

proportion of them not having access to, or being served by, adequate, affordable, water and waste disposal systems. Documentation to support the three criteria is required.[175]

A priority system is used to rank projects. As defined in the regulations, points are assigned on the basis of lower populated areas, statewide nonmetropolitan median household income, the percentage of joint financing, and other discretionary factors (for example, severe health risk or natural disasters).[176]

United States Department of Housing and Urban Development, Community Development Block Grant Program

Since 1974 the Community Development Block Grant (CDBG) program of the U.S. Department of Housing and Urban Development (HUD) has been administering grants through HUD's Economic Development Program. The goal of the CDBG program is to "ensure decent affordable housing for all, . . . to provide services to the most vulnerable in our communities, [and] to create jobs and expand business opportunities."[177] This program administers mostly grants and few loans, and as a result, it often is an attractive source of funding to communities.

CDBG funds are divided between a state program and a local jurisdictions (entitlement communities) program. Both sets of CDBG funding were included

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[175] Water and Waste Disposal Loans and Grants, 7 C.F.R. ch. 17, pt. 1777, § 306C (1998), available at www.access.gpo.gov/nara/cfr/waisidx_98/7cfr1777_98.html.

[176] *Ibid.*

[177] United States Department of Housing and Urban Development, Community Planning and Development, "Community Development Block Grant (CDBG) Programs" (last updated 27 May 2005), available at www.hud.gov/offices/cpd/communitydevelopment/programs/index.cfm.

in this analysis. The entitlement communities are (1) central cities of metropolitan statistical areas (2) other metropolitan cities with populations of at least 50,000, and (3) qualified urban counties with populations of at least 200,000 (excluding the populations of entitlement cities).

Entitlement community grants are used for a wide range of community development activities, including revitalization of neighborhoods, economic development, and provision of improved community facilities and services. Priority is given to projects targeting low- and moderate-income people. All recipients of entitlement city grants must complete an HUD planning document.

The nonentitlement program distributes funding directly to each state. The monies are directed to localities that do not qualify as entitlement communities. Nonentitlement areas are cities with populations of less than 50,000 and counties with populations of less than 200,000. The state program distributes funds to units of general local government involved in development activities, not directly to citizens or private organizations. The state-specific CDBG program determines the funding allocations.[178]

Eligible CDBG projects are those that meet at least one of the following criteria: (1) they benefit low- and moderate-income people, (2) they prevent or eliminate slums or blight, or (3) they address "community development needs having a particular urgency because existing conditions pose a serious and immediate threat to the health or welfare of the community."[179]

Grant prioritizations are based on a formula that uses several measures of community need, including poverty, population, incidence of overcrowded housing, age of housing, and population growth lag in relationship to other

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[178] *Ibid.*

[179] *Ibid.*

metropolitan areas. Plans must include a citizen participation component, particularly participation by residents of predominantly low- and moderate-income neighborhoods.[180]

Eligibility criteria for nonentitlement areas are state dependent and updated annually. The state must ensure that at least 70 percent of its CDBG grant funds are used for activities that benefit low- and moderate-income people. Priorities are given to programs that benefit low- and moderate-income families or aid in the prevention or elimination of slums or blight. Nonentitlement area funds are prioritized on the basis of a formula that includes population, poverty, incidence of overcrowded housing, and age of housing.[181]

In the 1990s the HUD–CDBG program distributed roughly $400 million annually.[182] Of the approximately $4.6 billion in public monies allocated from 2000 through 2003 in Appalachia, the CDBG program accounted for about $314 million (7 percent).[183]

Selected State Programs

The Georgia Fund

The Georgia Fund Water and Sewer Loan Program was established by the Georgia General Assembly in 1983 in response to the widening gap between local environmental infrastructure needs and available financial resources.

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[180] *Ibid.*

[181] *Ibid.*

[182] GAO, *Information on Financial Assistance*
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[183] UNCEFC, Master Funding Database, 2004.

Administered by the Georgia Environmental Facilities Authority (GEFA), this program assists local governments (cities, counties, and water and sewer authorities) in constructing and rehabilitating water, sewer, and solid waste facilities by loaning funds at reduced interest rates. All types of water and sewer projects, including water and sewer lines, treatment plants, pumping stations, and water storage tanks, are eligible, provided that the environmental certifications are met and there is a demonstrated ability to repay.[184] The Georgia Fund provided about $49 million in water and sewer infrastructure funding annually from 2000 through 2003.[185]

For water and wastewater loans, the maximum loan amount per year per applicant is $50,000,000. The actual amount loan is based on the population of the applicant community. The source of financing is annual state appropriations and repayments of outstanding loans. The (low) interest rates are based on the rate of the most recent sale of Georgia’s general obligation bonds. Certain communities may qualify for loans at 2 percent.[186]

The funding of projects only for the purpose of planning, carrying out of studies, design, engineering, or administration is not authorized. Such activities maybe funded through the program, provided that the related costs are necessary for project construction as defined by the scope of work and as identified in the budget of the approved contract.[187]

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[184] Georgia Environmental Facilities Authority, *Georgia Fund Water and Sewer Loan Program Policies* (Augusta: GEFA, 27 January 2004), available at www.gefa.org/pdfs/2004_GA_Fund_Loan_Policies_1_27_04.pdf; and Georgia Environmental Facilities Authority website (last visited 9 June 2005), at http://www.gefa.org/water_and_sewer.html.

[185] UNCEFC, Master Funding Database, 2004.

[186] GEFA, Georgia Fund; GEFA website.

[187] *Ibid*.

Coal and Tobacco Development Fund Program (Kentucky)

The goal of the Coal and Tobacco Development Fund Program is to make safe drinking water available to all Kentuckians in coal and tobacco counties. Developed in 2003, the program is administered through the Kentucky Infrastructure Authority, which was created in 1988 to provide financial assistance for local governments investing in infrastructure.[188]

Kentucky divides its counties by the principal commodity they export: coal or tobacco. This program took $5 million from coal severance taxes to finance more than $50 million in bonds to support (predominantly through grants) 103 individual water and sewer projects specified by legislators in coal counties. Likewise, it took $5 million in tobacco settlement money to finance more than $50 million in bonds to pay for 164 projects in tobacco counties. Future debt service payments on the latter projects will come from the state's General Fund.[189]

This analysis covers three programs associated with the funds that originated from the coal severance taxes and tobacco settlement money (see Table J-2).

Table J-2. Distribution of Coal and Severance Tax Receipts, 2002–2003

Program Name	Amount Distributed	Time Frame
Kentucky Coal and Tobacco Development Fund Program	$50, 000,000	2003
Kentucky Coal Severance Tax Receipts (KIA portion only) (total amount)	17,000,000	2002–03
Kentucky Single County Coal Program	27,000,000	2003

Source: UNCEFC, Master Funding Database, 2004.

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[188] Kentucky Infrastructure Authority home website (last visited 9 June 2005), at http://wris.ky.gov/kia/default.htm.

[189] *Ibid.*

High-Unit Cost Grant Program for Wastewater (North Carolina)

North Carolina's High-Unit Cost Grant Program for Wastewater is maintained by the North Carolina Construction Grants and Loans section of the Department of Environment and Natural Resources. The program is designed to provide up to $3,000,000 per applicant to communities that have high wastewater charges. The goal is to make projects more affordable by keeping user fees at a reasonable level.

Eligibility is based on a formula that includes an analysis of the applicant's monthly water and sewer rate versus the residential state average. Applications are to include engineering documents.

The monies originated from general obligation bonds issued in 1998. The bonds are being paid back by general state revenues (for example, taxes). The program has been providing funding since calendar year 1999 (for funding for CY 2000 through 2003, see Table J-3). However, as of 2004 the available funds were nearly diminished, and there were no immediate plans to revive the program.

Table J-3. Distribution of High-Unit Cost Grant Program Funds, 2000–2003

Calendar Year	Amount
2000	$99,047,183
2001	72,975,643
2002	54,024,184
2003	18,315,121

Source: UNCEFC, Master Funding Database, 2004.

Infrastructure and Jobs Development Council (West Virginia)

The West Virginia Infrastructure and Jobs Development Council was created in 1994 through the West Virginia Infrastructure and Jobs Development Act. The council funds water, wastewater, and economic development projects and coordinates funding from other state agencies and the federal government. It thus is a kind of funding clearinghouse that has created a pooled (bond bank) program that uses the state's administrative capacity and creditworthiness to obtain private capital at more favorable terms than individual communities could obtain.

The 1994 act authorized the state to issue $300 million in general obligation bonds for infrastructure.[190] 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 in the form of grants (approximately 20 percent of the funds) and loans of up to twenty years at 0, 1, and 2 percent interest. The state uses coal severance taxes to retire the original general obligation bond issue and established (as opposed to new) community loans to retire the revenue bonds.[191]

A select list of WVIJDC eligible projects , ranked by criteria specified in the 1994 act, are as follows: [192]

- Public health benefits
- Economic development benefits

[190] West Virginia Infrastructure and Jobs Development Council profile website (last visited 6 June 2005), http://www.wvinfrastructure.com/profile/index.html.

[191] Katy Mallory, Executive Secretary, West Virginia Infrastructure and Jobs Development Council, interview with Jeff Hughes, 21 October 2004 ; WVIJDC, *2002 Report*.

[192] West Virginia Infrastructure and Jobs Development Council website (last visited 6 June 2005), www.wvinfrastructure.com/events/projects.html.

- Compliance with state and federal regulations (the Clean Water Act and the Safe Drinking Water Act)
- The degree to which the project encourages system consolidation
- Cost-effectiveness
- The availability of alternative funding sources
- Operating and maintenance needs
- State or regional planning goals outlined in planning documentation
- Readiness to proceed

Applications, engineering reports, and West Virginia Public Service Commission data are to be included in the funding requests. The application deadline is the twentieth of each month.[193]

The council helps communities by providing a comprehensive overview of water and wastewater needs and areas where needs are the greatest to identify where consolidation of small systems can provide economies of scale that will reduce costs and improve residential service.

From 2000 through 2003, the council operated the largest pooled loan program in Appalachia, providing more than $215 million in loans and $56 million in grants to communities.[194]

[193] *Ibid.*

[194] UNCEFC, Master Funding Database, 2004.

APPENDIX K

Methodology for Analysis of Household Water and Wastewater Expenditures

Every ten years the U.S. Census Bureau conducts a census, for which every household (housing unit) in the nation is asked to complete a questionnaire. A randomly selected sample of one in six housing units receives *Form D-2*, a more detailed questionnaire referred to as "the long form." This questionnaire collects additional economic data, including household and personal income and expenditures. In the 2000 Census, question 45 asked what the annual costs of (expenditures on) different utilities and fuels were for the housing unit (house, apartment, or mobile home) in 1999. Water and sewer services combined were addressed in part "c" of the question.[195] For this part, the respondents could record an amount rounded to the nearest dollar, check an option stating that water and sewer service costs were included in their rent, or check an option stating that there were no charges to the housing unit for water and sewer services in 1999.

The Census Bureau does not make the raw data collected from the questionnaires available to the general public. However, in the Public Use Microdata Samples (PUMS), it does provide data from a stratified, random sample of housing units that responded to the long form.[196] Hence these samples contain records for a subsample of housing units on the characteristics of each unit and each person in it, and each microdata file is a stratified sample of the

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[195] U.S. Census Bureau, *Census 2000 Form D-2* (Washington, D.C.: the Bureau, 2000), available as appendix D in *Public Use Microdata Sample 2000 Technical Data*, at www.census.gov/prod/cen2000/ doc/pums.pdf.

[196] Available from the Census Bureau at ftp://ftp2.census.gov/census_2000/datasets/PUMS/.

population that was created by subsampling the one-in-six sample of housing units that received the long form.[197] Housing-unit weights and person-level weights, used to indicate the number of households and people each respondent represents, are included for each record in the microdata samples.

Two versions of the microdata files are available: a 5 percent sample of all long-form respondents, from which the Census Bureau can create highly populated microdata files for small areas called Public Use Microdata Areas (PUMAs), and a 1 percent sample of all long-form respondents, from which the Census Bureau can create less populated microdata files for large areas called super–Public Use Microdata Areas (super–PUMAs). All states are split into super–PUMAs, which are split further into PUMAs. PUMAs and super–PUMAs never cross state boundaries.[198] Each PUMA is an area in the state that contains a minimum of 100,000 people. As a result of this threshold, PUMAs range in size from small parts of a metropolitan city to several contiguous counties in rural areas, depending on the location in the state. Super–PUMAs consist of one or more contiguous PUMAs, and they contain at least 400,000 people. Both the 1 percent and the 5 percent samples contain data on the level of the housing unit for all of a state's super–PUMAs, whereas only the 5 percent samples contain data on the level of the housing unit for the state's PUMAs. Nationwide the 5 percent sample files contain records for more than 14 million people and more than 5 million housing units. The 1 percent sample files, due to the lower sampling rate of the long form respondents, contain records only for more than

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[197] U.S. Census Bureau, *Public Use Microdata Samples 2000 Technical Documentation* (Washington D.C.: the Bureau, 2000), available at www.census.gov/prod/cen2000/doc/pums.pdf.

[198] *Ibid.* Geographic Information System (GIS) shapefiles of PUMAs are available at www.census.gov/geo/www/cob/pu5_2000.html, and GIS shapefiles of super–PUMAS are available at www.census.gov/geo/www/cob/pu1_2000.html.

2.8 million people and more than 1 million housing units.[199] The 5 percent sample files contain a greater sample and provide the ability to conduct analysis at a smaller geographic region than the 1 percent sample files.

Methodology

The main power of the PUMS is that they give researchers the ability to analyze each housing unit's economic data separately and, using housing-unit weights appropriately, to produce regional estimates of expenditures and income that are not obtainable from the summaries produced by the Census Bureau. For this report, the University of North Carolina, Environmental Finance Center (UNCEFC) research team used STATA statistical software to analyze the data from the 5 percent microdata samples for the thirteen Appalachian states.[200] Using the dataset of housing unit level data, in which each record represents one household sampled for the 5 percent PUMS, six variables were retained:

- STATE: the state in which the housing unit is located, using the FIPS state code
- PUMA5: the PUMA in which the housing unit is located, using a state-level identifier
- PUMA1: the super-PUMA in which the housing unit is located, using a state-level identifier
- HWEIGHT: the weight indicating the number of housing units in the population represented by the record

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[199] *Ibid.*

[200] For a description of the STATA software, visit www.stata.com. The microdata samples for the thirteen Appalachian state are available from ftp://ftp2.census.gov/census_2000/datasets/PUMS/FivePercent/.

- WATER: dollar payment for water and sewer services directly in 1999, or a code indicating the payment of these services through rent or no payment in 1999
- HINC: household income

Using the relationship between PUMAs and counties, the research team assigned each PUMA, and subsequently each housing unit, a dichotomous variable of 1 or 0 indicating whether or not any part of the PUMA was located inside the 410-county Appalachian area.[201] There are 699 PUMAs in the thirteen states; 184 are in Appalachia, including 28 that are partially in Appalachian counties and partially in non-Appalachian counties.[202]

To facilitate a comparison of the results of the present analysis with those of a similar national study that used a similar method, the research team dropped all households with less than $1,000 in income from the analysis.[203] The team assigned the remaining households to one of the following categories, on the basis of the coding of the WATER variable:[204]

- Households paying centralized systems directly for water and sewer services (records with an entry for WATER between 2 and 9,999)
- Households paying for water and sewer in their rent (records with an entry of 0 for WATER)

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[201] Files showing the relationship between PUMAs and counties are available for each state at ftp://ftp2.census.gov/census_2000/datasets/PUMS/FivePercent/.

[202] Data from the 5 percent PUMAs for the thirteen states, compiled by UNCEFC.

[203] Scott J. Rubin, *The Cost of Water and Wastewater Service in the United States*, Rural Water Partnership Fund White Paper (Duncan, Okla.: National Rural Water Association, 2004). Rubin deleted households with less than $1,000 in income to focus the analysis on households with positive incomes and positive expenditures

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[204] U.S. Census Bureau, *Public Use Microdata Samples 2000 Technical Documentation*, 7–33.

- Households that did not have a charge for water and sewer in 1999 (records with an entry of 1 for WATER)

Vacant housing units and group quarters were given a missing value for WATER by the Census Bureau in the microdata samples. The UNCEFC research team dropped these records before further analysis.

Using the housing-unit weights, the research team determined the total number and the proportions of housing units not paying for water and sewer services, paying for them directly and paying for them through rent, for all housing units in each of the thirteen Appalachian states as a whole, as well as in their Appalachian and non-Appalachian regions. For housing units paying directly for water and sewer services, the percentage of household income spent on these services in 1999 was calculated by dividing the cost of water and sewer services by the household income. Using the housing-unit weights again, the team determined the mean, the median, the standard deviation, the minimum and maximum cost of and percentage of household income spent on water and sewer services for each PUMA, for the Appalachian and non-Appalachian regions of each state, for each state as a whole, and for the entire Appalachian region.

Finally, the research team assigned households that paid directly for water and sewer services two dichotomous variables according to whether or not they spent more than 2.5 percent and 5 percent of their income on water and sewer services in 1999. The team then calculated the percentages of households that spent more than 2.5 percent and more than 5 percent of their income on water and sewer services for the Appalachian and non-Appalachian regions of each state, for each state as a whole, and for the entire Appalachian region.

The results of the analysis and their implications are discussed in chapter 6.