

## APPENDIX G

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

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

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

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

<sup>145</sup> *Ibid.*

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

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

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

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

<sup>147</sup> *Ibid.*

**Table G-1. Categorization of Appalachian Drinking Water Systems**

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

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

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

‡ Data from EPA, SDWIS database for 4<sup>th</sup> quarter of fiscal year 2003 frozen in January 2004, downloaded from [www.epa.gov/OGWDW/data/pivottables.html](http://www.epa.gov/OGWDW/data/pivottables.html) and compiled by UNCEFC.

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

the city in which the system was located, or, as a final resort, the city of the contact person listed for the system.

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

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

- Households that did not have a charge for water and sewer in 1999 (records with an entry of 1 for WATER)

Vacant housing units and group quarters were given a missing value for WATER by the Census Bureau in the microdata samples. The UNCEFC research team dropped these records before further analysis.

Using the housing-unit weights, the research team determined the total number and the proportions of housing units not paying for water and sewer services, paying for them directly and paying for them through rent, for all housing units in each of the thirteen Appalachian states as a whole, as well as in their Appalachian and non-Appalachian regions. For housing units paying directly for water and sewer services, the percentage of household income spent on these services in 1999 was calculated by dividing the cost of water and sewer services by the household income. Using the housing-unit weights again, the team determined the mean, the median, the standard deviation, the minimum and maximum cost of and percentage of household income spent on water and sewer services for each PUMA, for the Appalachian and non-Appalachian regions of each state, for each state as a whole, and for the entire Appalachian region.

Finally, the research team assigned households that paid directly for water and sewer services two dichotomous variables according to whether or not they spent more than 2.5 percent and 5 percent of their income on water and sewer services in 1999. The team then calculated the percentages of households that spent more than 2.5 percent and more than 5 percent of their income on water and sewer services for the Appalachian and non-Appalachian regions of each state, for each state as a whole, and for the entire Appalachian region.

The results of the analysis and their implications are discussed in chapter 6.