United States
Environmental Protection
Agency

Office of Water
(4101)

EPA 816-R-01-004
February 2001

Drinking Water Infrastructure Needs Survey

Second Report to Congress

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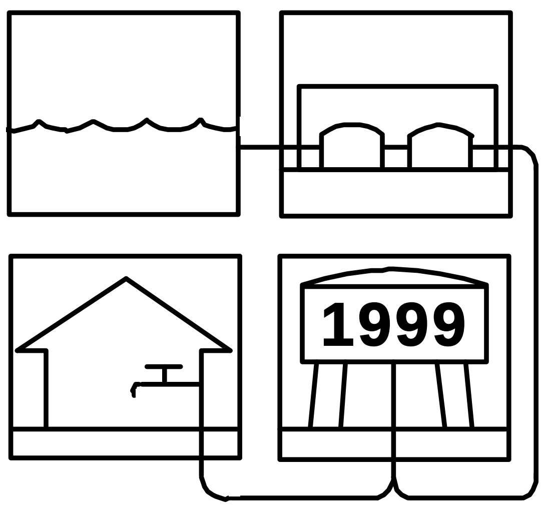
Credits left to right from upper left: Saint Joseph's College, Standish, Maine; Texas Water Development Board; Florida Department of Environmental Protection; Florida Department of Environmental Protection; and U.S. EPA

Pictured left to right from upper left: surface water supply, building a new treatment plant, laying distribution mains, an elevated storage tank, and child drinking water.

Drinking Water Infrastructure Needs Survey

Second Report to Congress



February 2001

U.S. Environmental Protection Agency
Office of Water
Office of Ground Water and Drinking Water
Drinking Water Protection Division (4101)
Washington, DC 20460

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EXHIBITS

Dedham-Westwood Water District

Constructed in 1881, the Walnut Street Storage tank in Dedham, Massachusetts, has the distinction of being the nation's oldest steel reservoir in continuous service. According to the Dedham Water Company Annual Report dated January 9, 1882:

> From the top of this structure a remarkably fine view of the surrounding country can be held....The reservoir complete in place, ready for water, and warranted tight....is literally a standing monument of excellence.

The Dedham-Westwood Water District will disassemble this tank upon completion of a new storage facility.[1]

[1] *Journal of New England Water Works Association*, Volume 113, No. 2, June 1999, 5a

ACKNOWLEDGMENTS

Many dedicated individuals contributed to the 1999 Drinking Water Infrastructure Needs Survey. We would like to thank the American Indian, Alaska Native Village, State, and EPA Needs Survey Coordinators for their active support and continuing interest in the survey. Not listed are the operators and managers of the approximately 4,000 systems that spent their valuable time searching through their records and completing the questionnaires we sent to them. We thank them for their assistance.

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Melanie Watkins–The Delaware Tribe of Western Oklahoma
Stephen Aoyama–Indian Health Services
Tammy Belone–The Navajo Nation EPA
Earl Hatley–The Quapaw Tribe of Oklahoma
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Clive Davies–Drinking Water Protection Branch Associate Chief
Prime Contractor–The Cadmus Group, Inc.

Texas Water Development Board

Corsicana, Texas, is increasing the capacity of its water treatment plant with a $10.8 million loan from the Texas DWSRF program. The expansion will allow Corsicana to extend service to the City of Frost where the State declared the water non-potable due to violations of health-based standards. Shown is one part of the plant expansion—the construction of a large clearwell that will provide the disinfection time necessary to inactivate harmful microbiological contaminants.

EXECUTIVE SUMMARY

In 1999, the U.S. Environmental Protection Agency conducted the second survey of the nation's infrastructure needs. The survey covers the nation's approximately 55,000 community water systems and 21,400 not-for-profit noncommunity water systems. The total national need for drinking water investments is large—$150.9 billion for the next 20 years. Of this total, $102.5 billion is needed now to ensure the continued provision of safe drinking water. Large and medium-sized systems account for most of the total need, although small systems have the greatest needs on a per-household basis. American Indian and Alaska Native Village systems represent $2.2 billion of the total national need. The results of this survey support the findings of the first survey, conducted in 1995, by documenting the continued need to install, upgrade, and replace the infrastructure on which the public relies for safe drinking water.

Public water systems must invest in infrastructure improvements to ensure that they can continue to deliver safe drinking water to consumers. These improvements vary greatly in complexity and cost: from replacing a low-capacity well pump that will serve a small community to constructing a 500 million gallon-per-day water treatment plant that will serve a large metropolitan area.

Despite the importance of these projects for protecting public health, water systems often encounter difficulties in obtaining affordable financing for such improvements. Recognizing this problem, Congress established the Drinking Water State Revolving Fund (DWSRF) in the 1996 Safe Drinking Water Act (SDWA) Amendments. The DWSRF provides low-interest loans and other forms of assistance to public water systems so they can supply safe drinking water. Since 1997, Congress has appropriated $3.6 billion to the DWSRF.

The Drinking Water Infrastructure Needs Survey is an important tool of the DWSRF program. The purpose of the survey is to estimate the documented 20-year capital investment needs of public water systems eligible to receive DWSRF funding—community water systems and not-for-profit noncommunity water systems.[1] The survey includes infrastructure needs that are required to protect public health, such as projects to preserve the physical integrity of the water system, convey treated water to homes, or ensure continued compliance with specific SDWA regulations.

As required by the SDWA, EPA uses the results of the most recent survey to allocate DWSRF funds to the States. Each State develops a priority system for funding projects based on public health criteria specified in the SDWA. Annual appropriations to the DWSRF are allocated to each State based on its share of the total national need—with each State receiving a minimum allotment of 1 percent of available funds. In addition, EPA uses the survey as a tool for allocating the Tribal Set-Aside (up to 1.5 percent of the DWSRF annual appropriation) to American Indian and Alaska Native Village water systems.

Sections 1452(h) and 1452(i)(4) of the Safe Drinking Water Act direct the EPA to conduct the Drinking Water Infrastructure Needs Survey every four years. The results are used to allocate Drinking Water State Revolving Fund monies to the States and Tribes. The 1999 Needs Survey is due to Congress by February 6, 2001.

[1] Community water systems serve at least 25 people or 15 connections year-round. Noncommunity water systems serve at least 25 people for more than 60 days, but less than year-round.

Total National Need

Total Need by System Size and Type. The survey found that the total infrastructure need nationwide is $150.9 billion. This estimate represents the needs of the approximately 55,000 community and 21,400 not-for-profit noncommunity water systems that are eligible to receive DWSRF assistance. The total national need includes all eligible water systems. These systems are found in all 50 States, Puerto Rico, the Virgin Islands, the Pacific Islands, and the District of Columbia. American Indian and Alaska Native Village water systems also are included in the total need.

The survey includes only infrastructure needs that are required to protect the public health. It is important to emphasize, however, that most of the needs represent projects that systems would address as preemptive measures to ensure the continued provision of safe drinking water, rather than as remedial actions to correct an existing violation of a drinking water standard. In addition, the majority of the total need derives from the inherent costs of being a water system which involves the nearly continual need to install, upgrade, and replace the basic infrastructure that is required to deliver safe drinking water to consumers.

As shown in Exhibit ES-1, the nation's 886 largest community water systems (each serving more than 50,000 people) account for the greatest share, 41 percent, of the total national need. Medium and small community water systems also have substantial needs of $43.3 billion and $31.2 billion, respectively. The Virgin Islands and the Pacific Island territories represent $387.5 million of the total need. The survey estimates that not-for-profit noncommunity water systems have $3.1 billion in needs. American Indian water systems need $1.2 billion in infrastructure improvements, while Alaska Native Village systems require $1.1 billion.[2]

Exhibit ES-1: Total 20-Year Need (in billions of January 1999 dollars)

System Size and Type	Need
Large Community Water Systems (serving over 50,000 people)	$61.8
Medium Community Water Systems (serving 3,301 to 50,000 people)	$43.3
Small Community Water Systems (serving 3,300 and fewer people)	$31.2
Not-for-Profit Noncommunity Water Systems	$3.1
American Indian and Alaska Native Village Water Systems	$2.2
Subtotal National Need	**$141.6**
Costs Associated with Proposed and Recently Promulgated Regulations (Taken From EPA Economic Analyses)	$9.3
Total National Need	**$150.9**

Total Need by Current and Future Needs. About 68 percent of the total need, $102.5 billion, is needed now to continue to protect the public health and maintain existing distribution and treatment systems. Appendix B-2 presents a further breakdown of the current need. Current needs are projects that a system would begin immediately.

In most cases a current need would involve installing, upgrading, or replacing infrastructure to enable a water system to continue to deliver safe drinking water. A system with a current need, therefore, usually is not in violation of any health-based drinking water

[2] These estimates slightly exceed the total $2.2 billion American Indian and Alaska Native Village system need due to rounding.

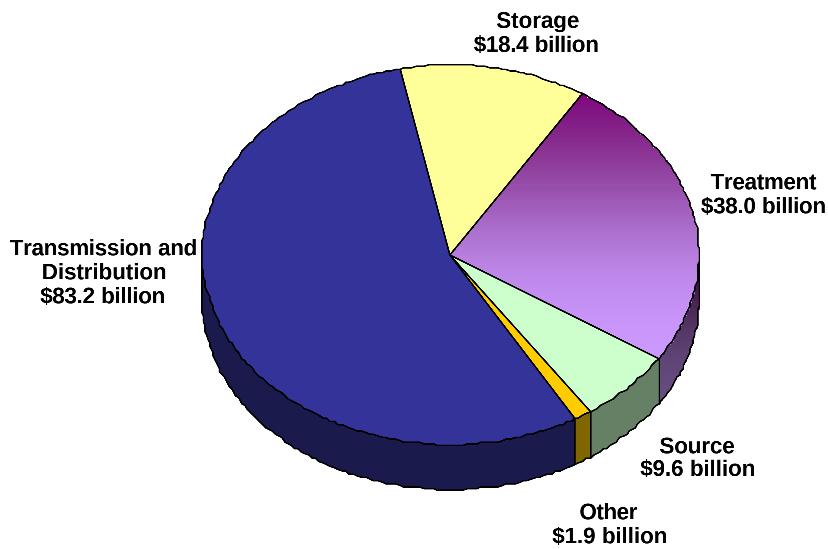
standard. For example, a surface water treatment plant may currently produce safe drinking water, but the plant's filters may require replacement due to their age and declining effectiveness, if the plant is to continue to provide safe water.

Future needs are projects that water systems expect to address in the next 20 years as part of routine rehabilitation of infrastructure or due to predictable events such as reaching the end of a facility's service-life. Approximately 32 percent of the total need, $48.4 billion is reported as future needs.

Total Need by Category. Every project in the survey belongs to one of five categories of need: source, transmission and distribution, treatment, storage, and "other." Each category represents projects that are of critical importance to providing safe drinking water. Exhibit ES-2 illustrates the total 20-year need by category.

- With $83.2 billion needed over the next 20 years, transmission and distribution projects constitute the largest category of need. Although the treatment plant is usually the most visible component of a water system, most of a system's infrastructure is buried underground in the form of transmission and distribution mains. For this reason, the transmission and distribution category comprises the largest proportion of the total need. The transmission and distribution category includes the installation and rehabilitation of raw

Exhibit ES-2: Total 20-Year Need by Category (in January 1999 dollars)



Note: Numbers may not total due to rounding.

AP/Wide World Photos

A ruptured water main in New York City closed a section of a major thoroughfare and limited service to two hospitals. The majority of the nation's distribution lines were installed in the mid-1900s. Towns and cities are finding it increasingly necessary to replace old and deteriorated pipe.

and finished water transmission pipes, distribution water mains, replacement of lead service lines, flushing hydrants, valves, and backflow prevention devices. Failure of transmission and distribution lines can interrupt the delivery of water. Broken transmission lines also can disrupt the treatment process, and leaking distribution mains can lead to a loss of pressure causing back-siphonage of contaminated water.

- Treatment projects represent the second largest category of need, $38.0 billion over the next 20 years. This category consists of projects needed to reduce contaminants through, for example, filtration, chlorination, corrosion control, and aeration. More than half of the total treatment need, $22.7 billion, is needed to address contaminants that pose acute health risks. The installation, upgrade, or rehabilitation of treatment infrastructure also is required to remove contaminants that can cause chronic health effects or taste, odor, and other aesthetic problems.

- The total 20-year need for storage projects is $18.4 billion. This category includes projects to construct new or rehabilitate existing finished water storage tanks. A water system with inadequate storage capacity cannot always provide water at pressures sufficient to prevent back-siphonage of microbial contaminants. In addition, constructing new tanks is necessary if the system cannot meet peak demands. Many projects in this category involve rehabilitating existing tanks to prevent structural failures that can cause microbiological contamination.

- The source category includes projects that are necessary to obtain safe supplies of surface or ground water. The infrastructure needs in this category include the installation and rehabilitation of drilled wells. The total 20-year need for source water projects is $9.6 billion.

- Other needs account for an estimated $1.9 billion. This category captures needs that cannot be assigned to one of the prior categories. Examples include emergency power generators, computer and automation equipment, and improvements for flood or earthquake protection.


Los Angeles Department of Water and Power and U.S. EPA

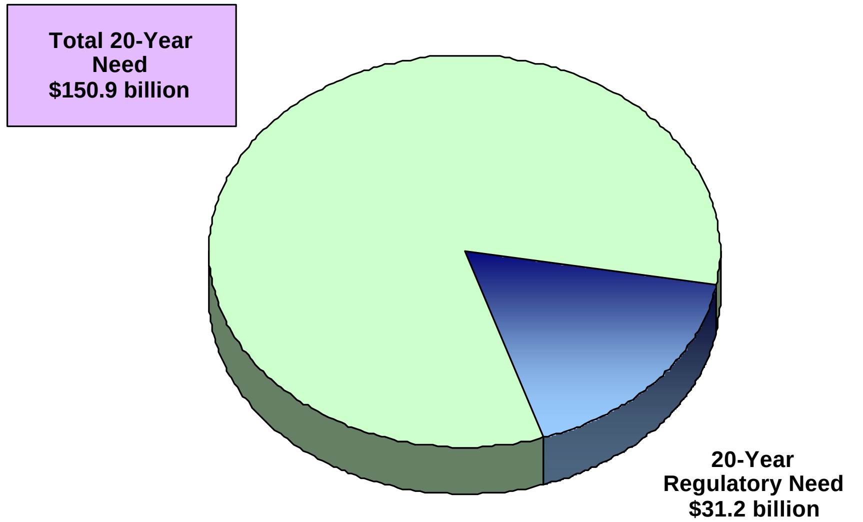
Water systems require storage facilities to serve the public during periods of peak use, to supply water in the event of an emergency, and to prevent contamination by maintaining water pressure. Two 30 million gallon tanks under construction in Los Angeles, California, and a 100 gallon tank (insert) underscore the difference in scale between large and small systems.

Conservative Estimate of Need. Although the total estimate of need is large, it is important to emphasize that the methods used by the survey produce a conservative estimate of need. The second chapter, *Findings*, discusses this issue in greater detail.

The Regulatory Need

The SDWA aims to ensure that public water systems meet national standards to protect consumers from the harmful effects of contaminated drinking water. Although all of the infrastructure projects included in the survey promote the SDWA's public health objectives, some are directly attributable to SDWA regulations. This report refers to these needs collectively as the "regulatory need." The total regulatory need is divided into two broad categories: existing SDWA regulations and recently promulgated and proposed regulations.

Exhibit ES-3: 20-Year Total Need and Regulatory Need (in January 1999 dollars)



As shown in Exhibit ES-3, the total regulatory need accounts for 21 percent, or $31.2 billion, of the total national need. This statistic reveals that most of the total need results from the costs of installing, upgrading, and replacing the basic infrastructure that is required to deliver drinking water to consumers—-costs that are borne by water systems independent of the SDWA. For a need to be included in the survey, however, it must be required to protect public health. Therefore, if a system fails to address a need, then a health-based violation of a standard eventually may occur.

Existing SDWA Regulations. The estimated need directly associated with existing SDWA regulations is $21.9 billion. Exhibit ES-4 displays the regulatory need by type of regulation and identifies how much of the need is a current need and how much is a future need.

Exhibit ES-4: 20-Year Regulatory Need (in millions of January 1999 dollars)

Regulations	Current Need	Future Need	Total Need
Existing SDWA Regulations			
Surface Water Treatment Rule [1]	$14,492.1	$4,873.3	**$19,365.4**
Total Coliform Rule [1]	$358.1	$112.8	**$470.9**
Nitrate/Nitrite Standard [1]	$197.1	$31.9	**$229.0**
Lead and Copper Rule	$1,039.6	$186.5	**$1,226.2**
Total Trihalomethanes Standard	$39.1	$60.6	**$99.7**
Other Regulations [2]	$430.8	$85.4	**$516.2**
Subtotal National Need	**$16,556.9**	**$5,350.4**	**$21,907.4**
Costs Associated with Proposed and Recently Promulgated Regulations (Taken From EPA Economic Analyses) [3]		$9,324.3	**$9,324.3**
Total National Need	**$16,556.9**	**$14,674.8**	**$31,231.7**

Note: Numbers may not total due to rounding.

[1] Regulations for contaminants that cause acute health effects.

[2] Includes regulated VOCs, SOCs, IOCs, and Radionuclides.

[3] Includes regulations for contaminants that cause acute and/or chronic health effects. In the Economic Analyses, the compliance costs with some regulations are given as a range. In calculating the $9.3 billion need, the survey used EPA's lead option, unless one was not available in which case the survey used the more conservative estimate.

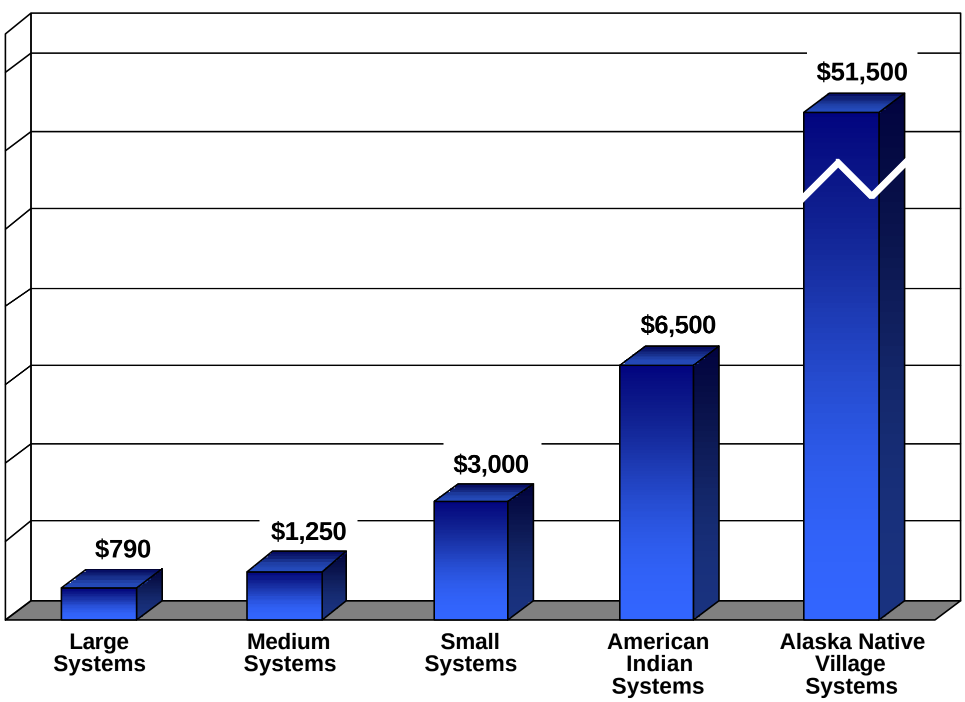
The SDWA requires that States use 15 percent of their DWSRF allotment for providing financial assistance to small water systems. In reality, States have committed an average of 41 percent of their allotments to small systems.

Microbial Contaminants. Projects to address microbiological contamination account for 91 percent, or $19.8 billion, of the total existing regulatory need. Under the SDWA, the Surface Water Treatment Rule (SWTR) and the Total Coliform Rule (TCR) are designed to reduce the amount of microbial contaminants in drinking water. Microbial contaminants, such as *Giardia* and *E. coli*, can cause acute gastrointestinal illness and, in extreme cases, death. The installation of a treatment plant to filter a surface water source and the installation of a disinfection system are examples of needs associated with this category.

Chemical Contaminants. Infrastructure needs to protect the public health from chemical contaminants comprise $2.1 billion of the total existing regulatory need. This category includes projects necessary for compliance with the Nitrate/Nitrite Standard, Lead and Copper Rule, Total Trihalomethanes Standard, and other regulations that set maximum allowable limits for organic and inorganic contaminants. Examples of projects in this category are aerating water to remove volatile organic compounds and applying corrosion inhibitors to reduce the leaching of lead from pipes.

Proposed or Recently Promulgated Regulations. The total need for proposed and recently promulgated regulations is $9.3 billion. Of this total, $2.6 billion is for the regulation of acute contaminants under the Interim Enhanced Surface Water Treatment Rule (IESWTR), Long Term I Enhanced Surface Water Treatment Rule (LT1), Ground Water Rule, and Filter Backwash Recycling Rule. The remaining $6.7 billion is for chronic contaminants regulated under the Stage 1 Disinfectants/Disinfection Byproducts Rule (DBPR), Arsenic Rule, Radon Rule, and Radionuclides Rule.

Exhibit ES-5: Average 20-Year Per-Household Need (in January 1999 dollars)



Does not include the costs associated with proposed or recently promulgated SDWA regulations.

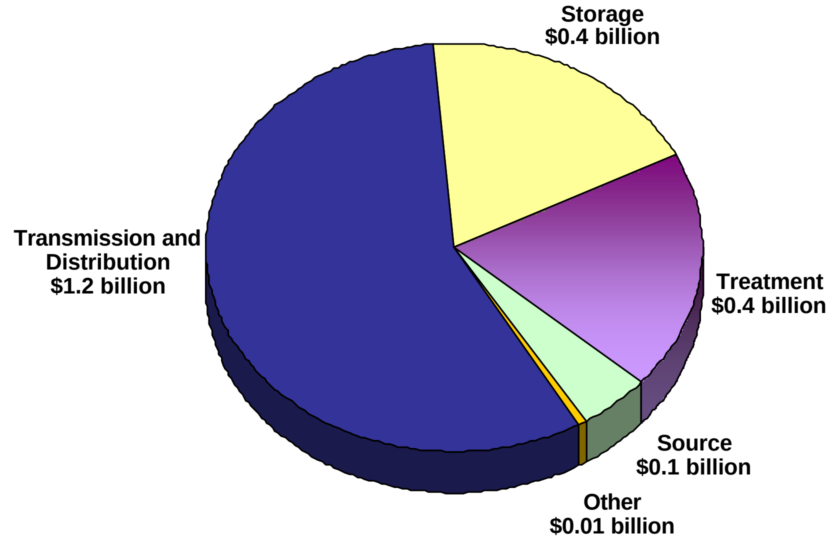
Economic Challenges Faced by Small Water Systems

Approximately 45,000 of the nation's 55,000 community water systems serve fewer than 3,300 people. Small water systems face many unique challenges in providing safe drinking water to consumers. The substantial capital investments required to rehabilitate, upgrade, or install infrastructure represent one such challenge. Although the total small system need is modest compared to the needs of larger systems, the costs borne on a per-household basis by small systems are significantly higher than those of larger systems. Exhibit ES-5 compares the average 20-year need per-household for water systems.

Needs of American Indian and Alaska Native Village Water Systems

Total American Indian and Alaska Native Village Water System Needs. The total need for American Indian and Alaska Native Village systems is $2.2 billion over 20 years. Exhibit ES-6 presents the total need by category for these systems. The significance of this need in terms of public health is underscored by considering the per-household costs, which average $6,500 for American Indians and $51,500 for Alaska Natives. The difficulty in transporting materials to remote areas, the lack of economies of scale for small system projects, and the limited annual construction period in some regions contribute to the high per-household costs for these systems.

Exhibit ES-6: Total 20-Year for American Indian and Alaska Native Village Water System Need by Category (in January 1999 dollars)



Note: Numbers may not total due to rounding.

Does not include the costs associated with proposed or recently promulgated SDWA regulations.

Indian Health Service

The construction of a treated water storage tank nears completion in Nuiqsut, one of the most northerly communities in Alaska. In many Alaska Native communities, water tanks and treatment plants must be elevated on pilings to prevent the heated facilities from subsiding into the permafrost.

American Indian Needs. The total 20-year need for American Indian systems is $1.2 billion. Of this total, approximately $1.0 billion is currently needed to ensure the continued provision of safe drinking water. Transmission and distribution projects account for 65 percent of the total need, followed by projects in the treatment, storage, and source categories of need.

Alaska Native Village Needs. The total 20-year need for Alaska Native Village systems is $1.1 billion. Of this total, approximately $1.0 billion is needed now to ensure the continued provision of safe drinking water. The largest categories of need in descending order are transmission and distribution, storage, and treatment.

U.S. EPA

Water systems use a variety of treatment technologies to remove harmful contaminants from drinking water. For example, aeration units (pictured) are used to remove volatile organic compounds and certain secondary contaminants, such as hydrogen sulfide.

Households Not Served by Public Water Systems

Data from the 1990 census indicate that approximately 16 million households are not served by public water systems. This survey was restricted to public water systems eligible for DWSRF assistance. It therefore, was not designed to estimate the needs for households that use private wells, haul water from non-public systems, or lack running water. However, the survey addressed these needs in a limited way by including projects to extend service from existing public water systems to homes that do not have access to safe drinking water. Approximately $6.0 billion is needed for such projects. This figure underestimates the true scale of the need, given that most systems in the survey focused their efforts on identifying projects for current consumers.

Methods

The approach for the survey was developed by EPA in consultation with a workgroup consisting of representatives of the States, American Indians and Alaska Native Villages, and the Indian Health Service. The workgroup refined the methods used in 1995 based on lessons learned from the 1995 survey and options made available from technological advancements in the Internet.

Methods Used to Assess State Needs

The survey used questionnaires to collect infrastructure needs from medium and large water systems. EPA mailed questionnaires to all 1,111 of the nation's largest water systems serving over 40,000 people and to a random sample of

2,556 of the 7,759 medium systems serving over 3,300 people. Approximately 96 percent of these systems returned the questionnaire: with 100 percent of the largest water systems responding.

Small systems serving fewer than 3,300 people often lack the specialized staff and planning documents needed to respond adequately to the questionnaire. Therefore, EPA conducted site visits to 599 randomly selected small community water systems and 100 not-for-profit noncommunity systems to identify and document their infrastructure needs.

Methods Used to Assess American Indian and Alaska Native Village Water System Needs

Each of the 19 American Indian systems serving more than 3,300 people completed a questionnaire. To assess the needs of small systems serving fewer than 3,300 people, EPA conducted site visits to a random sample of 78 American Indian water systems.

In Alaska, the availability of key personnel and data resources (such as aerial photographs) allowed for a census of the 174 Alaska Native Village water systems. The survey included 2 medium-sized systems and all 172 small systems. Current and future needs for Alaska Native Village systems were documented by EPA in consultation with district engineers, Village Safe Water, and Alaska Native Village representatives.

Total Need Compared to the 1995 Drinking Water Infrastructure Needs Survey

The 1995 Needs Survey estimated a total national need of $152.6 billion[3]–as compared to the $150.9 billion estimate of this survey. The *Findings* section discusses the $1.7 billion difference between the surveys' estimates in greater detail.

It is important to note that the fundamental methods used to collect and evaluate needs in 1999 remained largely unchanged from the 1995 survey. Most importantly, the 1999 survey retained the stringent documentation and eligibility requirements of the 1995 survey.

Conclusions

The 1999 Drinking Water Infrastructure Needs Survey, the second such national survey by EPA, estimates that the nation's public water systems need to invest $150.9 billion over the next 20 years to ensure the continued provision of safe drinking water to consumers. This finding lends support to the results from the previous survey which also identified a substantial need for infrastructure investments. The need to replace, upgrade, and install infrastructure will continue to increase as these systems age. The large magnitude of the need reflects the challenges confronting water systems as they deal with an infrastructure network that has aged considerably since the systems were constructed, in many cases, 50 to 100 years ago.

[3] The 1995 Needs Survey reported the total need as $138.4 billion. Adjusted to 1999 dollars this amount is $152.6 billion.

AP/Wide World Photos

This 31-year-old storage tank ruptured in Westminster, California, sending a 6-foot wave of water through the city that damaged or destroyed about 50 buildings and over a dozen vehicles. Storage tanks should be replaced or periodically rehabilitated to preserve their structural integrity.

OVERVIEW OF SURVEY METHODS

The second Drinking Water Infrastructure Needs Survey involved the collective efforts of the States, American Indian and Alaska Native Village representatives, the Indian Health Service, EPA, and thousands of water systems–all of which participated in identifying and documenting infrastructure needs. This chapter provides an overview of the methods used by these participants to assess drinking water needs. It also describes the refinements made to the methods used in the 1995 survey to improve the accuracy of this survey's results.

Scope of the Survey

Goal and Purpose. The goal of the 1999 Drinking Water Infrastructure Needs Survey was to estimate the documented 20-year national infrastructure need for the approximately 55,000 community and 21,400 not-for-profit noncommunity public water systems eligible to receive DWSRF assistance. A total of approximately 4,000 public water systems participated in the survey.

The 1996 Safe Drinking Water Act (SDWA) Amendments direct EPA to use the results from the latest needs survey to allocate DWSRF funds. For this purpose, the survey was designed to provide statistically precise estimates of need for each of the States. The DWSRF funds are allocated based on each State's share of the total national need (although, under SDWA, each State receives a minimum allotment of 1 percent).

The results of the survey are also used to allocate the set-aside—up to 0.33 percent of the DWSRF—for the U.S. Territories. Therefore, the survey generated separate estimates of need for Guam, American Samoa, the Commonwealth of Northern Mariana Islands, and the U.S. Virgin Islands.

For American Indian and Alaska Native Village water systems, EPA calculated the total infrastructure need for each EPA Region. The results are used to allocate the Tribal Set-Aside of up to 1.5 percent of the DWSRF to the Regions based in part on each Region's share of the total American Indian and Alaska Native Village need.

Infrastructure Needs. To fulfill the survey's purpose as a tool for allocating DWSRF funds, all of the infrastructure needs in the survey were required to meet the basic eligibility criteria established under the DWSRF program.[1] In general, projects eligible for funding facilitate compliance with the SDWA's National Primary Drinking Water Regulations or otherwise significantly further the health protection objectives of the Act.

Categories of Need. The survey assigned each project to one of five categories of need: source, transmission and distribution, treatment, storage, and "other." This classification allowed for an understanding of where on a broad scale the nation's water systems need to make capital investments.

[1] The survey excluded DWSRF-eligible needs which do not involve the installation, replacement, or rehabilitation of infrastructure: for example, refinancing loans, conducting studies, and acquiring other water systems.

- The source water category comprises projects necessary to obtain sufficient supplies of surface or ground water. Examples include wells, surface water intakes, and spring collectors.

- The transmission and distribution category includes the pipes that transport water to consumers. This category represents the needs associated with installing or rehabilitating raw and finished water transmission pipes, distribution water mains, flushing hydrants, valves, and backflow prevention devices.

- The treatment category consists of projects needed to address problems such as the presence of microbial pathogens and chemical contaminants.

- The storage category includes projects to construct new or rehabilitate existing finished-water tanks.

Dan Fraser

The rust on the hydropneumatic tank (foreground) signals the need for rehabilitation, while the severe corrosion on the other tank will require its replacement. Such deterioration can promote microbial growth and impair water quality.

- The “other” category captures needs that cannot be assigned to one of the prior categories. Examples include laboratory equipment, emergency power generators, computer and automation projects, and improvements for flood or earthquake protection.

Current and Future Needs. The survey identifies current and future needs for the 20-year period from January 1, 1999 through December 31, 2018. Current needs address infrastructure projects which systems would implement as preventive measures to avoid water quality problems. An example of a current need is replacing an old and leaking section of distribution line that is susceptible to contamination.

Future needs are projects that a water system expects to undertake in the next 20 years. These include the routine rehabilitation of infrastructure and the replacement of a facility that performs adequately now, but will need to be replaced over the next 20 years to ensure the continued provision of safe drinking water. For example, a system may anticipate that it will need to replace its chlorinator within the next 10 years.

Credibility of the Findings. The survey required that documentation describing the purpose and scope of a project accompany each need. This requirement was necessary to verify that all of the projects submitted to the survey met the eligibility criteria for DWSRF funding. The survey established specific documentation requirements to ensure that uniform requirements would be applied to the States, U.S. Territories, and Tribes in determining the adequacy of documentation and the eligibility of needs. These requirements not only lend credibility to the findings, but also address the issue of fairness when the results are used to apportion DWSRF funds. Of the 86,057 projects submitted to the survey, 14 percent were deleted for failing to meet the documentation criteria or for appearing to be ineligible for DWSRF funding.

Documented Costs and Cost Models

In addition to developing requirements for documenting needs, the survey set rigorous documentation criteria for assessing the legitimacy and scope of project costs. EPA required that each project cost submitted to the survey be supported by documentation to indicate that the cost had undergone an adequate degree of professional review. The documentation criteria also allowed EPA to review all of the components of a project that were included in a cost estimate. This enabled EPA to model portions of the project that might have been excluded from a cost estimate, or to delete DWSRF-ineligible portions of the submitted cost. For example, if a system identified a need to replace a section of old and leaking pipe, but lacked cost documentation, the system could supply the length and diameter of pipe to be replaced. Based on this information, the cost for this project could be modeled.

The number of projects submitted without cost documentation increased significantly in 1999 compared to the previous survey. Of 74,339 accepted projects, 67 percent were submitted without costs or documentation of cost. This increase necessitated a greater reliance on cost modeling.

For the 1999 survey, 59 models were developed to assign costs to 95 different infrastructure needs, from replacing broken valves to building new treatment plants. The cost documentation submitted by water systems was the sole source of data for all but 19 of the cost models. For some types of need, the survey data proved inadequate for generating a statistically significant model. Therefore, cost data from additional sources, including engineering firms and State DWSRF programs, were obtained to supplement the data submitted by survey respondents.

Developing the Methods

The methods for the 1999 survey were developed by a workgroup consisting of State, American Indian, Alaska Native Village, Indian Health Service, and EPA representatives. The workgroup decided to adopt the general design of the first survey in 1995. However, the workgroup refined some of the methods based on lessons learned in conducting the 1995 survey, findings from a 1997 follow-up study that EPA conducted to assess the first survey, and options made available by advances in Internet communications.

Acceptable Documentation

The following types of documents were used to justify the need and/or cost of a project.

For Need and/or Cost Documentation

- Capital Improvement Plan or Master Plan
- Facilities Plan or Preliminary Engineering Report
- Grant or Loan Application Form
- Engineer’s Estimate
- Intended Use Plan/State Priority List
- Indian Health Service Sanitation Deficiency System Printout

For Need Documentation Only

- Comprehensive Performance Evaluation (CPE) Results
- Sanitary Survey
- Source Water Protection Plan
- Monitoring Results
- Signed and dated statement from State, site visit contractor, or system engineer clearly detailing infrastructure needs.

For Cost Documentation Only

- Cost of Previous Comparable Construction

Massachusetts Water Resources Authority

Water from the Charles River in Massachusetts pours into a deteriorated transmission main which the Massachusetts Water Resources Authority (MWRA) had drained after detecting a leak. MWRA replaces or rehabilitates approximately 7 miles of pipe per year, some of which is more than 100 years old. Many older water systems will find it increasingly necessary to replace substantial portions of distribution networks that were installed 50 to 100 years ago.

The workgroup developed the following improvements for the 1999 survey:

- In 1995, all systems serving more than 50,000 people were included in a census. The 1999 survey expanded the census to include systems serving more than 40,000 people. This change increased the precision of the survey's estimates for the largest systems that represent the greatest share of the nation's infrastructure needs.

- For the first survey, EPA was primarily responsible for collecting information from systems that did not respond to the survey or that submitted inadequate documentation. For the 1999 survey, this responsibility was assumed by States. The involvement of those more familiar with the surveyed systems improved the response rate and the identification of needs.

- The workgroup modified the design of the survey questionnaire by providing more examples and simplifying the forms.

- The 1999 survey created a user-friendly website that allowed the States to readily identify which projects required additional documentation of need or cost.

- The 1999 survey included the infrastructure needs of the 21,400 not-for-profit noncommunity water systems eligible for DWSRF assistance. These systems were not included in the 1995 survey.

- For the American Indian portion of the 1999 survey, the number of small systems selected to participate was increased to provide a more precise estimate of national need.

- The use of a census for Alaska Native Village water systems increased the precision of the need estimates compared to the sampling methods used for the first survey.

Conducting the State Survey

The survey used a questionnaire to collect infrastructure needs from medium and large water systems. A package containing a questionnaire, instructions, an example of a completed questionnaire, and a list of commonly asked questions was sent to each system in the survey. Packages were mailed to all 1,111 of the nation's largest systems serving more than 40,000 people and to a random sample of 2,556 medium systems serving more than 3,300 people.

The systems returned the questionnaires and accompanying documentation to their State contacts. The States reviewed each questionnaire to ensure that systems identified all of their needs and that the projects fulfilled the eligibility and documentation criteria. If these criteria were not met, the States had the option of contacting the system to obtain more information. EPA conducted a final review of each project and entered the information into a database. Web-based communications allowed the States to review the data, including any changes made by EPA. The website provided States with the information necessary to identify projects not meeting the established criteria and provided the States with an opportunity to submit additional documentation of project need or cost.

Small systems serving 3,300 or fewer people generally lacked the personnel and planning documents necessary to complete the questionnaire. Therefore, the infrastructure needs of small systems were obtained through site visits to approximately 599 systems—with at least 6 systems selected in each State. EPA conducted an additional 100 site visits to assess the needs of not-for-profit non-community water systems.

Conducting the American Indian and Alaska Native Village Surveys

Developing the American Indian Methods. The 1999 survey used the same tools (questionnaires and site visits) to estimate the needs of American Indian and Alaska Native Village water systems as were used for systems in the State portion of the survey. Exhibit 1 displays the location of the American Indian and Alaska Native Village water systems included in the survey.

U.S. EPA

All 19 American Indian systems serving more than 3,300 people completed a questionnaire. EPA offered technical support to systems that requested assistance in identifying eligible needs and preparing documentation. The questionnaires for each system contained preprinted need and cost information derived from the Sanitation Deficiency System (SDS) of the Indian Health Service (IHS). The SDS provides information on specific needs and ranks communities' needs based on threats to public health. This information served as a baseline of needs to which the systems added projects for the survey.

The survey conducted 78 site visits to a random selection of small systems serving fewer than 3,300 people. Of the approximately 781 American Indian water systems, 762 systems are small.

All needs and costs submitted by American Indian systems were required to meet the documentation criteria established for the survey. To be considered adequate, documentation of need had to explain the purpose of the project, while documentation of cost had to indicate that the cost had been subject to professional review. If cost documentation was unavailable, the system was asked to provide information that enabled EPA to model the cost.

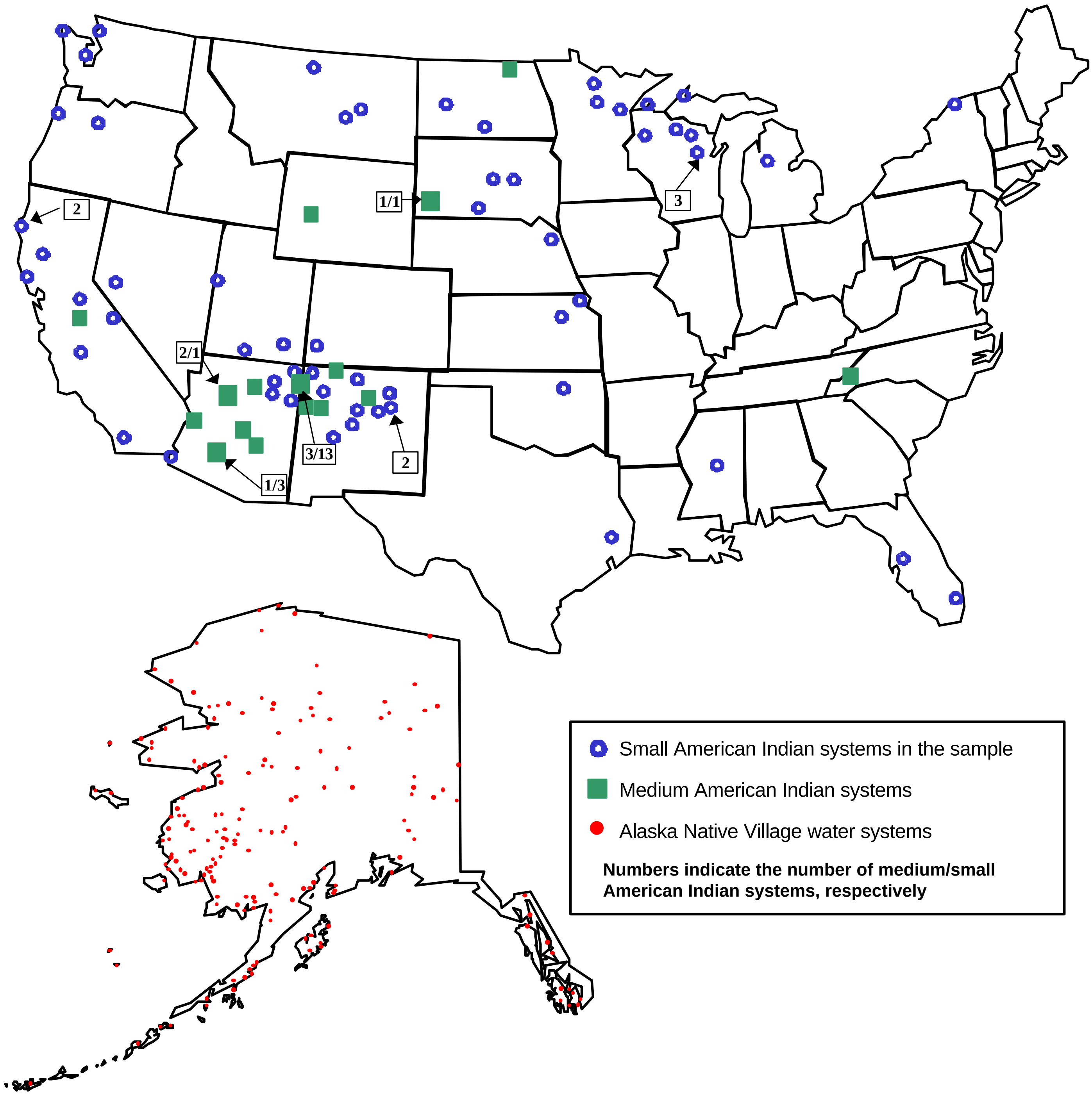
Developing the Alaska Native Village Methods. The availability of key personnel and data resources (e.g., aerial photographs) allowed EPA to use a census to assess the needs of Alaska Native Village water systems. A questionnaire was mailed to the two medium-sized systems serving more than 3,300 people. Infrastructure needs for 172 small systems were identified on questionnaires by representatives from the Alaska Native Village Health Consortia, IHS, and Village Safe Water with assistance from EPA.

A round-table of IHS and EPA engineers was convened to provide guidance on developing project costs. Villages were assigned to one of four geographical zones to account for distinct regional variations in costs. For most types of need, costs were established for each region. EPA developed these costs based on projects funded by IHS in Alaska Native Villages. However, the cost models that were developed from data provided by systems in the State and American Indian portions of the survey were used to assign costs to a few small-scale projects (e.g., flushing hydrants) for which IHS costs were unavailable.

Navajo Nation EPA

Many American Indians obtain their drinking water from watering points such as the one pictured here.

Exhibit 1: Location of American Indian and Alaska Native Village Water Systems In the Needs Survey Sample



U.S. EPA

Some water systems employ short-term measures to postpone the expense of replacing and rehabilitating infrastructure. Here a water system uses a broom to prop up a chemical feed line. With a $4.4 million DWSRF loan, a neighboring water system expanded its treatment capacity to serve the community previously served by this deteriorated system.

FINDINGS

This section of the report presents the results of the effort undertaken in 1999 to estimate the capital investment needs of the nation's approximately 55,000 community water systems and 21,400 not-for-profit noncommunity water systems. Appendix B provides greater detail of the need by State.

Total 20-Year National Need

The Needs Survey found that community water systems and not-for-profit noncommunity water systems need $150.9 billion over the next 20 years to install, upgrade, and replace infrastructure. The survey required that all needs be accompanied by documentation that described the purpose and scope of each project. To be included in the Needs Survey, projects had to meet the eligibility criteria established under the DWSRF program. In general, infrastructure projects were acceptable if they were needed to protect public health or to maintain the transmission and distribution of treated water to homes. Such projects varied greatly in scale, complexity, and cost—from drilling a well to serve a small mobile home court to constructing a high-capacity water treatment plant for a large metropolitan area. The survey excluded projects solely for operation and maintenance, future growth, and fire flow.[1] Projects to rehabilitate or replace deteriorated infrastructure were not considered operation and maintenance and, therefore, were included in the survey.

EPA Region 6

A section of wooden pipe dating from the early 1900s is removed for replacement by iron or PVC pipe. The service life of a water line can range from 10 to 200 years depending on the pipe material, soil type, and climate conditions.

[1] Projects solely for operation and maintenance, dams, reservoirs, future growth, and fire flow are generally ineligible for DWSRF assistance.

The estimate of total national need represents all community water systems and not-for-profit noncommunity water systems in the States, Puerto Rico, the Virgin Islands and the Pacific Island territories, American Indian communities, and Alaska Native Villages.

Exhibit 2 shows the total national need by system size and type, and by current and future need. The nation's 886 largest community water systems (serving more than 50,000 people) account for $61.8 billion, or 41 percent, of the total need. Medium and small community water systems have needs of $43.3 billion and $31.2 billion, respectively. The Virgin Islands and the Pacific Island territories account for $387.5 million of the total community water system need. The survey estimates that not-for-profit non-community water systems have $3.1 billion in needs. Exhibit 3 presents the approximate need by State. American Indian water systems need $1.2 billion in infrastructure improvements, while Alaska Native Villages need $1.1 billion[2] for capital projects. Because public water systems are not expected to have accurate estimates of their capital needs for recently proposed or promulgated regulations, capital costs from appropriate Economic Analysis documents were used to estimate those needs. Proposed or recently promulgated regulations contribute $9.3 billion to the total national need.

Most of the infrastructure needs in the survey represent projects that systems would address as preventive measures to ensure the continued provision of safe drinking water, rather than as corrective actions to address an existing violation of a drinking water standard. Also, it is important to recognize that the majority of the total national need stems from the inherent costs of being a water system—which involves the nearly continual need to install, upgrade, and replace the basic infrastructure that is required to deliver drinking water to consumers.

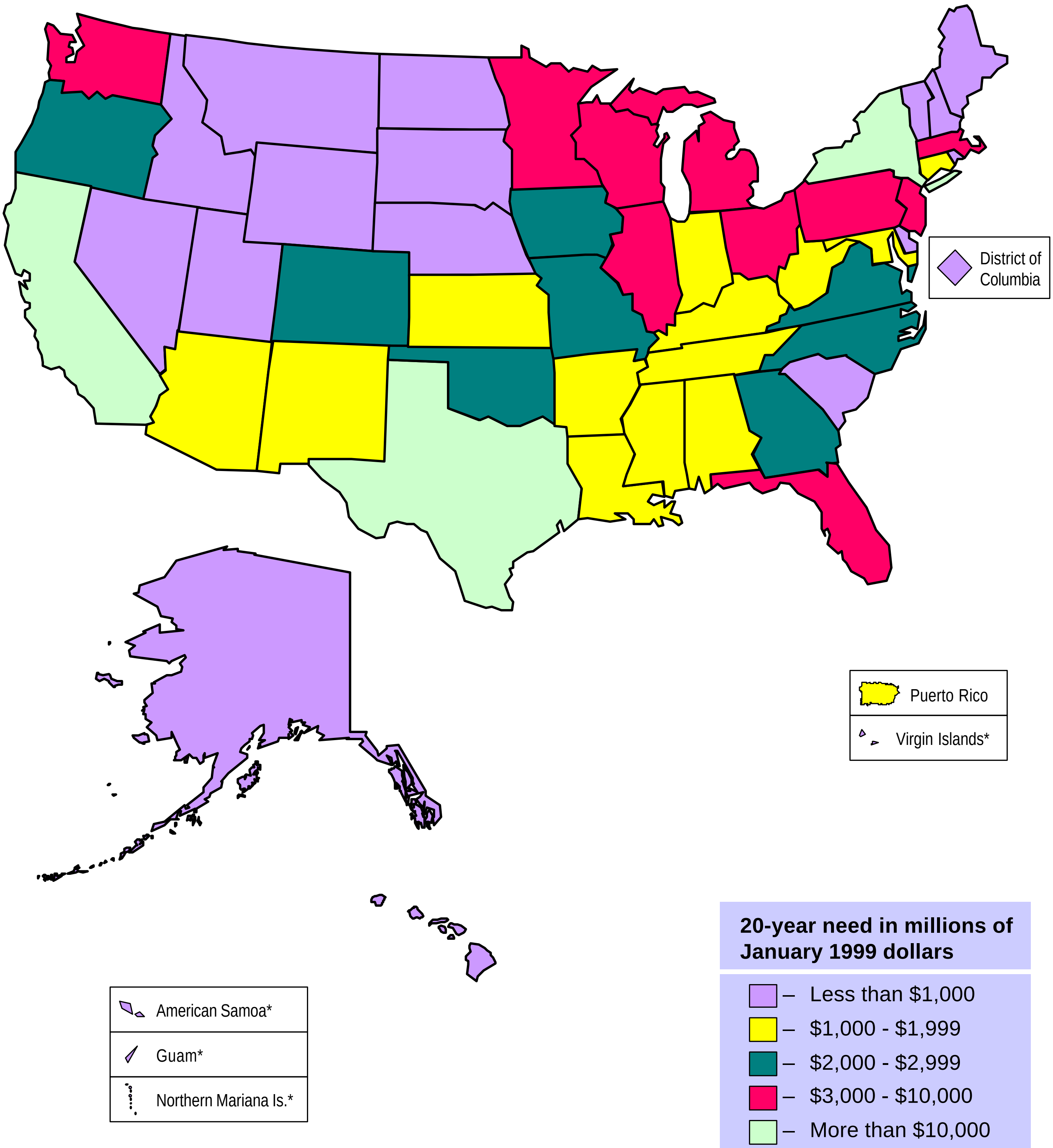
Exhibit 2: Total Need by Current and Future Need (in billions of January 1999 dollars)

System Size and Type	Current Need	Future Need	Total Need
Large Community Water Systems (serving over 50,000 people)	$47.2	$14.6	$61.8
Medium Community Water Systems (serving 3,301 to 50,000 people)	$29.9	$13.4	$43.3
Small Community Water Systems (serving 3,300 and fewer people)	$22.2	$8.9	$31.2
Not-for-Profit Noncommunity Water Systems	$1.1	$2.0	$3.1
American Indian and Alaska Native Village Water Systems	$2.0	$0.2	$2.2
Subtotal National Need	**$102.5**	**$39.1**	**$141.6**
Costs Associated with Proposed or Recently Promulgated Regulations (Taken From EPA Economic Analyses)		$9.3	$9.3
Total National Need	**$102.5**	**$48.4**	**$150.9**

Note: Numbers may not total due to rounding.

[2] These estimates slightly exceed the total $2.2 billion American Indian and Alaska Native Village system need due to rounding.

Exhibit 3: Overview of Need by State†



† Needs for American Indian and Alaska Native Village water systems are not included in this exhibit.
* The need for American Samoa, Guam, the Northern Mariana Islands, and the Virgin Islands is less than $1 billion each.

Exhibit 4: Total Need by Category of Need
(in millions of January 1999 dollars)

System Size and Type	Distribution and Transmission	Treatment	Storage	Source	Other	Total Need
Large Community Water Systems (serving over 50,000 people)	$39,031.1	$13,371.3	$4,575.3	$3,718.6	$1,149.8	**$61,846.1**
Medium Community Water Systems (serving 3,301 to 50,000 people)	$25,526.9	$8,627.6	$6,155.4	$2,519.5	$468.2	**$43,297.7**
Small Community Water Systems (serving 3,300 and fewer people)	$16,980.0	$5,619.9	$5,710.8	$2,617.5	$226.4	**$31,154.7**
Not-for-Profit Noncommunity Water Systems	$387.8	$611.0	$1,477.3	$620.8	$0.7	**$3,097.6**
American Indian and Alaska NativeVillage Water Systems	$1,228.4	$408.1	$447.0	$123.2	$12.4	**$2,219.0**
Subtotal National Need	**$83,154.2**	**$28,637.9**	**$18,365.8**	**$9,599.6**	**$1,857.5**	**$141,615.0**
Costs Associated with Proposed or Recently Promulagted Regulations (Taken From EPA Economic Analyses)		$9,324.3				**$9,324.3**
Total National Need	**$83,154.2**	**$37,962.2**	**$18,365.8**	**$9,599.6**	**$1857.5**	**$150,939.4**

Note: Numbers may not total due to rounding.

Current and Future Needs. Of the total need, $102.5 billion is the current need.

It is important to note that most systems with current needs provide safe drinking water. These systems identified projects that are required as preventive measures to avoid water quality problems. For example, a chlorination unit for deactivating harmful microbial contaminants may function adequately to provide safe drinking water now: although its design life may be exceeded and the system would replace the unit.

That systems require such an enormous investment to meet their current needs reflects the age and deteriorated condition of the nation's infrastructure. Many water systems were constructed 50 to 100 years ago. Operating within resource constraints relative to their needs, some systems have adopted a reactive approach to capital investment that involves replacing or upgrading infrastructure only as it fails. For example, a system may have the funding only to patch a leak in the distribution system, even though its deteriorated condition warrants replacing several miles of pipe to prevent contamination or the disruption of service.

Future needs account for $48.4 billion of the total need. Future needs are projects that water systems would undertake during the 20-year period of the survey to ensure the continued provision of safe drinking water. Future needs address components of a water system that operate adequately now, but will exceed their design-life or performance capabilities within the next 20 years. Examples include a water storage tank that requires rehabilitation and an aging pump that must be replaced because it cannot be rehabilitated.[2]

[2] Capital projects that will be needed for compliance with proposed or recently promulgated SDWA regulations are included in the survey as future needs. The estimated capital cost of each of these regulations is provided in Appendix B.

Total Need by Category

The infrastructure needs of water systems can be grouped into four major categories–source, transmission and distribution, treatment, and storage–each of which fulfills an important function in delivering safe drinking water to the public. Most needs were assigned to one of these categories. An additional “other” category is composed of projects that do not fit into the four categories, such as installing emergency power generators and upgrading facilities to protect against earthquakes and floods. Exhibit 4 shows the total national need by water system size and type and category of need.

Transmission and Distribution. Although the least visible component of a public water system, the buried pipes that comprise a transmission and distribution network generally account for most of a system’s capital value. It is not uncommon for even medium-sized systems to have several hundred miles of pipe.

Transmission and distribution projects represent the largest category of need, $83.2 billion over the next 20 years. Of this total, $65.6 billion is needed now. Replacing or refurbishing transmission and distribution mains is critical to providing safe drinking water. Failures in transmission and distribution lines can interrupt the delivery of water. Broken transmission lines can disrupt the treatment process, and deteriorated distribution mains can pose acute health risks from the back-siphonage of contaminated water.

Transmission and distribution projects include replacing aging and deteriorated water mains, refurbishing pipes to remove build-up on pipe walls, looping dead-end mains to improve water quality, and installing pumping stations to maintain adequate pressure. This category also includes projects to address the replacement of appurtenances, such as valves that are essential for controlling flows and isolating problem areas during repairs, and hydrants to flush the distribution system to maintain water quality.

Rehabilitation of Water Mains

Rehabilitating mains has become more common due to technological advancements that provide cost-effective alternatives to unearthing and replacing pipe. For example, the application of a cement lining will prolong the design life of certain types of pipe. Rehabilitation also may involve “pigging” lines to remove internal deposits, known as tubercles, which constrict water flow and impair water quality.

Montauk Services Inc. and U.S. EPA

This pipe shows clear signs of tuberculation, a condition resulting from the accumulation of mineral deposits and debris. Tuberculation can reduce pipe capacity and impair drinking water quality. One method of removing tubercles involves sending a “pig” (insert) through the system to scour the sides of the pipe.

U.S. EPA and Philadelphia Water Department

Water systems differ greatly in size and complexity, from a simple well pump with chlorinator (left) to a large-scale filtration plant.

Many water systems installed new transmission and distribution mains to keep pace with the rapid economic and population growth that followed World War II. The rate at which these pipes deteriorate varies greatly due to soil characteristics, weather conditions, construction methods, and type of pipe. However, it is reasonable to assume that most pipes will require replacement within 50 to 75 years of installation. Consequently, much of the pipe installed in the 1940s may require replacement over the next 20 years. The large need associated with the transmission and distribution category reflects this reality.

Treatment. With $38.0 billion needed over 20 years, treatment is the second largest category of need. Fifty-one percent of this total, $19.4 billion, is a current need. This category includes the installation or rehabilitation of infrastructure to reduce contamination through, for example, filtration, disinfection, corrosion control, and aeration. The majority of the capital costs for proposed and recently promulgated regulations are related to treatment, and thus these costs also are included in this category.

Treatment facilities vary significantly in scale depending on the quality of source water and type of contamination. Treatment systems may consist of a simple chlorinator for disinfection or a complete conventional treatment system with coagulation, flocculation, sedimentation, filtration, disinfection, laboratory facilities, waste handling, and computer automated monitoring and control devices.

Treatment technologies primarily address two general types of contaminants: those with acute health effects and those with chronic health effects.

An acute health effect usually occurs within hours or days after short-term exposure to a contaminant. Acute illnesses are associated mostly with microbial contaminants, although some chemical contaminants, such as copper and nitrate, also can cause acute health effects. Gastrointestinal illness resulting from the ingestion of microbial pathogens is the most common acute health effect.

Chronic health effects develop typically after long-term exposure to low concentrations of chemical contaminants. These effects include cancer and birth defects. The largest need associated with contaminants that pose chronic health effects is treatment for lead. Research has shown that exposure to lead may impair the mental development of children and cause other chronic health effects, such as high blood pressure.

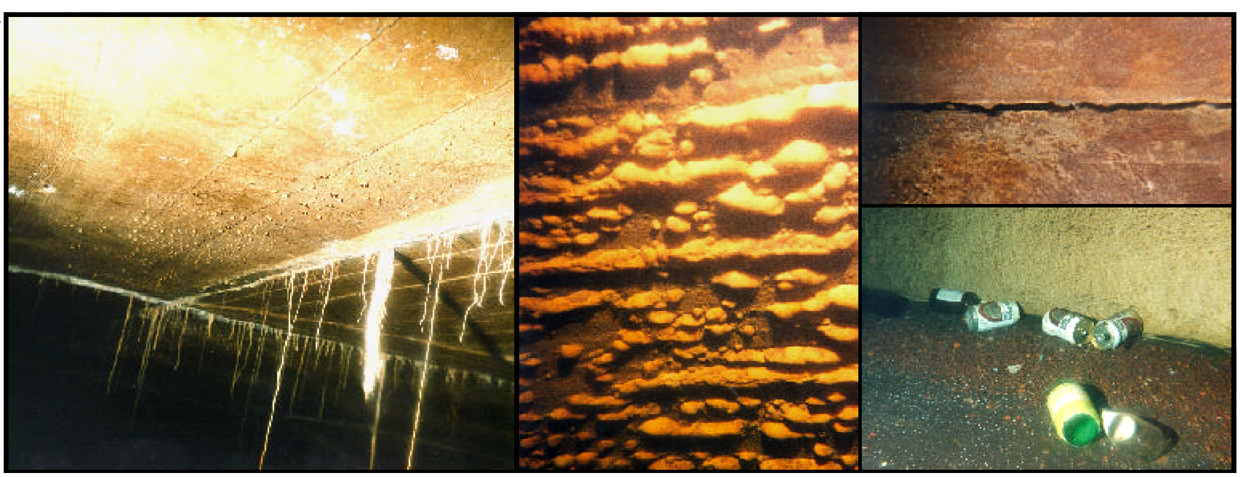
The treatment category also includes projects to remove contaminants that adversely affect the taste, odor, and color of drinking water. Treatment of these "secondary contaminants" usually involves softening the water to reduce manganese and calcium levels or applying chemical sequestrants for iron contamination. Although not a public health concern, the aesthetic problems caused by secondary contaminants may prompt some consumers to seek more palatable, but less safe, sources of water.

Storage. The total 20-year need for storage projects is $18.4 billion, of which $10.2 billion is current need. This category includes projects to construct or rehabilitate finished water storage tanks.

A water system that has sufficient storage can provide an adequate supply of treated water to the public even during periods of peak demand. This enables the system to sustain the minimum pressure required to prevent the intrusion of contaminants into the distribution network. Moreover, many States require that systems have the storage capacity to provide a nearly 2-day supply of water in the event of an emergency, such as a water source being temporarily unusable.

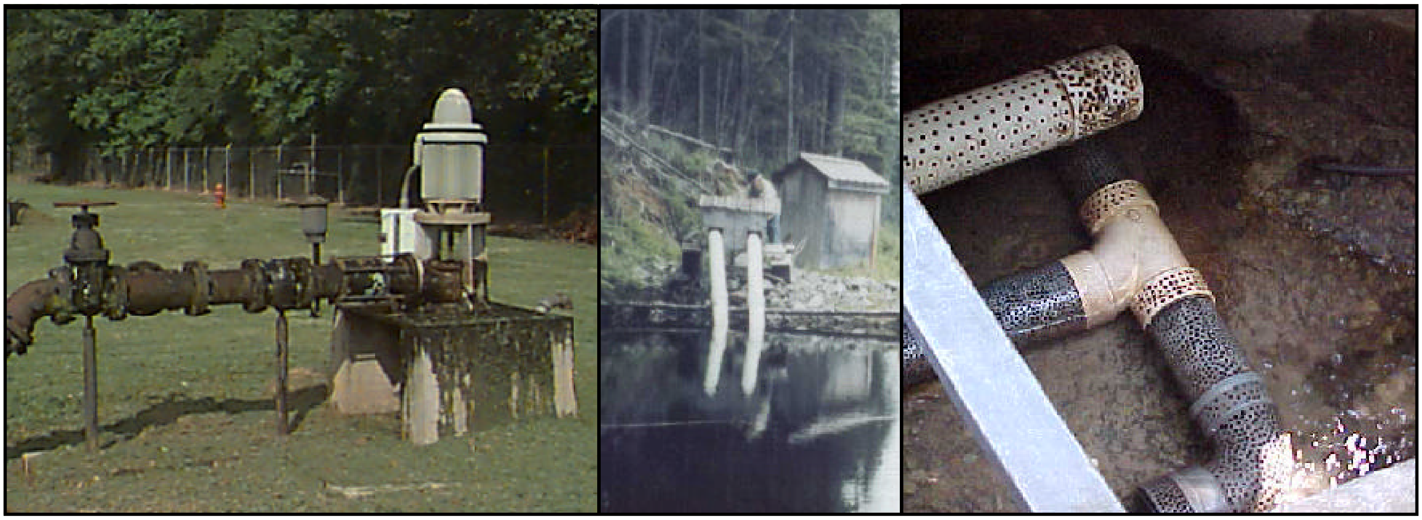
A system's optimal storage capacity generally depends on the population it serves. For example, a water system operated by a small homeowners association may need a 2,000-gallon hydropneumatic (pressurized) storage tank to provide sufficient water pressure and to prevent the operation of pumping facilities each time a consumer opens a faucet. By contrast, a larger system serving a metropolitan area may need several hundred million gallons of storage to satisfy similar operational requirements.

John Conrady



Storage tanks must be regularly drained, sandblasted, and coated with epoxy paint. Such rehabilitation is necessary to maintain the tanks' structural integrity and to prevent the intrusion of contaminants. Water systems commonly use underwater divers to inspect the inside of their tanks. These pictures, taken by a diver, show (left) stalactites formed by the leaching of calcium from a tank's roof, (middle) deep corrosion nearly requiring the tank's replacement, (upper right) a wide crack causing the loss of 5,000 gallons of water per day, and (lower right) discarded litter.

U.S. EPA and Dan Fraser



Approximately 89 percent of the nation's water systems use ground water as a primary source, although these systems generally serve far fewer people than do surface water systems. Examples of different types of source-related infrastructure include a vertical pump to extract well water (left), an intake structure to pump surface water (middle), and a perforated pipe to collect spring water (right).

Source. The total 20-year need for source water infrastructure is $9.6 billion. Of this total, $5.8 billion is a current need. The source category includes needs for constructing or rehabilitating surface water intake structures, raw water pumping facilities, drilled wells, and spring collectors.

Drinking water is obtained from either ground water or surface water sources. Wells are considered ground water sources, and rivers, lakes, and other open bodies of water are considered surface water sources. Whether drinking water originates from ground or surface water sources, its quality is an important component in protecting public health. A high quality water supply can minimize the possibility of microbial or chemical contamination and may eliminate the need to install expensive treatment facilities. Many source water needs relate to constructing new surface water intake structures or drilling new well fields to obtain improved raw water quality.

A water source also should provide enough water under all operating conditions to enable the water system to maintain minimum pressures. Low water pressure may result in the intrusion of contaminants into the distribution system through back-siphonage. The survey includes projects to expand the capacity of intake structures and wells to address supply deficiencies.

Other Needs. Needs not included in the previous categories are labeled "other" needs. These needs account for $1.9 billion of the total 20-year need. Examples of "other" projects include laboratory equipment to test water for chemical and microbiological contaminants, emergency power generators to provide continued pumping or treatment during power outages, and upgrades to protect infrastructure against floods or earthquakes.

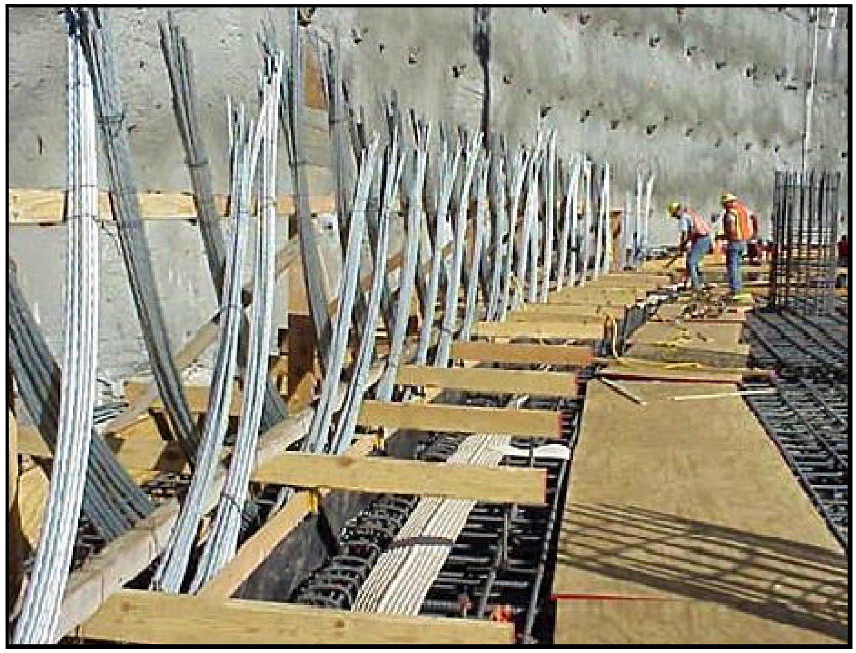
The Regulatory Need

Although all of the projects in the survey are needed to attain or maintain compliance with the SDWA regulations, some projects are directly attributable to specific regulations under the Act. These projects are collectively referred to as the "regulatory need." Most of the regulatory need involves the upgrade, replacement, or installation of treatment technologies.

Of the total national need, 21 percent, or $31.2 billion, is for compliance with current, new, and proposed SDWA regulations. This statistic reveals that most of the total need derives from the costs of installing, upgrading, and replacing the basic infrastructure that is required to deliver drinking water to consumers—costs that water systems would face independent of any SDWA regulations. However, for a project to be included in the survey, it must be required to protect public health. Therefore, if a system fails to address a need, then a health-based violation eventually may occur.

Also, by requiring systems to conduct routine monitoring of a contaminant, a SDWA regulation could prompt a system to identify a need that otherwise would have eluded detection until water quality or service became impaired. Thus, SDWA regulations, most notably the Total

Los Angeles Department of Water and Power



At a storage facility near Los Angeles, workers install seismic cables to provide structural resiliency for earthquake protection

Exhibit 5: 20-Year Total Need and Regulatory Need (in January 1999 dollars)

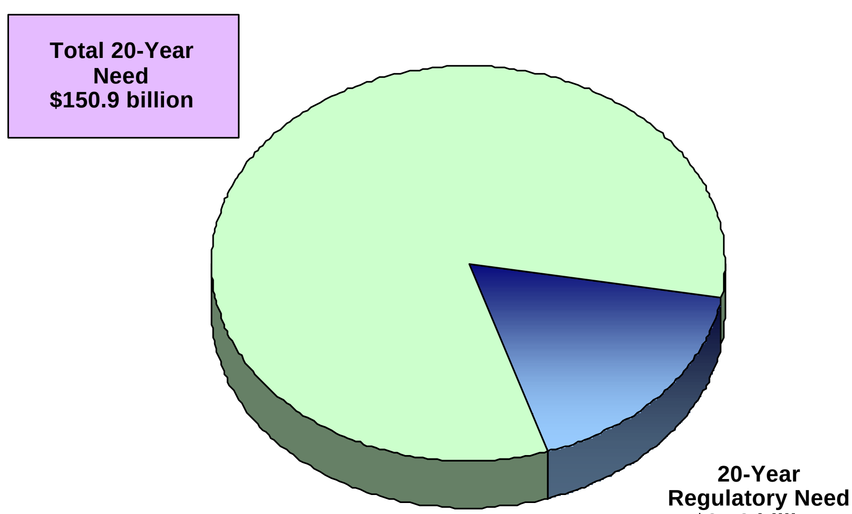


Exhibit 6: 20-Year Regulatory Need
(in billions of January 1999 dollars)

Regulations	Total Need
Existing SDWA Regulations	
Surface Water Treatment Rule[1]	$19.4
Total Coliform Rule[1]	$0.5
Nitrate/Nitrite Standard[1]	$0.2
Lead and Copper Rule	$1.2
Total Trihalomethanes Standard	$0.1
Other Regulations[2]	$0.5
Subtotal National Need	**$21.9**
Costs Associated with Proposed or Recently Promulgated Regulations (Taken From EPA Economic Analyses)[3]	$9.3
Total National Need	**$31.2**

Note: Numbers may not total due to rounding.
[1] Regulations for contaminants that cause acute health effects.
[2] Includes regulated VOCs, SOCs, IOCs, and Radionuclides.
[3] Includes regulations for contaminants that cause acute and/or chronic health effects. In the Economic Analyses, the compliance costs with some regulations are given as a range. In calculating the $9.3 billion need, the survey used EPA's lead option, unless one was not available in which case the survey used the more conservative estimate.

Coliform Rule, may enhance a system's awareness of the condition of its infrastructure and, consequently, increase the reporting of needs.

It is important to note that the regulatory need includes only those projects that systems identified and documented as being directly associated with a SDWA regulation. For projects to be counted as a regulatory need, systems had to submit documentation, such as a laboratory slip, showing an exceedance or imminent violation of an MCL or treatment technique requirement. A project without this documentation, even if it promotes compliance with a SDWA regulation, would not be counted as a regulatory need. For example, a ground water system may identify the need to replace an aging chlorinator used to inactivate microbial pathogens, but may lack the documentation to attribute the project to a specific regulation (in this case the Total Coliform Rule). The project would be included in the survey, but not as a regulatory need. The stringent documentation criteria, therefore, likely result in an understatement of the true regulatory need. However, the documentation is necessary to ensure that the regulatory need estimate has credibility.

The total regulatory need is divided into two broad categories: existing SDWA regulations ($21.9 billion), and recently promulgated or proposed regulations ($9.3 billion). Exhibit 6 displays the regulatory need by type of existing regulation.

The SDWA was enacted to protect consumers from the harmful effects of contaminated drinking water by requiring that public water systems meet national standards. Pursuant to the SDWA, EPA has set standards for 81 inorganic, organic, and microbial contaminants. EPA also requires water systems to install particular types of treatment, known as treatment techniques, to protect the public health from an additional 9 contaminants.

Existing Regulations: Microbial Contaminants. The Surface Water Treatment Rule (SWTR) and the Total Coliform Rule are the SDWA regulations that address microbial contamination. Projects directly attributable to these regulations account for $19.8 billion, or 91 percent, of the total existing regulatory need.

The SWTR accounts for almost all of the microbial contaminant-related need and most of the total regulatory need. This statistic reflects the fact that the majority of the nation's large municipal systems use surface water sources. Under the SWTR, all systems using surface water sources must install treatment to minimize microbial contamination. In most cases, this means installing filtration plants to inactivate or remove microbial pathogens, such as the bacterium *E. coli*, the virus Hepatitis A, and the protozoan *Giardia lamblia*. Projects associated with this regulation also include rehabilitating and upgrading existing treatment facilities.

Existing Regulations: Chemical Contaminants. Existing SDWA regulations to minimize chemical contamination accounts for $2.1 billion of the total regulatory need. This estimate includes projects attributable to the Nitrate/Nitrite Standard, Lead and Copper Rule, Total Trihalomethane standard, and the other regulations that set MCLs or treatment techniques for organic and inorganic chemicals. Examples of projects include aerating water to remove volatile organic compounds, such as tetrachloroethylene, and applying corrosion inhibitors to reduce the leaching of lead from pipes in home plumbing. This category includes over 80 inorganic or organic chemicals for which infrastructure projects may be needed.

Most chemical contaminants are associated with chronic health effects including cancer, reproductive difficulties, and liver or kidney problems. However, nitrate levels above the health-based standard can cause an acute illness, known as "blue baby syndrome," in which infants are deprived of oxygen in the bloodstream. Also, excessive copper levels can induce acute gastrointestinal illness.

Proposed or Recently Promulgated Regulation Infrastructure Needs. The total need to comply with proposed or recently promulgated regulations is $9.3 billion. Of this total, $2.6 billion is to address microbial contaminants that have acute health effects. This estimate is derived from the Economic Analyses (EAs) that EPA published when proposing each regulation. Water systems can readily identify the infrastructure needs required for compliance with existing regulations, but most systems have not yet determined the infrastructure needed to attain compliance with future or recently promulgated regulations. Relying on systems to identify the costs of complying with these regulations would significantly

Current and Future Regulatory Needs

Of the $31.2 billion total regulatory need, $16.6 billion is the current need for maintaining and attaining compliance with existing regulations. Most water systems with current regulatory needs are presently not in violation of any health-based standard. Rather, these systems identified needs that would enable them to continue to maintain compliance with existing regulations. Future regulatory needs include projects in which systems will need to invest due mostly to the routine rehabilitation or replacement of infrastructure. For example, most conventional filtration plants require the refurbishment of pumps, filters, chemical feed units, and other components within a 20-year period. All of the costs associated with the proposed or recently promulgated regulations are included as future regulatory needs.

Philadelphia Water Department

Workers repair a water main break in Philadelphia. Deteriorated distribution pipe is susceptible to microbiological contamination and can disrupt water service.

understate the true need of compliance. Therefore, the survey used EAs to estimate these compliance costs.

The 1999 survey differs from the first needs survey in the allocation of the costs associated with proposed or recently promulgated regulations. Although the method for calculating the capital costs of these regulations is unchanged, the costs are not apportioned to each State due to the regional occurrence of some contaminants. Applying the EAs on a state-level might over- or understate some States' actual needs for compliance.[3]

[3] See the section in Appendix A, "Estimating the Costs for Future and Recently Promulgated Regulations," for a more detailed discussion.

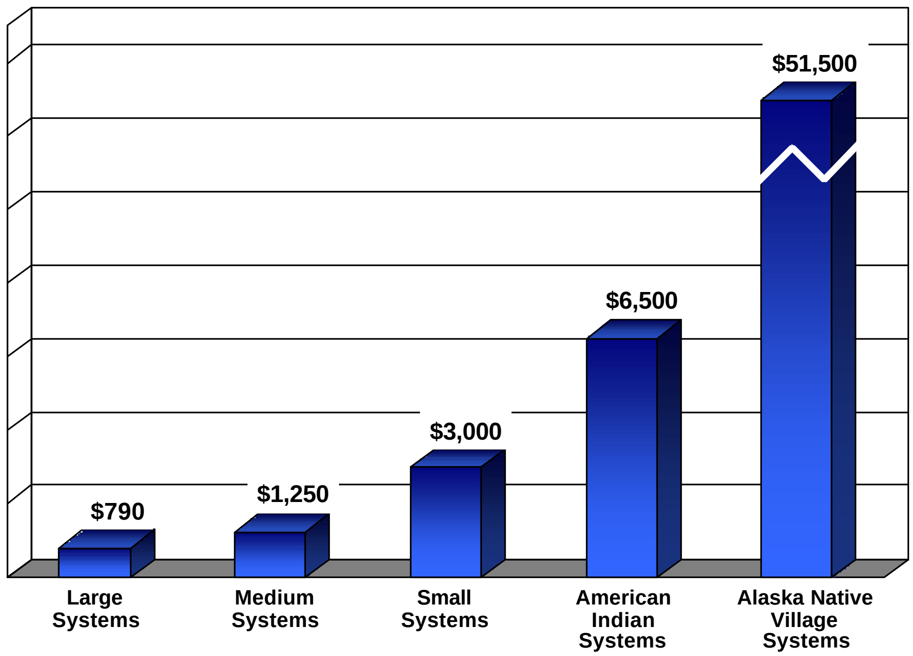
The regulations addressed by this category include the Interim Enhanced Surface Water Treatment Rule (IESWTR), Stage 1 Disinfectants/Disinfection Byproducts Rule (DBPR), Arsenic Rule, Radon Rule, Groundwater Rule, Filter Backwash Recycling Rule, Long Term 1 Enhanced Surface Water Treatment Rule, and the Radionuclides Rule. The total costs of these regulations are included in the survey as future regulatory needs. Capital cost estimates for each of these rules are provided in Appendix B.

Economic Challenges Faced by Small Water Systems

Approximately 45,000 of the nation's 55,000 community water systems serve fewer than 3,300 people. Small water systems vary widely in size and complexity. In general, systems serving more than 500 people have a configuration typical of larger public water systems: a water source, several miles of transmission and distribution piping, multiple storage tanks, and a treatment system. Systems serving fewer than 500 people are usually much simpler in design and consist of a ground water well, a small storage tank, and a few hundred feet of pipe. Some small systems purchase treated water from larger public water systems, and therefore lack the source water and treatment components of a complete water system.

Regardless of their size and configuration, small water systems face many unique challenges in providing safe drinking water to consumers. The substantial capital investments required to rehabilitate, upgrade, or install infrastructure represent one such challenge. Although the total small system need may seem

Exhibit 7: Average 20-Year Per-Household Need (in January 1999 dollars)



Does not include the costs associated with proposed and recently promulgated SDWA regulations.

minor relative to the needs of larger systems, the per-household costs borne by small systems are significantly higher than those of larger systems. Exhibit 7 compares the average 20-year per-household need for water systems of different sizes and for American Indian and Alaska Native Village water systems.

The per-household cost for infrastructure improvements is almost 4-fold higher for small systems than for large systems. Small systems lack the economies of scale that allow larger systems to spread the costs of capital improvements among their many consumers. For example, the installation of a new 1.2 MGD conventional treatment plant designed to serve a community of 1,000 people may cost approximately $2.5 million, whereas a 20 MGD plant serving 100,000 people may cost $30.3 million. The cost per-household is approximately 88 percent higher for the smaller community. Moreover, larger systems usually purchase material in quantities that result in significant savings on a unit basis.[4]

Community Water Systems Serving Fewer Than 10,000 People

Small water systems face considerable economic challenges in delivering safe drinking water. The SDWA targets water systems serving fewer than 10,000 people for special consideration by the DWSRF program. States must provide a minimum of 15 percent of the available funds for loans to small systems. Through June 2000, States have exceeded this requirement by providing approximately 41 percent of their funds to small water systems.

The survey estimates that systems serving fewer than 10,000 people represent 35 percent of the total national need for community water systems. In many States, these systems' needs comprise well over 50 percent of the total need. Appendix C presents the 20-year needs for small systems serving fewer than 10,000 people by State.

[4] These estimates are derived from the cost models. See Appendix A—"Methods and Cost Modeling" for a discussion of how the cost models were developed.

Total Need Compared to the 1995 Drinking Water Infrastructure Needs Survey

The 1995 Needs Survey estimate of $152.6 billion[5] exceeds the findings of this survey by $1.7 billion. A comparison of the surveys is complicated by the slightly different methods and project eligibility criteria used to calculate the needs. The 1995 Needs Survey, for example, included the $5.2 billion capital need associated with dams and untreated water reservoirs. After EPA completed the first Needs Survey, these needs were determined to be ineligible for DWSRF assistance and were consequently excluded from the 1999 survey. Conversely, unlike the 1995 survey, the 1999 survey includes $3.1 billion in needs of not-for-profit noncommunity water systems that are eligible for DWSRF funding. The varying estimates of costs associated with the proposed and recently promulgated regulations also contributes to the difference between the surveys.

Despite these slight variations, the fundamental methods used to collect and evaluate needs in 1999 remained largely unchanged from the 1995 survey. Most importantly, the 1999 survey retained the stringent documentation and eligibility requirements of the 1995 survey.

Conservative Estimate of Needs

The methods developed for the survey yield a conservative estimate of need. Despite the large magnitude of the total national need, the survey likely underestimates the true need due to the stringent documentation criteria and the use of a questionnaire to identify the needs of medium and large systems. Also, the scope of the survey is limited to those needs eligible to receive DWSRF assistance–thus excluding capital projects related solely to dams, raw water reservoirs, future growth, and fire protection. For example, a transmission project to extend service to an area where the construction of new homes is expected would be considered future growth and, therefore, omitted from the survey.

Site visits are the most effective method to collect information on infrastructure projects. To accommodate the limited resources of personnel and documentation available to most small systems serving 3,300 and fewer people, site visits were used to estimate the needs of small community water systems and not-for-profit noncommunity water systems. The site visitors assessed every major component of a water system from source to service line for inclusion in the survey. They also generated the documentation necessary to support each need and cost. Each site visit resulted in a thorough identification and documentation of needs over 20 years.

[5] The 1995 Needs Survey reported the total need as $138.4 billion. Adjusted to 1999 dollars this amount is $152.6 billion.

Resource constraints prevented the use of site visits to assess the needs of the 3,667 medium and large systems in the survey. Instead, these systems were asked to complete survey questionnaires and provide documentation for all projects.

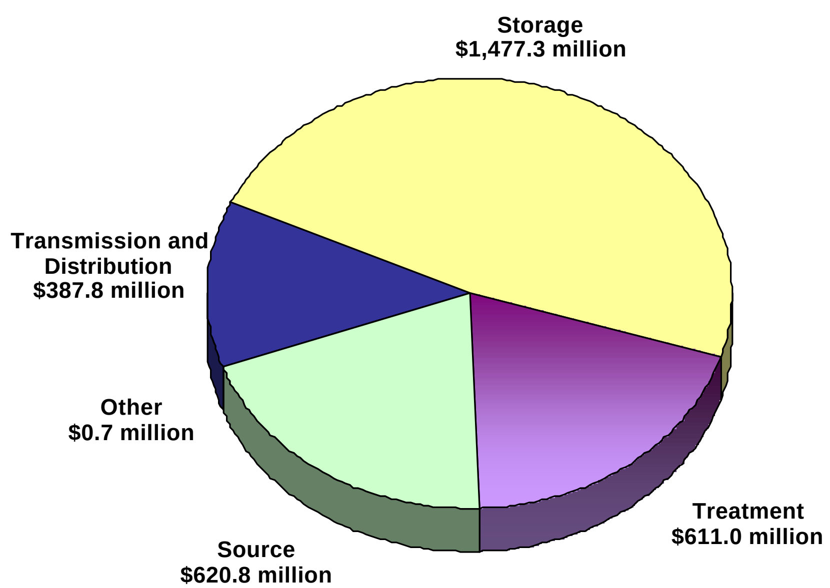
In completing the questionnaire, many medium and large systems relied exclusively on planning documents, such as Capital Improvement Plans (CIPs), that often covered just one to five years, rather than the 20-year scope of the survey. Thus, these systems likely overlooked eligible projects that will be needed beyond the timeframe of their planning documents. For example, many systems used CIPs to identify the need to replace sections of old and leaking pipe. In reality, the amount of pipe that may need to be replaced over a 20-year period may greatly exceed that portion identified in the CIPs. In addition, planning documents usually reflect the financial resources available to systems. Therefore, even though a system may need to replace most of its deteriorated distribution network over the next 20 years, the CIP may include a much smaller portion owing to the projected availability of funds. Despite measures taken to minimize underreporting, the continued reliance on medium and large systems to identify and document their needs produced a conservative estimate of need, particularly because these systems represent most of the total national need.

Not-for-Profit Noncommunity Water Systems

The survey estimates that not-for-profit noncommunity water systems need to invest $3.1 billion in infrastructure improvements over the next 20 years. Of this total, $1.1 billion is needed now to ensure the continued protection of public health. Exhibit 8 presents the noncommunity need by category.

Noncommunity water systems are either transient or nontransient systems. Transient noncommunity systems serve at least 25 of the same persons for no more than 6 months of the year. Examples include gas stations, campgrounds, and roadside rest areas. Nontransient noncommunity systems serve at least 25 of the same people for more than 6 months per year, but less than year-round. Examples include factories, schools, and office buildings.

Exhibit 8: Total 20-Year for Not-for-Profit Noncommunity Water Systems Need by Category (in January 1999 dollars)



Does not include the costs associated with proposed SDWA regulations.

The scope of the survey was restricted to the approximately 21,400 not-for-profit noncommunity water systems that are eligible to receive DWSRF assistance. EPA estimates that approximately 10 percent of transient noncommunity systems and 50 percent of nontransient noncommunity systems are not-for-profit systems.

The needs of noncommunity systems comprise a small proportion of the total national need. This result reflects the limited infrastructure required for a noncommunity system compared to a community water system. The lower needs of noncommunity systems is due mostly to their relative lack of transmission and distribution infrastructure. Many noncommunity systems consist of so few buildings–often just one–that the miles of pipe typically required for even the smaller-sized community water systems are unnecessary.

With respect to the other categories of need, noncommunity systems have fewer sources, limited storage requirements, and smaller treatment facilities than most community water systems. The absence

Infrastructure Needs of the U.S. Pacific Islands and the Virgin Islands

The SDWA established a 0.33 percent set-aside of the DWSRF to provide grants to community water systems in American Samoa, the Commonwealth of Northern Mariana Islands (CNMI), Guam, and the U.S. Virgin Islands. As it did with the States, EPA used a combination of questionnaires and site visits to assess the needs of water systems on the islands. These systems face many challenges in delivering safe drinking water. The expense of transporting materials to the islands, the limited availability of water resources, and pervasive salt water intrusion require capital investments that are substantial, particularly when considered on a per-household basis.

In America Samoa and CNMI, the primary source of drinking water is a thin layer of groundwater which lies above the seawater. High salinity levels have forced many water systems to shut-down wells or install expensive reverse osmosis units to remove the saltwater.

Drinking water in Guam is obtained from ground water and surface water sources. The main municipal water supplier in Guam has difficulties meeting the treatment performance standards of the Surface Water Treatment Rule that protect against microbial contamination.

Dan Fraser

A water distillation plant, operated by the Virgin Islands Water and Power Authority, is shut down and disassembled for repair. Seawater is pumped through screens, then distilled to remove the salts and make the water potable. This facility also uses an ion separation process to extract chlorine from the seawater for use as a disinfectant.

of a full-time population accounts for these reduced infrastructure needs. In addition, noncommunity systems generally do not experience the peak demands in use–associated with morning showers, watering lawns, and meal preparation–with which community water systems must contend in designing their facilities.

The noncommunity need should not be discounted because of its modest contribution to the total national need. The rapid turnover of consumers at transient systems and the sensitive populations at some nontransient systems, such as schools and day care centers, mean that the infrastructure needs of these systems have an important public health dimension.

Separate State Estimates

In response to the Needs Survey workgroup's request, EPA provided States with the opportunity to prepare separate estimates of needs which were not included in the survey due to DWSRF ineligibility. EPA also invited States to submit needs that the States felt were underestimated by the survey. Four States submitted separate estimates, which are provided in Appendix D.

Dave Clark

The expense of burying pipe leads some systems to develop expedient but precarious solutions such as the one pictured here. Water service will be disrupted if pipes are not buried or otherwise adequately protected.

FINDINGS: AMERICAN INDIAN AND ALASKA NATIVE VILLAGE WATER SYSTEMS

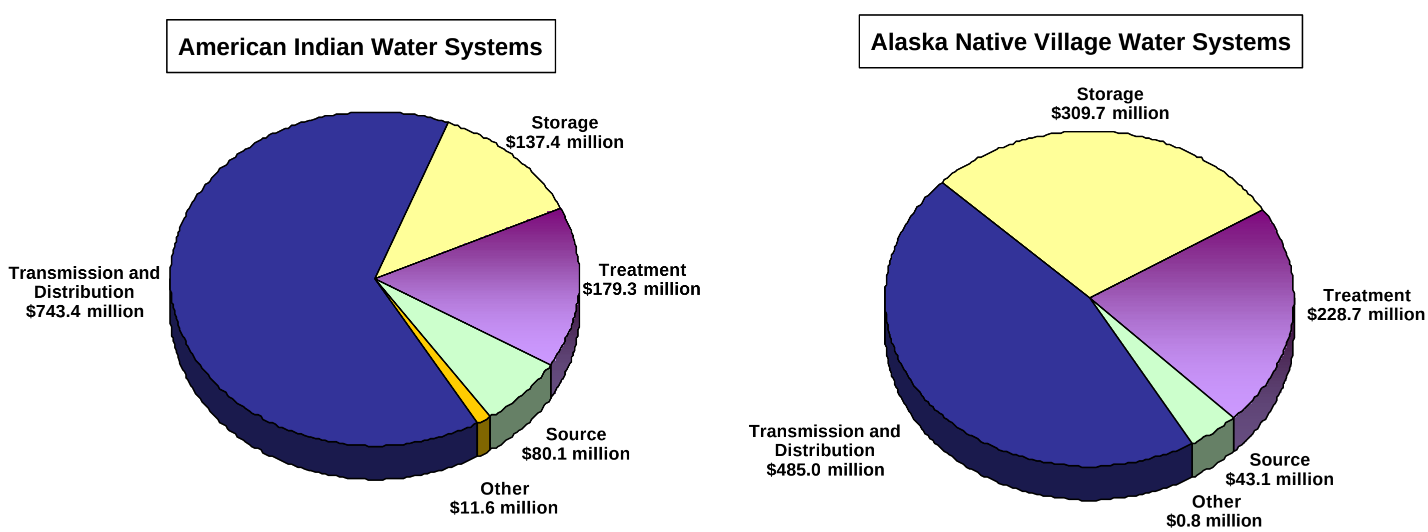
In 1999, EPA conducted a survey to estimate the 20-year capital needs of American Indian and Alaska Native Village water systems. This section of the report presents the total need for these systems. The section also describes the need by category and the existing regulatory need. Appendix B presents the American Indian need by EPA Region.

The survey estimates that American Indian and Alaska Native Village water systems need to invest $2.2 billion in capital improvements over the next 20 years. Of this total, $2.0 billion is needed now to ensure the continued provision of safe drinking water. Exhibit 9 presents the total need by category for American Indian and Alaska Native Village systems.

The public health significance of this need is underscored by considering the per-household needs of American Indian and Alaska Native Village water systems. As Exhibit 7 shows, these household needs are the highest in the nation–averaging $6,500 per-household for American Indians and $51,500 per-household for Alaska Native Villages. It is to be expected that American Indian and Alaska Native Village systems would have high per-households needs because most of these systems are small, serving between 25 and 3,300 people. Small systems lack the economies of scale that

> The majority of American Indian systems, 762 of 781, are small systems serving between 25 and 3,300 people. The remaining 19 systems are of medium size serving between 3,300 and 50,000 people. A similar breakdown in size applies to the Alaska Native Village systems: 172 systems are small and 2 systems are of medium size.

Exhibit 9: Total American Indian and Alaska Native Village Water System Need by Category of Need (in millions of January 1999 dollars)



Does not include the costs associated with proposed or recently promulgated SDWA regulations.

Indian Health Services

Workers install a section of water main on the Navajo reservation in Arizona. Many American Indian systems have disproportionately high distribution needs relative to their size, because they serve widely dispersed homes in remote locations.

reduce the per-household needs of larger systems.[1]

However, American Indian and Alaska Native Village systems have substantially higher needs than the small systems in the State portion of the survey. For American Indian systems, the widely dispersed and remote location of many communities and the limited availability of water resources are among the logistical challenges that account for these high per-household needs. Alaska Native Village water systems face higher costs due to their remote arctic locations and the unique design and construction standards required in permafrost conditions.

The isolation of many American Indian communities and Alaska Native Villages makes it infeasible to obtain water from neighboring water systems. In less remote areas, water systems often find that consolidation with other systems can reduce or eliminate the needs associated with treatment and source development. Also, a group of homes lacking safe drinking water can connect to a nearby system without the expense of laying miles of pipe or creating a new water system. These options are not available to remote American Indian communities and Alaska Native Villages.

The problem of delivering safe water in these communities is compounded by their poor economic condition. According to the 1990 census, approximately 32 percent of American Indians and Alaska Natives live below the poverty line, compared to the national average of 13 percent. Also, the median household income of American Indians and Alaska Natives is just 66 percent of the national average. These communities, therefore, often lack the internal financial resources to invest in water infrastructure.

The Indian Health Service (IHS) estimates that approximately 20,000 households in American Indian communities and Alaska Native Villages lack potable water supplies. Some of these households must haul their drinking water from community watering points. In the course of being transported and stored, sometimes in unsanitary conditions, hauled water is vulnerable to microbial contamination. For example, in arctic areas of Alaska, the common practice of hauling buckets of human waste along the same walkways used for hauling drinking water poses significant public health risks. Households without access to a watering point must obtain their water from alternative supplies, such as untreated surface sources that are subject to contamination from waterborne bacteria, viruses, and protozoa.

Irrespective of where these households obtain their water, a lack of running water tends to limit hand-washing and bathing. Consequently, these households face an increased risk from such communicable diseases as Hepatitis A, shigellosis, and Impetigo.

Although the risk of waterborne and water-related diseases remains an important public health concern, the occurrence of these diseases has declined in many American Indian communities and Alaska Native Villages. The construction of water systems and waste disposal facilities was a critical factor in this decrease. The challenge many American Indian commu-

[1] For more discussion, see the earlier section, "Economic Challenges of Small Water Systems."

nities and Alaska Native Villages now face is the lack of financial and technical resources necessary to operate and maintain these new water systems. The survey found that a disproportionately large number of these treatment facilities required replacement rather than rehabilitation. Without adequate operation and maintenance, water systems will cease to provide safe drinking water well before the end of their design life. Thus, in many American Indian communities and Alaska Native Villages, new water systems often deteriorate to an extent that premature replacement of the facilities is required.

Exhibit 10: Total 20-Year Need by Category for American Indian Water Systems (in millions of January 1999 dollars)

Categories of Need	Current Need	Future Need	Total Need
Distribution and Transmission	$691.6	$51.8	**$743.4**
Treatment	$157.2	$22.1	**$179.3**
Storage	$106.3	$31.1	**$137.4**
Source	$64.9	$15.2	**$80.1**
Other	$11.6	$0	**$11.6**
Total Need	**$1,031.5**	**$120.3**	**$1,151.8**

Note: Numbers may not total due to rounding.
Does not include the costs associated with proposed SDWA regulations.

American Indian Water System Needs

The total 20-year need for American Indian systems is $1.2 billion. Of this total, approximately $1.0 billion is needed now to provide safe drinking water. Exhibit 10 presents the total need by category for American Indian systems.

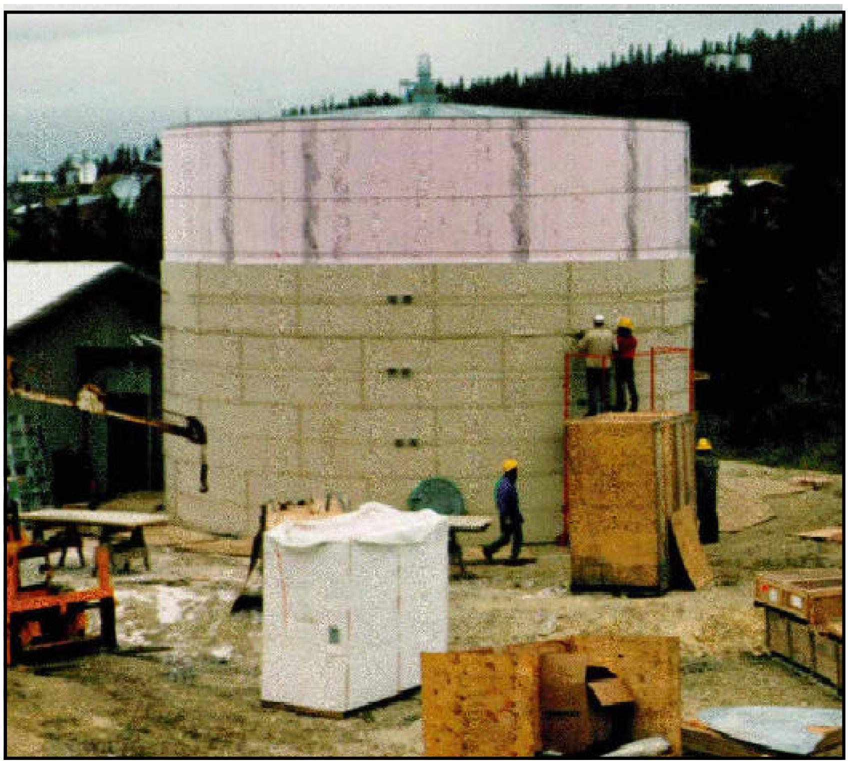
Transmission and distribution projects account for 65 percent of the total American Indian need, a finding which reflects the long lengths of main often needed to transport water from a source to a treatment facility and from the facility to remote users. The cost of extending service to each home may be prohibitive in some communities given the distances involved. In these circumstances, more affordable options include drilling private wells to serve individual homes and constructing treated water stations from which water can be hauled and stored under sanitary conditions.

Treatment represents the second largest category of need at $179 million. Although some American Indian systems have surface water treatment facilities, many systems are located in dry regions where ground water is the only available source. The fact that approximately 93 percent of American Indian systems rely on ground water also reflects their small size, since most small systems in the country use ground water sources. The treatment needs of American Indian systems therefore are typical of ground water systems–with disinfection being the most common form of treatment.

Many American Indian systems are located in arid areas where the aesthetic quality of the ground water is poor. The survey estimates that $26 million is needed for projects to remove secondary contaminants that impart an unpleasant taste, odor, or color to the water.

Of the remaining categories of need, $137 million is needed to install or rehabilitate water storage tanks. Another $80 million is needed to develop and maintain adequate sources of water–a significant challenge for many American Indian systems due to the scarcity of water resources. Representing $12 million in

Indian Health Service



A storage tank under construction in White Mountain, Alaska, is encased in insulation to prevent water in the system from freezing. Constructing water systems to withstand extreme weather conditions is one reason Alaska Native Village systems have high per-household needs.

needs, the "other" category comprises the remaining 1 percent of the total need. This category includes projects for installing emergency power generators and upgrading facilities to protect against floods and earthquakes.

Regulatory Need for American Indian Systems. Infrastructure needed for compliance with existing SDWA regulations comprise 5 percent, or $57 million, of the total 20-year American Indian need. The regulatory need category includes projects which are necessary to attain or maintain compliance with a maximum contaminant level (MCL) or treatment technique requirement. Approximately 98 percent of these projects involve the upgrade, replacement, or installation of treatment technologies required for compliance with the Surface Water Treatment Rule. Less than 2 percent of the regulatory need is for compliance with the Total Coliform Rule. The remainder is for compliance with the Lead and Copper Rule.

Alaska Native Village Water System Needs

The total 20-year need for Alaska Native Village systems is $1.1 billion. Of this total, approximately $1.0 billion is needed now to ensure the continued provision of safe drinking water. Exhibit 11 shows the total Alaska Native Village need by category. The Alaska Native Village need contributes a disproportionately large share to the total national need on a per-household basis.

The main reason for this high per-household need is that Alaska Native Village systems must contend with significantly higher transportation and construction costs. For communities located on the coast or near navigable rivers, equipment often must be transported by barge during the summer months. In the absence of navigable waterways or roads, communities must rely on helicopters or airplanes to transport equipment.

Another factor contributing to the high per-household need is the unique construction standards required to accommodate arctic conditions. For example, storage tanks, treatment facilities, and other water system components must be placed on large gravel beds or support structures, called pilings, to prevent the transfer of heat from a water system component to the permafrost. Without these measures, the underlying permafrost would subside and destabilize the component.

Transmission and distribution projects comprise the largest category of need, representing $485 million, or 45 percent of the total need. Alaska Native Village water systems usually require only a modest amount of pipe to provide service to each residence, given the close proximity of the homes to each other. However, the transmission and distribution of water in many Alaska Native communities requires the use of supplemental infrastructure that is not needed in more temperate climates. In arctic areas, distribution networks consist of insulated, above-ground mains, known as utilidors. To prevent water in the system from freezing, the water in these mains is heated and the distribution network is looped to provide continuous circulation of water throughout the entire system–from the treatment plant and storage tank, to the homes and back to the plant.

Exhibit 11: Total 20-Year Need by Category for Alaska Native Village Water Systems (in millions of Jan. '99 dollars)

Categories of Need	Current Need	Future Need	Total Need
Distribution and Transmission	$481.8	$3.2	**$485.0**
Treatment	$212.0	$16.8	**$228.7**
Storage	$292.5	$17.1	**$309.7**
Source	$34.6	$8.5	**$43.1**
Other	$0.8	$0	**$0.8**
Total Need	**$1,021.7**	**$45.5**	**$1,067.2**

Note: Numbers may not total due to rounding.
Does not include the costs associated with proposed SDWA regulations.

With $310 million needed over the next 20 years, water storage projects represent the second largest category of need. Storage facilities in arctic systems require heavy insulation and the continuous circulation and heating of water to prevent freezing. In addition, the formation of ice renders many surface water sources inaccessible for most of the year. Consequently, many surface water systems must treat and store an entire year's supply of water within 8 to 12 weeks during the summer. These systems require treatment plant and storage capacities that greatly exceed what would normally be necessary for similarly sized systems in the lower 48 States.

Treatment comprises 21 percent of the need for a cost of $229 million. Although ground water systems are not subject to the seasonal limitations which require the over-sizing of facilities, the quality of the water often is poor. High levels of iron and manganese require these systems to install expensive treatment facilities to improve the taste and color of the water.

The total 20-year need for source projects is $43 million. Most of these projects are for drilling or rehabilitating wells. Alaska Native Village systems also included projects to install or upgrade surface water intake structures.

Regulatory Need for Alaska Native Village Systems. For Alaska Native Village systems, all of the projects directly attributable to the existing SDWA are for compliance with the Surface Water Treatment Rule (SWTR). These projects total $108 million, or 47 percent, of the entire Alaska Native Village need for treatment.

Total American Indian and Alaska Native Village Needs Compared to the 1995 Results. The total need for American Indian systems and Alaska Native Village systems increased by $533.8 million and $216.2 million, respectively, compared to the 1995 findings. This increase results largely from refining the methods used to estimate the needs. For the American Indian survey, the sample size was increased to provide a more precise estimate of national need. Similarly, the use of a census for Alaska Native Village systems increased the precision of the need estimate compared to the sampling methods used in the first survey.

Florida Department of Environmental Protection

The wells serving the city of Hollywood, Florida, had severe microbiological contamination which fouled the membrane treatment system. In addition, the combined output of the wells could not meet demand and the distribution system routinely failed to reach minimum pressure standards. With a $13 million DWSRF loan, the city drilled 12 new wells and added 1.5 miles of raw water lines.

HOUSEHOLDS NOT SERVED BY PUBLIC WATER SYSTEMS

EPA estimates that approximately 16 million households obtain their drinking water from sources other than public water systems. Of these households, nearly 15 million are served by private drilled or dug wells, while 1 million use untreated surface water such as lakes, rivers, and springs. The adequacy of these supplies in terms of quality and quantity cannot be comprehensively assessed on a national or even individual State level due to a lack of data. This owes largely to the fact that most private supplies are not subject to the same rigorous federal or state monitoring requirements as public water systems.

In addition, an unknown number of people live in homes without running water. This population faces an increased risk of waterborne diseases and related illnesses, because a safe supply of running water is essential to basic sanitation.

Needs Included in the Survey. For households without access to safe drinking water, two DWSRF-eligible options are available for addressing the problem. An existing public water system can extend service to these households or a new public water system can be constructed to provide drinking water.

Although systems had the opportunity to identify these DWSRF-eligible needs, the survey likely underestimates the true needs for households without access to safe drinking water. The lack of comprehensive data on the water quality at private wells obscures the extent of the problem for many water systems and States. Thus, respondents may have overlooked these needs for lack of public health data. Also, in responding to the survey, most water systems concentrated their efforts on identifying projects for their current, rather than potential, customers. Therefore, the survey estimate of $6.0 billion to extend service to homes without safe drinking water understates the true need.

Private Wells. A lack of monitoring data prevents a comprehensive assessment of the quality of water supplied by private wells. Although EPA believes that most of the households served by private wells likely receive safe drinking water, several studies have found that contamination rates in some areas are very high.

New York State Department of Health

Pipe is installed to provide safe drinking water to homes in Rensselaer County, New York, that had previously used untreated water from a transmission line. The DWSRF contributed $4.9 million in funding assistance to this project.

- Based on data from six states, a 1997 General Accounting Office study reported bacterial and nitrate contamination as high as 42 and 18 percent, respectively, of the private wells tested.[1]

- A 1995 Centers for Disease Control and Prevention report found that total coliform bacteria exceeded the health-based standard in 46, 37, and 23 percent of the private wells tested in Illinois, Nebraska, and Wisconsin, respectively. The study also detected nitrate concentrations above the standard in 15, 15, and 7 percent of the wells sampled in these states, respectively.[2]

- Although data on pesticides, heavy metals, and volatile organic compounds are extremely limited, one study found that lead exceeded 15 ppb (an action level for public water systems) in 19 percent of the wells tested in Pennsylvania.[3]

U.S. EPA

The proximity of this small ground water system to a gasoline station provides an example of a poorly sited well. Spills or leakage from underground gasoline storage tanks could contaminate the ground water. Wells such as this one should be replaced by new wells that are drilled away from potential sources of contamination or, alternatively, the source of contamination should be eliminated.

Improper siting and construction is one of the main causes of contamination in older private wells. Because of land availability constraints, a lack of understanding of health implications, and a desire to minimize cost, some older private wells are located too close to septic systems or other potential sources of contamination. The length of the well casing also influences the susceptibility of wells to microbial contamination, with the probability of contamination increasing as casing length decreases.[4] Although all States now have well construction standards, an unknown number of private wells were constructed before these standards were established.

Hauled Water and Untreated Surface Water Sources. More than 1 million households obtain water directly from cisterns, springs, rivers, and lakes. Drinking water from untreated surface sources is often stored in barrels or cisterns which are susceptible to microbiological contamination. Census data show that 2 percent of American Indian households on federally recognized Tribal lands and 20 percent of mainland Alaska Native Village households obtain their water from untreated surface sources.

[1] *Well, Well, Well Water.* 1997. Environmental Health Perspectives 105(12):1290-1292.

[2] Center for Disease Control and Prevention, et.al. *A Survey of the Presence of Contaminants in Water in Private Wells in Nine Midwestern States*. Report in Draft.

[3] Swistock, B.R., W.E. Sharpe, and P.D. Robillard. *A Survey of Lead, Nitrate and Radon Contamination of Private Individual Water Systems in Pennsylvania*. 1993. Journal of Environmental Health 55(5):6-12.

[4] Tuthill A., D.B. Meikle, M. C.R. Alavanja. 1998. *Coliform Bacteria and Nitrate Contamination of Wells in Major Soils of Frederick, Maryland*. Journal of Environmental Health 60(8):16-20.

***Colonias* and Washeterias.** A significant number of consumers commonly use untreated sources of water or water hauled from unsanitary sources in areas called *colonias* along the Texas-Mexico border and in Alaska Native communities.

Texas Water Development Board

The City of El Paso, Texas, received a $15 million loan from the Texas DWSRF program to expand the capacity of the Jonathan Rogers Treatment Plant. This project will provide water to colonias *that lack access to safe drinking water.*

Colonias—Nearly 400,000 people live in communities, known as *colonias*, which extend along the border with Mexico. These communities have the largest concentration of people living without basic services in the nation. Most *colonias* do not have a safe supply of running water. Therefore, people must haul water from central watering points or untreated sources such as irrigation canals. The lack of water service to homes in *colonias* tends to limit hand-washing and bathing. Consequently, these households face an increased risk from communicable diseases including Hepatitis A, shigellosis, and Impetigo.

The Needs Survey includes the capital needs of *colonias* only to the extent that States have identified the water systems serving these communities. The survey likely underestimates the needs of *colonias*, as most States have yet to locate all of these systems for inclusion in their inventory.

Washeterias Serving Alaska Native Communities—Approximately 30,000 Alaskans, or 30 percent of the population, live in rural communities without adequate water and sewer facilities. The only drinking water available to many Alaska Natives is from the community washeteria, particularly during cold weather when snow and ice make alternative sources of water inaccessible. A washeteria is a single building with showers, toilets, and washing machines. The washeteria often doubles as a water treatment plant with heated water storage. Residents haul drinking water, usually by walking along a boardwalk, from a watering point at the washeteria. In most cases, the access boardwalk is also used to haul sewage to disposal sites. As sewage spills are not uncommon, there is a high risk of contaminating the drinking water. Other sources of water include rain, melting snow, rivers, lakes, individual wells, and individual storage tanks. In addition, container vehicles are used to transport water to, and sewage from, these communities.

Kimberlie Staheli, Bennett Staheli, Engineers

Workers retrieve a tunnel boring machine (TBM) used to excavate an underground passage for a transmission line. TBMs allow water systems to bore through rock at rates faster than conventional drilling and blasting methods. By avoiding the need to tear up streets and set underground explosives, TBMs also minimize traffic disruption and noise for the surrounding areas.

APPENDIX A— METHODS: SAMPLING AND COST MODELING

The sampling methods for the 1999 Needs Survey were developed by a workgroup consisting of State, American Indian, Alaska Native Village, Indian Health Service (IHS), and U.S. Environmental Protection Agency (EPA) representatives. In addition to designing the methods, the State, American Indian, and Alaska Native Village representatives played critical roles in implementing the survey. The workgroup met four times to develop the survey methods.

The workgroup based the approach for the 1999 survey on the methods used in 1995, with refinements from the lessons learned in conducting the 1995 survey, findings of a follow-up study that EPA performed in 1997, and options made available by technological advances in database management and the Internet. Different data collection methods were used to account for the strengths and resource constraints of the different sized systems in the survey. Systems were organized into three size categories: Large (serving more than 50,000 people), medium (serving 3,301 - 50,000 people), and small (serving 3,300 and fewer people). Exhibit A-1 shows the data collection method used, sample size, target precision levels, and response rate for each size category.

Methods for Estimating State Needs

Inventory Verification. To ensure that the survey accounted for all community and not-for-profit noncommunity water systems in the States, the universe of water systems (from which the samples were drawn) was obtained from the Safe Drinking Water Information System (SDWIS). SDWIS is EPA's centralized database for information on public water systems. It is an ideal choice for determining the inventory, because it is designed to identify all public water systems. States verified information on population served, water sources, and other important variables for their systems. In some

Exhibit A-1: Community Water Systems Sampling for the 1999 Needs Survey

	Small Systems	Medium Systems		Large Systems
Population Served	3,300 or fewer	3,301 - 50,000		more than 50,000
Data Collection Method	Site Visits	Questionnaire		Questionnaire
Sample Size	599	2,556 $\leq$ 40,000	225 > 40,000[1]	886[1]
Response Rates	98 Percent	96 Percent	100 Percent	100 Percent
Precision Target	95%±10% Precision Nationally	95%±10% Precision by State		

[1] Systems sampled with certainty (census).

cases, EPA reviewed State files to verify the number of systems in a State.

Stratification. The sample design for the survey was based on the concept of stratified random sampling. Stratification made the design more efficient by enabling it to meet precision targets with a smaller sample size than if the sample were not stratified. These efficiencies are achieved if the design accounts for the fact that some water systems, as a group, will have different needs than other water systems. For example, large water systems generally require much greater investments than do small systems.

Water systems were stratified using two source (surface and ground) and several population groups. Results from the 1995 survey indicated that systems purchasing treated water have needs more similar to ground water systems than systems using and treating surface water sources. Therefore, systems that solely purchase water were included in the ground water strata. Also, in assigning a system to a size category, the survey included the population served by other utilities which purchase water from the system. Systems that sell water must design their infrastructure, particularly treatment facilities, to serve the purchasing system populations.

Estimating Needs for Large and Medium Community Water Systems. The 1999 survey included all of the nation's 1,111 systems serving more than 40,000 people. The needs associated with these systems contributed directly to each State's total need. A random sample of medium-sized systems serving between 3,300 and 40,000 people was selected in each State. The survey sampled 2,556 community water systems out of the national inventory of 7,759 medium-sized community water systems. This sample allowed for a high level of precision in estimating the needs of medium-sized systems for each State. Because these medium-sized systems were included in a sample, and not a census, their needs were extrapolated to the remainder of the systems (i.e., those not sampled) in each State.

The 3,667 medium and large systems in the survey received a mailed questionnaire package. Systems were asked to identify capital projects needed to protect the public health for current customers and for households without access to safe drinking water. The questionnaire prompted systems to provide:

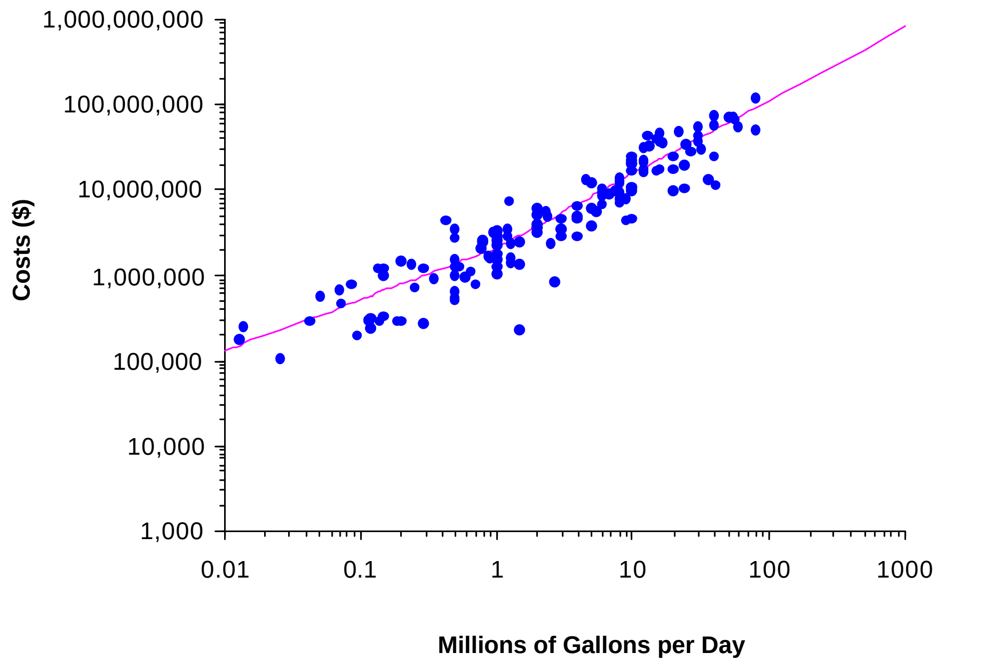
- A description of the infrastructure need.
- Documentation explaining why the project is needed.
- An indication whether the project is a current or future need.
- An indication whether the project involves installing new or rehabilitating existing infrastructure.
- An indication whether the project is triggered by a SDWA regulation.
- A cost estimate, if available.
- Documentation of cost, if available.
- Design capacities of projects with or without costs for cost modeling.

Systems returned the completed questionnaires to the States for review, along with the supporting need and cost documentation. The States reviewed each questionnaire to ensure that systems thoroughly identified their needs and that all projects were documented and described correctly. The States had the option of providing supplemental information, if documentation of need or cost was inadequate. In many instances the States contacted the systems to obtain additional information. The States then forwarded the questionnaires to EPA for final review. Once EPA's review was completed the questionnaires were entered into a database. This database was made available on the Internet to provide States with a final opportunity to review their systems' data.

This review process differed from the procedures used in 1995. Although some States were involved in data collection for the 1995 survey, EPA assumed primary responsibility for reviewing needs and, whenever necessary, contacting systems to obtain further documentation. The greater involvement of the States–with their familiarity with the systems–accounts in part for the larger number of projects received for the 1999 survey.

Some of the medium and large drinking water systems provided capital improvement plans or engineering reports to document the costs of their infrastructure projects. However, approximately 42,920 of the 65,430 projects lacked cost estimates. EPA used models to assign costs to these projects. Cost models were developed from documented cost estimates provided by the systems in the survey. For a limited number of infrastructure needs, the cost data collected were insufficient to develop a cost model. For these projects additional project cost information was obtained from the States, Indian Health Service, manufacturers, EPA Economic Analyses, and engineering firms. All costs were converted to January 1999 dollars.

Exhibit A-2: Cost Curve for New Conventional Filtration Plant



For example, a cost model would have been used if a system lacked cost documentation for rehabilitating a conventional filtration treatment plant that no longer met performance standards. If the system provided the design capacity of the plant on the questionnaire, EPA would have applied the specific cost model for rehabilitating this type of plant. Exhibit A-2 provides an example of a cost curve used to apply costs to a new conventional treatment plant project.

Estimating Needs for Small Community Water Systems. The Needs Survey workgroup agreed that small systems generally lack the planning documents and available personnel to complete a mailed questionnaire. Therefore, needs data were collected through site visits. Site visits were conducted by water system specialists who had extensive experience working with small systems and who received training in the project eligibility and documentation criteria established for the survey. In most cases, State personnel also attended the site visits. Based on the results of the site visit, EPA completed the survey questionnaire and developed documentation for each project. The questionnaires were reviewed by EPA and entered into a database. The database was made available for the States to review on the Internet. Most small systems lacked documented cost estimates. Therefore, the models were used to assign costs to the majority of their needs.

Unlike the medium and large systems, the design for small systems is driven by a budgetary constraint— there were not sufficient funds to complete the approximately 22,000 site visits necessary to accurately estimate the needs of small systems on a State-by-State level. Also the large investment required to generate State-level estimates of need would not be justified, given that medium and large systems generally comprise most of the States' needs. Therefore, the survey used a national sample for systems serving 3,300 and fewer people. The needs of small systems in the national sample were extrapolated to calculate the total national small system need. This need then was apportioned among the States based on the number of small systems in each stratum in each State.

Estimating Needs for Not-for-profit Noncommunity Water Systems. There are approximately 21,400 not-for-profit noncommunity water systems (NPNCWSs) nationwide. For the 1999 survey, EPA conducted site visits to a sample of approximately 100 NPNCWSs. This sample was not stratified into size and source categories, because EPA lacked the empirical data necessary to develop strata. Also, stratification would increase the sample size. The added costs of visiting more systems were not justified, because the needs of NPNCWSs were expected to represent a small proportion of the total national need. Data collection and cost modeling were completed using the same methods applied to small community water systems.

Precision Targets. The survey was designed to provide a high level of precision for each State's estimate of need. Because medium and large systems usually represent the majority of a State's need, the survey established a precision target of 95 percent ± 10 percent for the combined needs of these systems. This means that, for each State, there is a 95 percent likelihood that the true need lies within 10 percent of the survey's estimated need for medium and large systems. For example, if the survey estimates that a State's total medium and large system need is $2.0 billion, then the actual need for these systems is probably between $1.8 and $2.2 billion (that is, 10 percent of the estimated need).

The survey design provided a national level estimate of small community water system needs with a precision target of 95 percent ± 10 percent. A precision target of 95 percent ± 30 percent was established for the NPNCWSs.

Estimating the Needs of American Indian and Alaska Native Village Water Systems

American Indian Water Systems. The 1999 survey estimated the infrastructure needs of medium-sized American Indian water systems using a census. Each of the 19 community water systems serving more than 3,300 people completed a questionnaire. EPA offered technical

Exhibit A-3: American Indian and Alaska Native Village System Sampling for the 1999 Needs Survey

	American Indian Small Systems	American Indian Medium Systems	Alaska Native Systems
Population Served	3,300 or fewer	3,301 - 50,000	All populations
Data Collection Method	Site Visits	Questionnaire	Questionnaire
Sample Size	78	19	174
Response Rates	100 Percent	100 Percent	100 Percent
Precision Target	95%±10% Precision Nationally	Systems Sampled With Certainty (Census)	

assistance to help these systems identify eligible needs and prepare documentation. In addition, drinking water projects from IHS's Sanitation Deficiency System (SDS) were pre-printed on each questionnaire. The SDS was not designed to capture the full extent of the needs allowable for the survey, so these data served as a baseline to which systems added projects. For example, SDS contains only current needs, while the survey asks for current and future needs. The systems returned the completed questionnaire and documentation to EPA for final review.

A sample of 78 small American Indian systems was randomly selected. Site visits were conducted by drinking water system specialists who had extensive experience working with small systems, had received special Needs Survey training, and had previous experience with American Indian water systems. In some cases, IHS and Tribal officials attended the site visits. EPA was responsible for completing the questionnaire and documenting needs and costs.

Alaska Native Village Water Systems. Current and future needs of Alaska Native Village water systems were identified through a census of water systems that serve predominantly Alaska Natives. The inventory consisted of 2 medium systems and 172 small systems. A list of projects needed for each small system was developed by EPA in consultation with Village representatives, Village Safe Water, IHS, and State officials. Site visits to 5 Alaska Native Village water systems were performed to confirm the need assessments.

Needs for the two medium Alaska Native Village water systems were obtained through phone interviews with the systems. Based on the responses from the water systems, EPA prepared the questionnaires and documentation.

Using cost models developed with data from systems in the State and American Indian portions of the survey would not reflect the unique construction challenges that face Alaska Native Villages. For example, in some areas, water tanks and treatment plants need to be elevated on pilings to prevent the heated facilities from subsiding into the permafrost. Therefore, a roundtable meeting of IHS and EPA engineers was held to provide guidelines for determining project costs. In assigning costs to projects, water systems were grouped into three geographic areas roughly corresponding to the northern, central, and southern parts of the State. These areas coincided roughly with the different factors that influence project costs, such as the means used to transport equipment. This process omitted water systems located on the North Slope, because they had prepared master plans and capital improvement plans that documented the costs of all of their needs. IHS provided cost documentation for projects constructed in Alaska Native Villages throughout the State. These costs were used to estimate the average costs of projects in each geographic area. Costs for some projects were derived from the cost models developed for the State and American Indian systems. The models were used to assign costs to small-scale projects (e.g., flushing hydrants) for which IHS costs were unavailable.

U.S. EPA

Precision Targets. Because all of the Alaska Native Village and medium-sized American Indian water systems were included in the survey, the needs of these systems were calculated with certainty. The estimates of need for small American Indian water systems have a national precision level of 95 percent ± 10 percent.

Estimating Costs for Proposed and Recently Promulgated Regulations

A portion of the needs collected in the survey are attributable directly to SDWA regulations. Systems were able to identify projects needed for compliance with existing regulations. However, most systems had not yet identified the infrastructure needed to comply with proposed and recently promulgated regulations. Consequently, the costs of these regulations were based on the Economic Analysis (EAs) that EPA published when proposing or finalizing each regulation. The survey did not cover the costs of regulations that were proposed after July 1, 2000.

The costs associated with future and recently promulgated regulations are included only in the total national need, not in each State's need. In general, an EA assigns the cost of complying with a new regulation on the basis of a system's size and water source. The use of EAs to allocate these costs to each State is problematic, given that the cost of a regulation is not necessarily a direct function of the number of systems in each size and source category. For example, the cost of complying with a new regulation will vary significantly from State-to-State if the contaminant occurs mostly in specific regions of the country. Allocating costs based solely on the inventory of systems would fail to capture this variation.

Dan Fraser

Filtration plants consist of a series of treatment stages, each of which is critical to the production of safe water. Shown is a filter bed that is clogged with mud and treatment chemicals. The clarifier that should have removed these particulates in the preceding stage is in poor condition and needs to be replaced.

APPENDIX B—SUMMARY OF FINDINGS

Needs for Water Systems in the States
(community water systems and not-for-profit noncommunity water systems)

Exhibit B-1—Total Need by Category

Exhibit B-2—Current Need by Category

Exhibit B-3—Total Need by System Size

Exhibit B-4—Current Regulatory Need

Exhibit B-5—Total Regulatory Need

Needs for American Indian and Alaska Native Village Water Systems

Exhibit B-6—Total Need for American Indian and Alaska Native Village Systems by EPA Region

Exhibit B-7—Total Need by Category for American Indian and Alaska Native Village Water Systems

Exhibit B-8—Total Regulatory Need for American Indian and Alaska Native Village Water Systems

Needs Attributable to Future Drinking Water Regulations

Exhibit B-9—Total Proposed or Recently Promulgated Regulatory Need

Exhibits B-1- B-8 do not include the costs associated with proposed or recently promulgated SDWA regulations.

Exhibit B-1: Total Need by Category (20-year need in millions of January 1999 dollars)

State	Transmission and Distribution	Treatment	Storage	Source	Other	Total
Alabama	622.1	186.1	175.7	91.7	5.3	**1,080.9**
Alaska	345.4	105.0	101.6	31.5	1.7	**585.2**
Arizona	781.9	434.8	244.7	130.6	30.4	**1,622.4**
Arkansas	834.1	287.6	238.9	141.6	31.8	**1,534.0**
California	10,709.3	2,354.1	2,393.8	1,565.7	466.2	**17,489.1**
Colorado	1,285.8	642.8	304.2	246.0	51.6	**2,530.4**
Connecticut	569.1	234.4	128.6	59.0	15.7	**1,006.7**
Delaware	130.4	107.2	33.5	31.8	1.1	**304.0**
District of Columbia	388.4	0.0	25.6	0.0	0.0	**414.1**
Florida	1,766.2	1,043.9	366.3	500.5	47.4	**3,724.3**
Georgia	1,438.7	463.4	308.3	165.9	30.2	**2,406.4**
Hawaii	89.3	17.7	23.0	14.6	2.0	**146.7**
Idaho	261.0	90.4	107.1	53.3	4.1	**515.9**
Illinois	3,392.2	1,459.7	850.6	358.6	88.4	**6,149.5**
Indiana	890.8	379.7	295.1	114.3	13.7	**1,693.5**
Iowa	1,990.3	407.1	282.5	148.9	17.8	**2,846.6**
Kansas	782.0	487.7	226.8	122.2	27.2	**1,645.9**
Kentucky	1,185.1	319.7	182.5	70.5	11.5	**1,769.3**
Louisiana	690.2	231.4	224.0	106.9	20.4	**1,272.8**
Maine	283.2	82.5	96.4	30.9	5.5	**498.6**
Maryland	986.2	357.5	195.5	101.7	30.2	**1,671.0**
Massachusetts	3,907.2	1,323.4	463.1	168.6	14.1	**5,876.4**
Michigan	4,545.6	1,330.3	601.8	268.6	42.1	**6,788.4**
Minnesota	1,346.9	994.4	453.1	247.0	58.1	**3,099.4**
Mississippi	697.0	317.3	228.4	108.1	10.0	**1,360.7**
Missouri	1,342.6	362.0	308.2	154.2	12.8	**2,179.8**
Montana	483.0	186.0	130.1	69.2	3.6	**871.9**
Nebraska	448.1	219.8	96.9	62.0	5.3	**832.0**
Nevada	351.2	42.0	135.5	30.0	43.8	**602.4**
New Hampshire	233.3	105.5	108.0	49.4	3.3	**499.4**
New Jersey	2,593.7	425.6	425.6	183.0	31.0	**3,658.9**
New Mexico	526.9	246.8	114.0	128.9	25.3	**1,042.0**
New York	8,590.8	2,852.7	994.3	674.4	43.1	**13,155.3**
North Carolina	1,402.9	551.3	504.2	218.4	30.3	**2,707.1**
North Dakota	274.2	90.5	71.2	49.3	4.6	**489.9**
Ohio	2,585.7	1,022.9	798.8	401.0	150.5	**4,959.0**
Oklahoma	1,480.3	486.6	262.4	101.1	10.4	**2,340.8**
Oregon	1,442.4	575.7	470.5	183.5	36.9	**2,709.1**
Pennsylvania	3,148.3	939.9	800.2	313.5	56.2	**5,258.2**
Puerto Rico	1,040.5	612.5	229.0	52.8	37.0	**1,971.8**
Rhode Island	396.1	110.8	43.1	22.3	4.8	**577.1**
South Carolina	376.1	258.6	132.2	47.0	6.7	**820.5**
South Dakota	216.5	111.3	67.6	39.5	4.9	**439.7**
Tennessee	686.7	414.3	252.2	49.0	8.0	**1,410.1**
Texas	7,935.5	2,625.6	1,524.3	811.9	170.0	**13,067.3**
Utah	256.5	123.1	88.6	43.2	2.4	**513.9**
Vermont	175.1	48.5	59.8	20.7	2.9	**306.9**
Virginia	1,023.9	518.9	282.1	189.9	40.6	**2,055.4**
Washington	2,368.4	504.7	684.6	341.2	48.4	**3,947.4**
West Virginia	572.5	222.9	158.6	59.8	6.2	**1,020.0**
Wisconsin	1,634.7	723.9	496.6	224.2	18.6	**3,098.0**
Wyoming	233.3	127.1	48.7	30.7	2.4	**442.2**
Subtotal	**81,737.8**	**28,167.2**	**17,838.6**	**9,428.6**	**1,836.3**	**139,008.5**
American Samoa	18.5	7.4	7.0	2.7	0.7	**36.4**
Guam	75.6	1.7	9.9	22.9	4.7	**114.7**
North Mariana Is.	25.7	21.0	14.8	10.9	2.5	**74.8**
Virgin Islands	68.3	32.5	48.4	11.3	1.1	**161.7**
Subtotal	**188.1**	**62.6**	**80.2**	**47.8**	**8.9**	**387.5**
Total	**81,925.8**	**28,229.9**	**17,918.8**	**9,476.4**	**1,845.1**	**139,396.1**

Exhibit B-2: Current Need by Category (20-year need in millions of January 1999 dollars)

State	Transmission and Distribution	Treatment	Storage	Source	Other	Total
Alabama	434.4	108.4	101.3	28.2	4.9	**677.2**
Alaska	169.2	36.3	46.4	19.1	1.5	**272.5**
Arizona	591.7	321.7	112.1	68.9	28.9	**1,123.3**
Arkansas	593.0	164.2	130.2	97.3	29.5	**1,014.2**
California	9,207.7	1,773.1	1,517.2	1,144.1	430.1	**14,072.3**
Colorado	882.0	449.6	141.6	168.1	50.9	**1,692.1**
Connecticut	493.0	161.2	52.7	23.8	4.4	**735.1**
Delaware	73.5	95.1	17.2	23.6	0.9	**210.4**
District of Columbia	388.4	0.0	25.6	0.0	0.0	**414.1**
Florida	1,454.6	756.7	178.4	310.1	37.1	**2,736.9**
Georgia	1,041.3	270.8	143.1	105.5	22.4	**1,583.1**
Hawaii	80.2	9.8	13.3	10.5	2.0	**115.8**
Idaho	186.8	42.9	45.8	32.7	3.4	**311.5**
Illinois	2,582.6	1,076.4	440.9	218.7	73.5	**4,392.1**
Indiana	716.7	214.9	135.9	61.9	11.5	**1,140.8**
Iowa	1,843.4	265.1	149.6	86.8	11.3	**2,356.2**
Kansas	638.7	367.3	130.8	86.3	26.4	**1,249.4**
Kentucky	919.3	275.1	117.8	54.4	9.6	**1,376.2**
Louisiana	546.6	130.2	114.9	58.0	7.3	**857.0**
Maine	237.6	37.1	41.1	15.7	4.8	**336.2**
Maryland	877.2	286.1	100.9	71.5	29.2	**1,365.0**
Massachusetts	3,615.0	1,062.3	377.0	88.1	10.4	**5,152.8**
Michigan	2,367.8	802.5	327.5	143.7	33.4	**3,674.9**
Minnesota	875.3	468.4	208.2	133.7	32.4	**1,718.1**
Mississippi	605.3	200.2	109.6	58.4	8.2	**981.8**
Missouri	1,107.6	194.7	156.5	102.4	10.8	**1,572.1**
Montana	369.3	84.1	66.4	32.0	3.1	**554.8**
Nebraska	343.4	144.9	45.9	33.9	4.2	**572.2**
Nevada	281.6	18.6	70.7	17.4	43.3	**431.6**
New Hampshire	194.6	40.4	44.8	23.9	2.7	**306.5**
New Jersey	1,781.0	317.1	158.2	88.5	23.2	**2,368.0**
New Mexico	455.6	71.5	43.1	52.8	24.9	**648.0**
New York	6,925.3	2,481.8	665.8	412.1	33.3	**10,518.2**
North Carolina	1,040.4	336.2	220.5	129.6	23.9	**1,750.5**
North Dakota	162.6	37.1	31.6	32.4	3.0	**266.6**
Ohio	2,235.9	704.3	443.3	259.4	73.6	**3,716.4**
Oklahoma	1,162.7	268.5	118.5	49.8	7.7	**1,607.3**
Oregon	1,347.4	470.0	369.2	130.1	35.0	**2,351.6**
Pennsylvania	2,347.4	550.0	360.1	188.2	36.4	**3,482.1**
Puerto Rico	1,013.5	585.6	206.0	45.8	36.8	**1,887.6**
Rhode Island	263.4	100.0	18.1	15.9	4.1	**401.4**
South Carolina	298.0	146.0	54.4	30.2	4.4	**532.9**
South Dakota	163.6	70.0	36.6	18.8	4.1	**293.1**
Tennessee	503.6	211.2	157.0	29.5	7.0	**908.2**
Texas	6,029.6	1,469.8	766.2	442.7	152.1	**8,860.5**
Utah	192.3	66.5	53.0	27.1	1.9	**341.0**
Vermont	156.5	28.1	36.4	11.2	2.6	**234.8**
Virginia	609.8	362.5	137.5	59.5	32.7	**1,202.1**
Washington	2,105.8	272.8	356.4	170.5	45.1	**2,950.5**
West Virginia	500.8	134.4	95.2	35.4	5.3	**771.0**
Wisconsin	1,047.5	359.5	190.2	117.2	10.4	**1,724.8**
Wyoming	207.0	64.8	28.9	17.5	2.3	**320.5**
Subtotal	**64,267.5**	**18,965.9**	**9,709.4**	**5,682.7**	**1,507.6**	**100,133.2**
American Samoa	17.9	6.7	6.9	2.6	0.6	**34.7**
Guam	72.2	1.4	7.9	21.0	1.3	**103.7**
North Mariana Is.	24.0	10.8	14.7	10.8	1.4	**61.7**
Virgin Islands	63.8	21.7	30.8	10.5	1.1	**127.8**
Subtotal	**177.8**	**40.5**	**60.3**	**44.9**	**4.3**	**327.9**
Total	**64,445.4**	**19,006.4**	**9,769.7**	**5,727.6**	**1,511.9**	**100,461.0**

Exhibit B-3: Total Need by System Size (20-year need in millions of January 1999 dollars)

State	Large CWSs	Medium CWSs	Small CWSs	NPNCWSs	Total
Alabama	120.9	549.7	407.3	2.9	**1,080.9**
Alaska	31.9	317.6	189.2	46.5	**585.2**
Arizona	712.2	471.8	424.3	14.1	**1,622.4**
Arkansas	391.3	638.6	498.5	5.6	**1,534.0**
California	12,310.8	2,896.7	2,204.4	77.2	**17,489.1**
Colorado	1,109.2	917.5	502.8	1.0	**2,530.4**
Connecticut	547.0	215.0	223.8	20.9	**1,006.7**
Delaware	158.4	25.2	117.9	2.5	**304.0**
District of Columbia	414.1	0.0	0.0	0.0	**414.1**
Florida	2,163.1	553.7	910.2	97.2	**3,724.3**
Georgia	984.9	654.7	756.4	10.5	**2,406.4**
Hawaii	18.1	28.2	99.6	0.8	**146.7**
Idaho	37.9	88.2	361.0	28.7	**515.9**
Illinois	2,020.8	2,738.6	1,306.2	83.9	**6,149.5**
Indiana	237.7	722.6	599.0	134.3	**1,693.5**
Iowa	336.2	1,800.3	696.2	14.0	**2,846.6**
Kansas	507.3	513.6	622.4	2.6	**1,645.9**
Kentucky	312.3	1,100.5	355.7	0.8	**1,769.3**
Louisiana	234.2	291.5	735.8	11.4	**1,272.8**
Maine	28.4	194.1	249.8	26.2	**498.6**
Maryland	1,116.6	226.5	253.2	74.8	**1,671.0**
Massachusetts	2,628.4	2,998.8	224.1	25.1	**5,876.4**
Michigan	3,647.1	1,919.3	862.4	359.6	**6,788.4**
Minnesota	730.7	1,498.5	665.9	204.3	**3,099.4**
Mississippi	157.3	337.5	858.6	7.3	**1,360.7**
Missouri	623.5	645.1	881.4	29.8	**2,179.8**
Montana	125.1	340.3	368.0	38.6	**871.9**
Nebraska	226.7	261.7	331.5	12.2	**832.0**
Nevada	377.2	57.6	156.8	10.8	**602.4**
New Hampshire	44.9	90.3	317.1	47.1	**499.4**
New Jersey	1,721.7	1,464.0	318.2	155.0	**3,658.9**
New Mexico	433.2	270.8	326.2	11.7	**1,042.0**
New York	9,305.0	2,015.4	1,739.0	96.1	**13,155.3**
North Carolina	600.2	916.9	908.5	281.5	**2,707.1**
North Dakota	120.1	164.0	201.7	4.1	**489.9**
Ohio	1,689.9	2,096.7	957.5	214.9	**4,959.0**
Oklahoma	810.7	792.2	721.0	17.0	**2,340.8**
Oregon	907.5	1,198.2	561.1	42.3	**2,709.1**
Pennsylvania	1,722.1	1,946.5	1,375.0	214.5	**5,258.2**
Puerto Rico	1,110.6	479.9	380.4	0.9	**1,971.8**
Rhode Island	352.9	180.5	31.5	12.3	**577.1**
South Carolina	297.9	197.3	313.0	12.3	**820.5**
South Dakota	55.4	136.2	244.2	3.9	**439.7**
Tennessee	106.8	939.2	342.2	21.9	**1,410.1**
Texas	6,684.2	3,691.7	2,655.1	36.3	**13,067.3**
Utah	196.0	45.4	262.7	9.9	**513.9**
Vermont	0.0	82.7	224.1	0.1	**306.9**
Virginia	846.0	508.8	630.8	69.8	**2,055.4**
Washington	1,401.1	1,201.3	1,256.5	88.4	**3,947.4**
West Virginia	96.0	337.5	549.7	36.7	**1,020.0**
Wisconsin	878.4	1,159.5	692.0	368.1	**3,098.0**
Wyoming	80.7	234.7	117.6	9.3	**442.2**
Subtotal	**61,770.7**	**43,153.1**	**30,987.2**	**3,097.6**	**139,008.5**
American Samoa	0.0	19.3	17.1	0.0	**36.4**
Guam	57.2	50.9	6.5	0.0	**114.7**
North Mariana Is.	18.2	33.7	22.9	0.0	**74.8**
Virgin Islands	0.0	40.7	121.0	0.0	**161.7**
Subtotal	**75.4**	**144.6**	**167.5**	**0.0**	**387.5**
Total	**61,846.1**	**43,297.7**	**31,154.7**	**3,097.6**	**139,396.1**

Exhibit B-4: Current Regulatory Need (20-year need in millions of January 1999 dollars)

State	SWTR	TCR	Nitrate/ Nitrite	Lead and Copper Rule	TTHMs	Other*	Total
Alabama	62.2	9.2	0.0	2.4	0.0	1.9	**75.8**
Alaska	32.6	0.5	0.1	0.5	0.0	0.2	**33.9**
Arizona	270.6	0.1	5.3	1.4	0.0	0.8	**278.3**
Arkansas	104.5	0.3	0.1	3.1	0.0	1.7	**109.6**
California	1,320.2	4.5	32.5	12.0	0.0	33.5	**1,402.8**
Colorado	428.1	0.0	4.9	8.5	0.0	0.8	**442.3**
Connecticut	148.5	0.2	0.2	0.7	0.0	0.3	**149.8**
Delaware	70.7	0.0	0.1	0.3	0.0	0.2	**71.3**
District of Columbia	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Florida	181.0	1.2	0.4	2.9	30.2	4.2	**219.9**
Georgia	180.0	1.5	0.4	6.5	0.0	1.3	**189.7**
Hawaii	3.0	0.0	0.0	0.6	0.0	0.4	**3.9**
Idaho	26.7	0.3	0.2	1.2	0.0	0.4	**28.9**
Illinois	664.7	41.8	61.3	35.2	0.0	27.2	**830.3**
Indiana	59.3	1.4	0.2	21.0	0.0	4.9	**86.7**
Iowa	114.5	228.6	67.5	3.2	0.8	70.1	**484.7**
Kansas	262.7	0.0	4.4	4.5	0.0	3.5	**275.1**
Kentucky	229.0	3.5	0.0	16.7	0.9	1.1	**251.2**
Louisiana	64.7	0.1	0.2	3.5	0.0	5.5	**74.1**
Maine	24.6	0.3	0.1	1.7	0.0	0.4	**27.1**
Maryland	250.3	0.8	0.1	1.0	0.0	0.5	**252.7**
Massachusetts	1,057.0	0.3	0.1	18.0	0.0	0.6	**1,076.0**
Michigan	549.5	5.5	2.5	213.5	2.8	10.5	**784.3**
Minnesota	60.3	2.2	0.2	47.8	0.0	55.9	**166.5**
Mississippi	71.2	1.0	0.1	3.6	2.0	3.5	**81.5**
Missouri	131.2	0.3	0.3	4.0	0.0	2.3	**138.2**
Montana	54.5	0.4	0.3	1.7	0.0	0.4	**57.3**
Nebraska	114.2	0.1	2.9	10.7	0.0	6.9	**134.9**
Nevada	5.4	0.1	0.1	0.6	0.0	0.4	**6.6**
New Hampshire	23.7	0.5	0.2	1.3	0.0	0.4	**26.1**
New Jersey	237.2	5.9	0.1	92.0	0.0	25.7	**360.9**
New Mexico	32.8	0.1	0.2	1.2	0.0	1.7	**36.1**
New York	2,491.1	3.9	0.8	177.4	0.0	11.1	**2,684.3**
North Carolina	221.3	2.9	0.6	3.2	0.0	1.5	**229.4**
North Dakota	38.8	0.0	0.1	1.9	0.0	0.5	**41.3**
Ohio	453.6	2.2	0.3	26.7	0.0	2.9	**485.7**
Oklahoma	231.2	0.2	2.5	15.8	0.0	1.7	**251.3**
Oregon	425.1	0.4	0.3	4.4	0.0	0.8	**430.9**
Pennsylvania	495.6	2.2	0.6	65.3	0.0	2.9	**566.6**
Puerto Rico	601.4	0.0	0.0	3.2	0.0	0.4	**605.1**
Rhode Island	92.2	0.7	0.0	6.5	0.0	0.1	**99.4**
South Carolina	126.1	1.0	0.1	1.5	0.0	0.8	**129.5**
South Dakota	11.0	0.0	0.1	0.9	0.0	0.5	**12.6**
Tennessee	179.1	0.2	0.0	3.0	0.0	1.1	**183.4**
Texas	1,184.3	9.5	0.9	13.1	0.7	15.8	**1,224.2**
Utah	52.1	0.1	0.1	1.2	0.0	0.7	**54.2**
Vermont	20.2	0.0	0.1	1.3	0.0	0.2	**21.9**
Virginia	315.7	1.3	0.4	7.3	0.0	0.8	**325.4**
Washington	195.0	15.8	0.9	5.5	0.0	2.4	**219.6**
West Virginia	102.7	0.4	0.1	5.1	0.0	1.2	**109.5**
Wisconsin	157.4	4.1	3.7	171.1	1.7	118.0	**456.1**
Wyoming	58.5	0.1	0.1	3.7	0.0	0.2	**62.6**
Subtotal	**14,287.4**	**356.1**	**197.1**	**1,039.1**	**39.1**	**430.8**	**16,349.7**
American Samoa	3.9	0.9	0.0	0.0	0.0	0.0	**4.9**
Guam	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
North Mariana Is.	3.0	0.1	0.0	0.0	0.0	0.0	**3.1**
Virgin Islands	38.8	0.0	0.0	0.4	0.0	0.0	**39.2**
Subtotal	**45.8**	**1.0**	**0.0**	**0.4**	**0.0**	**0.0**	**47.3**
Total	**14,333.3**	**357.1**	**197.1**	**1,039.5**	**39.1**	**430.8**	**16,396.9**

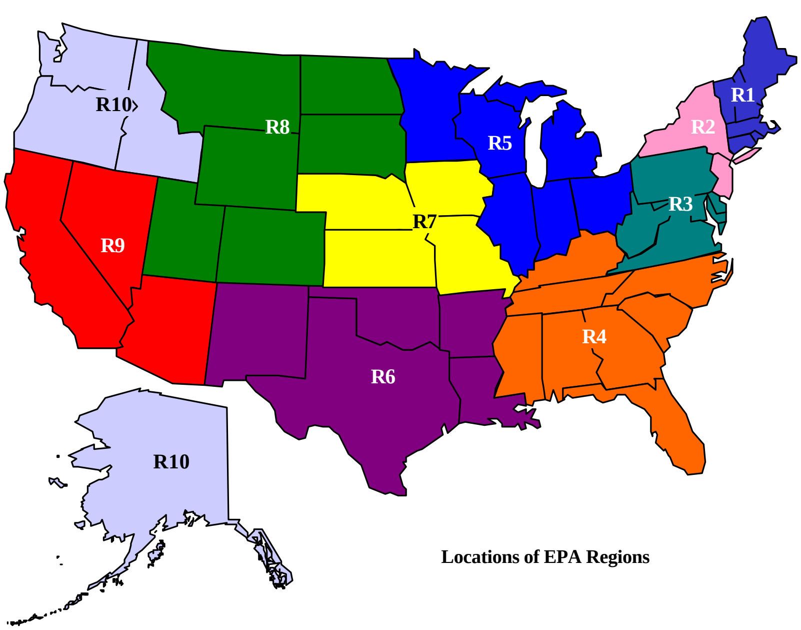
Exhibit B-5: Total Regulatory Need (20-year need in millions of January 1999 dollars)

State	SWTR	TCR	Nitrate/ Nitrite	Lead and Copper Rule	TTHMs	Other*	Total
Alabama	110.4	9.3	0.0	2.4	0.0	1.9	**124.1**
Alaska	164.0	0.9	0.1	0.5	59.0	0.2	**224.7**
Arizona	328.7	0.8	5.4	1.4	0.0	0.8	**337.1**
Arkansas	143.0	5.2	0.1	3.1	0.0	1.7	**153.1**
California	1,672.1	8.1	35.6	12.2	0.9	35.7	**1,764.5**
Colorado	615.0	0.6	6.8	9.1	0.0	2.7	**634.3**
Connecticut	196.3	1.8	0.2	0.7	0.0	0.3	**199.2**
Delaware	70.7	0.3	0.1	0.3	0.0	0.2	**71.6**
District of Columbia	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
Florida	262.8	2.5	0.4	3.0	30.2	4.2	**303.1**
Georgia	314.3	2.8	0.4	6.5	0.0	1.3	**325.3**
Hawaii	3.8	0.1	0.0	0.6	0.0	0.4	**4.8**
Idaho	40.7	1.0	0.2	1.3	0.0	0.4	**43.6**
Illinois	833.9	53.5	61.3	38.3	0.0	28.3	**1,015.4**
Indiana	109.5	1.9	0.2	21.0	0.0	4.9	**137.4**
Iowa	174.9	229.4	67.5	3.3	0.8	70.2	**546.0**
Kansas	308.7	0.6	4.4	4.5	0.0	6.2	**324.5**
Kentucky	260.9	3.6	0.0	17.0	0.9	1.1	**283.5**
Louisiana	96.4	0.8	0.2	3.6	0.6	5.5	**107.2**
Maine	49.2	0.6	0.1	1.7	0.0	0.4	**52.1**
Maryland	285.3	1.2	0.1	1.0	0.0	0.5	**288.2**
Massachusetts	1,208.5	49.0	0.1	18.0	0.0	2.3	**1,277.8**
Michigan	813.5	6.6	2.5	256.6	2.8	10.5	**1,092.4**
Minnesota	325.0	4.9	0.2	136.4	0.0	108.8	**575.3**
Mississippi	71.7	1.9	0.1	3.7	2.0	3.5	**82.9**
Missouri	164.9	1.6	0.3	4.1	0.0	2.3	**173.2**
Montana	119.2	1.2	0.3	1.7	0.0	0.4	**122.7**
Nebraska	114.8	0.6	2.9	32.0	0.0	6.9	**157.2**
Nevada	14.7	0.3	0.1	0.6	0.0	0.4	**16.1**
New Hampshire	40.4	1.2	0.2	1.3	0.0	1.2	**44.4**
New Jersey	255.3	6.3	0.1	92.0	0.0	25.7	**379.4**
New Mexico	176.7	0.7	0.2	1.3	0.0	1.7	**180.6**
New York	2,571.2	6.4	8.2	180.9	0.0	28.3	**2,794.9**
North Carolina	306.1	4.7	0.6	3.2	0.0	1.5	**316.1**
North Dakota	65.8	0.3	0.1	1.9	0.0	0.5	**68.6**
Ohio	653.5	3.2	19.2	26.8	0.0	2.9	**705.6**
Oklahoma	361.3	0.8	2.5	15.8	0.0	1.7	**382.2**
Oregon	473.4	1.3	0.3	4.4	0.0	0.8	**480.1**
Pennsylvania	741.4	4.1	0.6	81.3	0.0	3.0	**830.5**
Puerto Rico	618.1	0.2	0.0	3.2	0.0	0.4	**621.9**
Rhode Island	98.5	0.8	0.0	6.5	0.0	0.1	**105.8**
South Carolina	209.6	1.4	0.1	1.5	0.0	0.8	**213.4**
South Dakota	31.3	0.4	0.1	0.9	0.0	0.5	**33.2**
Tennessee	285.4	0.4	0.0	3.0	0.0	1.1	**289.9**
Texas	2,047.3	12.1	0.9	13.2	0.7	15.8	**2,089.9**
Utah	87.3	0.4	0.1	1.2	0.0	0.7	**89.8**
Vermont	24.8	0.4	0.1	1.3	0.0	0.2	**26.8**
Virginia	396.4	2.4	0.4	10.6	0.0	0.8	**410.5**
Washington	250.8	19.7	0.9	5.6	0.0	2.4	**279.3**
West Virginia	157.1	0.8	0.1	5.1	0.0	1.2	**164.4**
Wisconsin	309.2	9.9	4.3	176.8	1.7	122.4	**624.4**
Wyoming	111.1	0.3	0.1	3.7	0.0	0.2	**115.4**
Subtotal	**19,145.1**	**468.9**	**229.0**	**1,225.6**	**99.7**	**516.2**	**21,684.5**
American Samoa	4.0	0.9	0.0	0.0	0.0	0.0	**5.0**
Guam	0.0	0.0	0.0	0.0	0.0	0.0	**0.0**
North Mariana Is.	3.0	0.1	0.0	0.0	0.0	0.0	**3.1**
Virgin Islands	49.7	0.0	0.0	0.4	0.0	0.0	**50.1**
Subtotal	**56.8**	**1.0**	**0.0**	**0.4**	**0.0**	**0.0**	**58.2**
Total	**19,201.9**	**469.9**	**229.0**	**1,226.0**	**99.7**	**516.2**	**21,742.7**

Exhibit B-6: Total Need for American Indian and Alaska Native Village Systems by EPA Region (20-year need in millions of January 1999 dollars)

Category of Need	Total Need
Region 1	3.9
Region 2	6.0
Region 3[1]	0.0
Region 4	17.8
Region 5	157.3
Region 6	151.9
Region 7	14.3
Region 8	133.4
Region 9[2]	548.9
Region 10[3]	118.3
Alaska Native Systems	1,067.2
Total	**2,219.0**

[1] There are no American Indian water systems in EPA Region 3.
[2] Navajo water systems are located in EPA Regions 6, 8, and 9, but for purposes of this report, all Navajo needs are shown in EPA Region 9.
[3] Needs for Alaska Native Village water systems are not included in the EPA Region 10 total.



Locations of EPA Regions

Exhibit B-7: Need by Category for American Indian and Alaska Native Village Water Systems (20-year need in millions of January 1999 dollars)

Category of Need	Current Needs	Future Needs	Total Need
Transmission and Distribution	1,173.4	55.0	**1,228.4**
Treatment	369.2	38.9	**408.1**
Storage	398.8	48.2	**447.0**
Source	99.5	23.7	**123.2**
Other	12.4	0.0	**12.4**
Total	**2,053.2**	**165.8**	**2,219.0**

Exhibit B-8: Total Regulatory Need for American Indian and Alaska Native Village Water Systems (20-year need in millions of January 1999 dollars)

Category of Need	Current Needs	Future Needs	Total Need
Regulations for Contaminants with Acute Health Effects	159.8	4.7	**164.5**
Regulations for Contaminants with Chronic Health Effects	0.1	0.0	**0.1**
Total	**160.0**	**4.7**	**164.6**

Exhibit B-9: Total Proposed and Recently Promulgated Regulatory Need (20-year need in millions of January 1999 dollars)

Category of Need	Range of Costs		Estimate Included in the 1999 Needs Survey
	Low Estimate	High Estimate	
Stage 1 Disinfection/Disinfectants Byproduct Rule			2,354.7
Interim Enhanced Surface Water Treatment Rule			1,248.6
Long-Term 1 Enhanced Surface Water Treatment Rule			176.1
Filter Backwash Recycling Rule			143.9
Ground Water Rule	854.1	1,048.7	1,048.7
Arsenic Rule			877.1
Radon Rule	132.0	5,282.6	2,537.1
Radionuclides Rule	81.9	938.2	938.2
Total			**9,324.3**

In calculating the $9.3 billion need associated with proposed or recently promulgated regulations, the survey used EPA's lead option, unless one was not available in which case the survey used the more conservative estimate. These estimates include only the capital costs (i.e., exclude operation and maintenance costs).

Florida Department of Environmental Protection

The City of Port Orange, Florida, received $9.1 million in DWSRF assistance to upgrade and expand its ground water treatment facility. Shown is an aerial view of the project site (left) and the construction of a new lime softening tank (insert).

APPENDIX C—SUMMARY OF FINDINGS FOR SYSTEMS SERVING 10,000 AND FEWER PEOPLE

Needs for Water Systems in the States
(community water systems)

Exhibit C-1—Total Current and Future Need for Systems Serving 10,000 and Fewer People

Exhibits C-1 does not include the costs associated with proposed or recently promulgated SDWA regulations.

Exhibit C-1: Need for Systems Serving 10,000 and Fewer People (20-year need in millions of January 1999 dollars)

State	CWSs Serving 10,000 and Fewer People			CWS Need (All Sizes)	Percent of Need for CWSs Serving 10,000 and Fewer People
	Current Need	Future Need	Total Need	Total Need	
Alabama	448.7	225.5	**674.2**	1,078.0	**62.5%**
Alaska	198.7	258.0	**456.7**	538.7	**84.8%**
Arizona	386.1	199.4	**585.6**	1,608.3	**36.4%**
Arkansas	567.2	287.6	**854.8**	1,528.5	**55.9%**
California	2,183.2	839.3	**3,022.5**	17,411.9	**17.4%**
Colorado	550.5	258.8	**809.3**	2,529.4	**32.0%**
Connecticut	165.1	96.3	**261.4**	985.8	**26.5%**
Delaware	80.7	38.3	**119.0**	301.6	**39.5%**
District of Columbia	0.0	0.0	**0.0**	414.1	**0.0%**
Florida	867.8	291.3	**1,159.1**	3,627.1	**32.0%**
Georgia	702.1	334.2	**1,036.3**	2,395.9	**43.3%**
Hawaii	94.0	29.7	**123.7**	145.9	**84.8%**
Idaho	276.1	134.9	**411.0**	487.2	**84.4%**
Illinois	1,699.0	764.8	**2,463.8**	6,065.7	**40.6%**
Indiana	784.7	300.7	**1,085.4**	1,559.3	**69.6%**
Iowa	743.2	341.0	**1,084.2**	2,832.6	**38.3%**
Kansas	575.5	226.1	**801.7**	1,643.2	**48.8%**
Kentucky	582.0	233.3	**815.2**	1,768.5	**46.1%**
Louisiana	640.2	251.3	**891.5**	1,261.5	**70.7%**
Maine	212.9	82.7	**295.6**	472.3	**62.6%**
Maryland	218.9	104.5	**323.4**	1,596.2	**20.3%**
Massachusetts	670.1	126.5	**796.7**	5,851.3	**13.6%**
Michigan	1,180.6	536.7	**1,717.3**	6,428.8	**26.7%**
Minnesota	783.4	398.6	**1,182.0**	2,895.1	**40.8%**
Mississippi	738.9	312.7	**1,051.6**	1,353.4	**77.7%**
Missouri	827.1	401.2	**1,228.2**	2,150.0	**57.1%**
Montana	337.5	150.8	**488.2**	833.3	**58.6%**
Nebraska	299.5	154.3	**453.8**	819.9	**55.3%**
Nevada	124.9	55.6	**180.4**	591.6	**30.5%**
New Hampshire	234.0	114.7	**348.7**	452.3	**77.1%**
New Jersey	500.2	358.9	**859.2**	3,503.9	**24.5%**
New Mexico	430.5	131.7	**562.3**	1,030.3	**54.6%**
New York	1,655.7	746.9	**2,402.6**	13,059.3	**18.4%**
North Carolina	997.9	406.5	**1,404.4**	2,425.6	**57.9%**
North Dakota	160.0	132.7	**292.7**	485.8	**60.2%**
Ohio	1,280.7	382.4	**1,663.2**	4,744.1	**35.1%**
Oklahoma	955.1	310.7	**1,265.8**	2,323.8	**54.5%**
Oregon	698.2	230.9	**929.0**	2,666.8	**34.8%**
Pennsylvania	1,619.3	673.9	**2,293.2**	5,043.6	**45.5%**
Puerto Rico	367.6	82.9	**450.5**	1,970.9	**22.9%**
Rhode Island	38.7	24.7	**63.3**	564.8	**11.2%**
South Carolina	245.8	139.1	**384.8**	808.2	**47.6%**
South Dakota	186.4	90.7	**277.1**	435.8	**63.6%**
Tennessee	583.2	245.0	**828.2**	1,388.2	**59.7%**
Texas	2,911.4	1,406.3	**4,317.7**	13,031.0	**33.1%**
Utah	198.8	87.8	**286.6**	504.0	**56.9%**
Vermont	221.0	72.0	**293.1**	306.8	**95.5%**
Virginia	542.3	253.2	**795.5**	1,985.6	**40.1%**
Washington	971.8	530.1	**1,501.9**	3,859.0	**38.9%**
West Virginia	606.2	172.7	**778.9**	983.3	**79.2%**
Wisconsin	788.6	424.2	**1,212.8**	2,729.9	**44.4%**
Wyoming	171.9	104.9	**276.8**	432.9	**63.9%**
Subtotal	**33,303.9**	**14,557.3**	**47,861.2**	**135,910.9**	**35.2%**
American Samoa	15.3	1.7	**17.1**	36.4	**46.9%**
Guam	26.7	2.3	**29.0**	114.7	**25.2%**
North Mariana Is.	25.3	12.6	**37.9**	74.8	**50.7%**
Virgin Islands	105.1	16.7	**121.8**	161.7	**75.3%**
Subtotal	**172.4**	**33.3**	**205.7**	**387.5**	**53.1%**
Total	**33,476.2**	**14,590.6**	**48,066.8**	**136,298.5**	**35.3%**

U.S. EPA

This 1,000-gallon storage tank is mounted on top of a stone structure to provide a pressure gradient.

APPENDIX D—SEPARATE STATE ESTIMATES

In response to the Needs Survey workgroup's request, EPA gave States the opportunity to prepare separate estimates of needs which were not included in the survey because they are ineligible for DWSRF funding. EPA also invited the submission of needs that the States felt were underestimated by the survey. Four States responded:

- Arizona stated that between $28.2 million and $ 49.3 million in infrastructure improvements would be needed for compliance with the new Arsenic Rule.

- Kentucky submitted costs, totaling $74 million, for projects to create two new regional water systems. These systems would provide new sources of water, and new treatment and distribution systems for areas facing chronic water shortages and deteriorated infrastructure. The State provided this estimate after the close of the data collection period. Therefore, these projects may include needs already addressed by other systems in the State's sample. To avoid the possibility of double-counting this estimate is presented separately.

- Nevada estimated that a capital cost of $400 million would be required to bring the State's water systems into compliance with the new Arsenic Rule.

- Washington estimated that Seattle's water system would require approximately $51 million in DWSRF-ineligible investments to comply with the Endangered Species Act, such as constructing fish ladders at dams.

Saint Joseph's College, Standish, Maine

Sebago Lake, in Maine, provides water to Portland and surrounding communities.

APPENDIX E—GLOSSARY

Acute health effects: health effects resulting from exposure to a contaminant that causes severe symptoms to occur quickly—often within a matter of hours or days. Examples include gastrointestinal illness and “blue baby syndrome.”

Capital improvement plan (CIP): a document produced by a local government, utility, or water system that thoroughly outlines, for a specified period of time, all needed capital projects, the reason for each project, and their costs.

Chronic health effects: health effects resulting from long-term exposure to low concentrations of certain contaminants. Cancer is one such health effect.

Coliform bacteria: a group of bacteria whose presence in a water sample indicates the water may contain disease-causing organisms.

Community water system: a public water system that serves at least 15 connections used by year-round residents or that regularly serves at least 25 residents year-round. Examples include cities, towns, and communities such as retirement homes.

Current infrastructure needs: new facilities or deficiencies in existing facilities identified by the State or system for which water systems would begin construction as soon as possible to avoid a threat to public health.

Engineer’s report: a document produced by a professional engineer that outlines the need and cost for a specific infrastructure project.

Existing regulations: drinking water regulations promulgated under the authority of the Safe Drinking Water Act by EPA; existing regulations can be found in the Code of Federal Regulations (CFR) at 40 CFR 141.

Finished water: water that is considered safe and suitable for delivery to customers.

Future infrastructure needs: infrastructure deficiencies that a system expects to address in the next 20 years due to predictable deterioration of facilities. Future infrastructure needs do not include current infrastructure needs. Examples are storage facility and treatment plant replacement where the facility currently performs adequately, but will reach the end of its useful life in the next 20 years. Needs solely to accommodate future growth are not included in the Needs Survey.

Ground water: any water obtained from a source beneath the surface of the ground which has not been classified as ground water under the direct influence of surface water.

Growth: needs planned solely to accommodate projected future growth are not included in the survey. Eligible projects, however, can be designed for growth expected during the design-life of the project. For example, the survey would allow a treatment plant needed now and expected to treat water for 20 years. Such a plant could be designed for the population anticipated to be served at the end of the 20-year period.

Infrastructure needs: the capital costs associated with ensuring the continued protection of public health through rehabilitating or building facilities needed for continued provision of safe drinking water. Categories of need include source development and rehabilitation, treatment, storage, and transmission and distribution. Operation and maintenance needs are not considered infrastructure needs and are not included in this document.

Large water system: in this document, this phrase refers to a community water system serving more than 50,000 people.

Medium water system: in this document, this phrase refers to a community water system serving from 3,301 to 50,000 people.

Microbiological contamination: the occurrence in a water supply of protozoan, bacteriological, or viral contaminants.

Noncommunity water system: a public water system that is not a community water system and that serves a nonresidential population of at least 25 individuals or 15 service connections daily for at least 60 days of the year. Examples of not-for-profit noncommunity water systems include schools and churches.

Public water system: a system for the provision to the public of water for human consumption through pipes or, after August 5, 1998, other constructed conveyances, if such system has at least 15 service connections or regularly serves an average of at least 25 individuals daily at least 60 days out of the year.

Regulatory need: a capital expenditure required for compliance with regulations.

Safe Drinking Water Act (SDWA): a law passed by Congress in 1974 and amended in 1986 and 1996 to ensure that public water systems provide safe drinking water to consumers. (42 U.S.C.A. §300f to 300j-26)

Small water system: in this document, this phrase refers to a community water system serving 3,300 people or fewer.

Source rehabilitation and development: a category of need that includes the costs involved in developing or improving sources of water for public water systems.

State: in this document, this term refers to all 50 States of the United States, Puerto Rico, the District of Columbia, American Samoa, Guam, the Northern Mariana Islands, and the Virgin Islands.

Storage: a category of need that addresses finished water storage needs faced by public water systems.

Supervisory Control and Data Acquisition (SCADA): an advanced control system that collects all system information for an operator and allows him/her, through user-friendly interfaces, to view all aspects of the system from one place.

Surface water: all water which is open to the atmosphere and subject to surface run-off including streams, rivers, and lakes.

Transmission and distribution: a category of need that includes replacement or rehabilitation of transmission or distribution lines which carry drinking water from the source to the treatment plant or from the treatment plant to the consumer.

Treatment: a category of need that includes conditioning water or removing microbiological and chemical contaminants. Filtration of surface water sources, pH adjustment, softening, and disinfection are examples of treatment.

Watering point: a central source from which people without piped water can draw drinking water for transport to their homes.