Prepared in cooperation with the National Water-Quality Assessment Program

Estimates for Self-Supplied Domestic Withdrawals and Population Served for Selected Principal Aquifers, Calendar Year 2005

Open-File Report 2010–1223

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By Molly A. Maupin and Terri L. Arnold

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Open-File Report 2010–1223

**U.S. Department of the Interior
U.S. Geological Survey**

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Foreword

The U.S. Geological Survey (USGS) is committed to providing the Nation with reliable scientific information that helps to enhance and protect the overall quality of life and that facilitates effective management of water, biological, energy, and mineral resources (<http://www.usgs.gov>). Information on the Nation's water resources is critical to ensuring long-term availability of water that is safe for drinking and recreation and is suitable for industry, irrigation, and fish and wildlife. Population growth and increasing demands for water make the availability of that water, now measured in terms of quantity and quality, even more essential to the long-term sustainability of our communities and ecosystems.

The USGS implemented the National Water-Quality Assessment (NAWQA) Program in 1991 to support national, regional, state, and local information needs and decisions related to water-quality management and policy (<http://water.usgs.gov/nawqa>). The NAWQA Program is designed to answer: What is the quality of our Nation's streams and ground water? How are conditions changing over time? How do natural features and human activities affect the quality of streams and ground water, and where are those effects most pronounced? By combining information on water chemistry, physical characteristics, stream habitat, and aquatic life, the NAWQA Program aims to provide science-based insights for current and emerging water issues and priorities. From 1991 to 2001, the NAWQA Program completed interdisciplinary assessments and established a baseline understanding of water-quality conditions in 51 of the Nation's river basins and aquifers, referred to as Study Units (<http://water.usgs.gov/nawqa/studyu.html>).

National and regional assessments are ongoing in the second decade (2001–2012) of the NAWQA Program as 42 of the 51 Study Units are reassessed. These assessments extend the findings in the Study Units by determining status and trends at sites that have been consistently monitored for more than a decade, and filling critical gaps in characterizing the quality of surface water and ground water. For example, increased emphasis has been placed on assessing the quality of source water and finished water associated with many of the Nation's largest community water systems. During the second decade, NAWQA is addressing five national priority topics that build an understanding of how natural features and human activities affect water quality, and establish links between sources of contaminants, the transport of those contaminants through the hydrologic system, and the potential effects of contaminants on humans and aquatic ecosystems. Included are topics on the fate of agricultural chemicals, effects of urbanization on stream ecosystems, bioaccumulation of mercury in stream ecosystems, effects of nutrient enrichment on aquatic ecosystems, and transport of contaminants to public-supply wells. In addition, national syntheses of information on pesticides, volatile organic compounds (VOCs), nutrients, selected trace elements, and aquatic ecology are continuing.

The USGS aims to disseminate credible, timely, and relevant science information to address practical and effective water-resource management and strategies that protect and restore water quality. We hope this NAWQA publication will provide you with insights and information to meet your needs, and will foster increased citizen awareness and involvement in the protection and restoration of our Nation's waters.

The USGS recognizes that a national assessment by a single program cannot address all water-resource issues of interest. External coordination at all levels is critical for cost-effective management, regulation, and conservation of our Nation's water resources. The NAWQA Program, therefore, depends on advice and information from other agencies—Federal, state, regional, interstate, Tribal, and local—as well as nongovernmental organizations, industry, academia, and other stakeholder groups. Your assistance and suggestions are greatly appreciated.

Matthew C. Larsen
Associate Director for Water

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Conversion Factors, and Abbreviations and Acronyms

Conversion Factors

Inch/Pound to SI

	Multiply	By	To obtain
gallon (gal)		3.785	liter (L)
million gallons per day (Mgal/d)		0.04381	cubic meter per second (m ³ /s)

Abbreviations and Acronyms

NWIS	National Water Information System
NAWQA	National Water-Quality Assessment Program
NWUIP	National Water Use Information Program
USGS	U.S. Geological Survey
WSC	Water Science Center

Estimates for Self-Supplied Domestic Withdrawals and Population Served, for Selected Principal Aquifers, Calendar Year 2005

By Molly A. Maupin and Terri L. Arnold

Abstract

The National Water-Quality Assessment Program of the U.S. Geological Survey has groundwater studies that focus on water-quality conditions in principal aquifers of the United States. The Program specifically focuses on aquifers that are important to public supply, domestic, and other major uses. Estimates for self-supplied domestic withdrawals and the population served for 20 aquifers in the United States for calendar year 2005 are provided in this report. These estimates are based on county-level data for self-supplied domestic groundwater withdrawals and the population served by those withdrawals, as compiled by the National Water Use Information Program, for areas within the extent of the 20 aquifers. In 2005, the total groundwater withdrawals for self-supplied domestic use from the 20 aquifers represented about 63 percent of the total self-supplied domestic groundwater withdrawals in the United States; the population served by the withdrawals represented about 61 percent of the total self-supplied domestic population in the United States.

Introduction

The National Water-Quality Assessment (NAWQA) Program of the U.S. Geological Survey (USGS) focuses its groundwater studies on water-quality conditions, including status and trends in principal aquifers of the United States, and specifically those aquifers important to public supply and domestic uses (Lapham and others, 2005; National Water-Quality Assessment Program, 2010) ([fig. 1](#)). NAWQA studies need accurate, current data about the amount of water withdrawn from these aquifers and the size of the Nation's population that relies on them.

The USGS Office of Groundwater identified more than 60 principal regional aquifers in the United States (U.S. Geological Survey, 2003), some of which are major sources of water for drinking-water supplies. Estimates of groundwater withdrawals for three major water uses (public supply, self-supplied industrial, and irrigation) were compiled for each of these principal aquifers using 2000 data (Maupin

and Barber, 2005); however, groundwater withdrawal data for the population served by those withdrawals do not exist for self-supplied domestic use by principal aquifer. Self-supplied domestic withdrawals are derived from private wells for domestic indoor and outdoor use, as compared to public-supply withdrawals, which are derived from public water systems and are used for public, domestic (homes on public-supply systems), commercial, and industrial purposes. This study used 2005 county-level self-supplied domestic groundwater withdrawals and the population served by those withdrawals from the USGS National Water Use Information Program (NWUIP) as the source data to allocate withdrawals and population served to 20 selected principal aquifers ([fig. 1](#)). Some of the principal aquifers were combined for this study; for example, the sand and gravel aquifers north of the limit of Quaternary continental glaciations and east of the Rocky Mountains (hereinafter referred to as Glacial aquifer system) also include aquifers denoted as 'Unconsolidated-deposit aquifers (Alaska)' and 'Puget Sound aquifer system' as shown in the National Atlas (U.S. Geological Survey, 2003).

Groundwater is the primary source of water for self-supplied domestic use. In 2005, groundwater withdrawals for self-supplied domestic use in the United States were an estimated 3,740 Mgal/d (million gallons per day) (Kenny and others, 2009), which comprised 98 percent of the total self-supplied domestic withdrawals in the Nation (2 percent of withdrawals were from surface-water sources). An estimated 42.9 million people in the United States, or 14 percent of the total population, supplied themselves with water obtained from private wells.

Purpose and Scope

This report summarizes estimates of groundwater withdrawals for self-supplied domestic use and the population served by those withdrawals from 20 aquifers in the United States during calendar year 2005 ([fig. 1](#)). This report also explains the different sources of data and the methods that were used to derive the groundwater withdrawals and population served. These data were compiled as part of the NAWQA principal aquifers studies using data from

Figure 1. Location and extent of the principal aquifers for regional assessment as part of the National Water-Quality Assessment Program. Self-supplied domestic groundwater withdrawals and population served data were estimated for 20 of the aquifers shown for calendar year 2005.

the NWUIP's 5-year county dataset for 2005, or other data provided by water-use specialists in USGS Water Science Centers. Data were compiled for 20 aquifers or aquifer groups (some principal aquifers were combined), which represents a subset of the more than 60 principal aquifers as shown on the USGS principal aquifer map of the National Atlas of the United States (U.S. Geological Survey, 2003). The data represent groundwater withdrawals for calendar year 2005 in Mgal/d, and population served, in thousands of people.

Sources of Data and Methods

County groundwater data are compiled by each USGS Water Science Center (WSC) every 5 years as part of the NWUIP. The most recent compilation at the time this study was conducted was for calendar year 2005. Data for counties within the areal extent of the selected aquifers were compiled to create the initial dataset of self-supplied domestic groundwater withdrawals and the population served by those withdrawals (<http://water.usgs.gov/watuse/data/2005/index.html>). Water-use specialists in a few WSCs provided domestic withdrawals and population data by principal aquifer for the states in which they are located. Withdrawals and the population served by those withdrawals, by aquifer, were supplied for Florida, New Jersey, Oklahoma, Vermont, Virginia, and Wisconsin; only withdrawals were provided for Georgia, Illinois, Indiana, Louisiana, Michigan, Missouri, Tennessee, and West Virginia. Withdrawal and population served data for all other states that did not provide data were allocated to the 20 aquifers either using USGS database information regarding the number of domestic wells and aquifer sources in each county, or using maps showing the areal extent of the aquifers.

Data provided directly from WSCs were initially compiled by WSC water-use specialists using methods and techniques that followed guidelines for the 2005 national water-use compilation (Hutson, 2007). Groundwater withdrawals and population data were allocated to the 20 aquifers either as part of the 2005 compilation (Marella, 2009; Tortorelli, 2009), or using methods developed from other studies that focused on similar goals (Pope and others, 2008). All data were checked for consistency and accuracy by WSC water-use specialists.

If withdrawal and population served data were not provided by a WSC, it was interpolated using USGS databases and geographic analysis of the areal extent of the 20 aquifers. Each WSC maintains well information in a database system common to all USGS offices in the United States, the National Water Information System (NWIS). NWIS stores information about wells used for many purposes, but this study specifically focused on domestic wells. Well information in NWIS includes location, depth of well, water use and water levels, and some aquifer information. A retrieval of all domestic wells in NWIS databases for 48 States (excluding Alaska and

Hawaii; also excluding the Territories of Puerto Rico and the Virgin Islands, and the District of Columbia) was conducted in April 2009. Specific information about aquifers was queried to determine which aquifers were supplying water to domestic wells. In total, there were more than 443,300 domestic wells in NWIS databases in the lower 48 States. About 65 percent of the total domestic wells (almost 291,000) had information that identified a principal aquifer. These data were used to construct a county database with the percentage of wells in each county that withdraw water from 1 of the 20 aquifers. The percentage of wells in each county that withdraw water from any of the 20 aquifers was used to allocate withdrawals and population served to those aquifers.

NWIS databases are not an entirely complete or current inventory of all domestic wells in each state. The databases store a compilation of wells that were inventoried as part of projects and studies conducted in each state over time. For example, if groundwater studies in a state focused more intensely on one particular aquifer than another, or on wells in one particular part of a state rather than across all areas, the database will reflect a bias and cannot be expected to reflect a completely accurate representation of all aquifers or all areas of a state. However, lacking any other nationally consistent and readily available sources, the NWIS databases were the best source of information for this study and in many cases, the aquifers or areas of a state that are the focus of studies also are the important sources of drinking water.

A few states did not have domestic well information in NWIS and thus aquifer information regarding which aquifer to allocate withdrawal and population served data was not readily available. This lack of available information does not mean that these counties do not have domestic wells, but does indicate where NWIS had deficient information that would otherwise have been used in this study. Counties lacking domestic well information in NWIS at the time of the retrievals (April 2009) are shown in [figure 2](#). If a county did not have domestic well information in NWIS, then the domestic withdrawals and population served for that county were allocated to any of the 20 aquifers based on the percentage of the county's geographic area that was coincident with the geographic area of the aquifer. A simple area-weighted allocation was used to calculate withdrawals and population served in those areas based on the percentage of area and the county data from NWUIP.

Results

Total self-supplied domestic withdrawals and population served for the 20 aquifers are summarized in [tables 1–3](#). The 20 aquifers represent about 63 percent of the total self-supplied domestic groundwater withdrawals and about 61 percent of the total population served by those withdrawals in the United States for calendar year 2005. The Glacial aquifer system ([table 1](#)) had the largest withdrawals and supplied the

Figure 2. Counties lacking domestic well information in the U.S. Geological Survey National Water Information System (NWIS) database as of April 2009.

most people among all the 20 aquifers. The Glacial aquifer system also supplied the most water to public-supply systems in 2000 (Maupin and Barber, 2005). The four aquifers with the largest withdrawals and the largest population served were the Glacial aquifer system, Piedmont and Blue Ridge crystalline and carbonate-rock aquifers, the Floridan aquifer system and the overlying Surficial aquifer system, and the Northern Atlantic Coastal Plain aquifer system. Combined, these four aquifers accounted for more than 60 percent of the total self-supplied withdrawals and about 66 percent of the total population served from all 20 aquifers. The daily per-capita use rate, in gallons per-capita per day (gpcd) is shown in [table 1](#). These values range from about 312 gpcd for the Central Valley aquifer system, to about 59 gpcd for the Cambrian-Ordovician aquifer system. Generally, the daily per-capita use rate varies in accordance with general climatic regions. Dry and hot regions, such as the Southwest, generally exhibit higher per-capita use rates than cooler, wet regions.

Data for self-supplied domestic withdrawals and population served for the 20 aquifers, by state, are shown in [tables 2](#) and [3](#), respectively. Three aquifers in four states accounted for the largest withdrawals (greater than

100 Mgal/d)—the Glacial aquifer system in Michigan (184 Mgal/d) and Indiana (124 Mgal/d), the Floridan aquifer system combined with the overlying Surficial aquifer system in Florida (168 Mgal/d), and the Central Valley aquifer system in California (136 Mgal/d) ([table 2](#)). More than 1 million people in Florida, Michigan, and Indiana used groundwater from the Floridan and overlying Surficial aquifer systems, or the Glacial aquifer system, respectively ([table 3](#)).

Total withdrawals and total population served, by state for the 20 aquifers, are shown in [tables 2](#) and [3](#), along with the state total withdrawals and population served from the 2005 compilation (Kenny and others, 2009). These data provide a reference point from which to determine the percentage of the entire state's self-supplied domestic use and population served that is accounted for by the 20 aquifers. Self-supplied domestic withdrawals and population served in six states are completely provided by four aquifers as follows: Hawaii is supplied entirely by the Hawaiian volcanic-rock aquifers, Indiana is supplied entirely by the Glacial aquifer system, and Maine, New Hampshire, Rhode Island, and Vermont each are entirely supplied by the Glacial aquifer system and the New England crystalline-rock aquifers.

Table 1. Summary of total self-supplied domestic groundwater withdrawals and total population served for 20 aquifers during calendar year 2005.

[Shading indicates combination of principal aquifer. Glacial aquifer system is aquifer composed of glacial deposits. Figures may not sum to totals because of independent rounding. **Abbreviations:** Mgal/d, million gallons per day; gpcd, gallons per capita per day]

Principal aquifer name	Groundwater withdrawals by principal aquifers (Mgal/d)	Population served (thousands)	Daily per-capita use (gpcd)
Glacial aquifer system	741	8,820	84.0
Piedmont and Blue Ridge carbonate- and crystalline-rock aquifers	360	4,610	78.2
Floridan aquifer system and the overlying Surficial aquifer system	212	1,960	108
Northern Atlantic Coastal Plain aquifer system	140	1,820	76.8
Central Valley aquifer system	136	437	312
Coastal Lowlands aquifer system	112	1,320	84.6
Valley and Ridge aquifers	110	1,540	72.0
Mississippi Embayment-Texas Coastal Uplands aquifer system	100	972	103
Early Mesozoic basin aquifers	80.5	1,150	69.7
Basin and Range basin-fill and carbonate aquifers	63.6	432	147
Edwards-Trinity aquifer system	63.4	552	114
New England crystalline-rock aquifers	48.7	642	75.8
Cambrian-Ordovician aquifer system	41.2	702	58.8
California Coastal Basin aquifers	35.5	310	114
SNAKE River basin-fill and basaltic-rock aquifers	34.0	168	201
Columbia Plateau basin-fill and basaltic-rock aquifers	33.4	258	129
Rio Grande aquifer system	18.0	175	103
Hawaiian volcanic-rock aquifers	12.2	74.0	164
Biscayne aquifer	3.44	36.1	95.2
Denver basin aquifer system	3.22	26.8	120
TOTAL	2,340	26,000	90.3

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Table 2. Estimated self-supplied domestic groundwater withdrawals by state and aquifer for calendar year 2005.

[Withdrawals are in million gallons per day (Mgal/d). Shading indicates combination of principal aquifer. Glacial aquifer system is aquifer composed of glacial deposits. Asterisk (*) next to a state name indicates data provided by water-use specialists at the U.S. Geological Survey Water Science Center. Values for total self-supplied domestic groundwater withdrawals are from Kenny and others (2009). Figures may not sum to totals because of independent rounding]

State	Self-supplied domestic withdrawals, in million gallons per day										
	Basin and Range basin-fill and carbonate aquifers	Biscayne aquifer	California Coastal Basin aquifers	Cambrian-Ordovician aquifer system	Central Valley aquifer system	Coastal Lowlands aquifer system	Columbia Plateau basin-fill and basaltic rock aquifers	Denver basin aquifer system	Early Mesozoic basin aquifers	Edwards-Trinity aquifer system	Floridan aquifer system and overlying Surficial aquifer system
Alabama	0.00	0.00	0.00	0.00	0.00	7.59	0.00	0.00	0.00	0.00	0.00
Alaska	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Arizona	12.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Arkansas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00
California	24.0	0.00	35.5	0.00	136	0.00	0.00	0.00	0.00	0.00	0.00
Colorado	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.22	0.00	0.00	0.00
Connecticut	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.2	0.00	0.00
Delaware	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Florida*	0.00	3.44	0.00	0.00	0.00	1.85	0.00	0.00	0.00	0.00	168
Georgia*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	36.9
Hawaii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Idaho	1.73	0.00	0.00	0.00	0.00	0.00	2.17	0.00	0.00	0.00	0.00
Illinois*	0.00	0.00	0.00	4.19	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Indiana*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iowa	0.00	0.00	0.00	0.50	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kansas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kentucky	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Louisiana*	0.00	0.00	0.00	0.00	0.00	33.8	0.00	0.00	0.00	0.00	0.00
Maine	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maryland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Massachusetts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.03	0.00	0.00
Michigan*	0.00	0.00	0.00	3.24	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Minnesota	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mississippi	0.00	0.00	0.00	0.00	0.00	26.2	0.00	0.00	0.00	0.00	0.00
Missouri*	0.00	0.00	0.00	1.27	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Montana	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nebraska	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nevada	20.5	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
New Hampshire	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
New Jersey*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	17.6	0.00	0.00
New Mexico	0.13	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
New York	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0.00	0.00
North Carolina	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.78	0.00	3.81
North Dakota	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ohio	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oklahoma*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1.39	0.00
Oregon	0.10	0.00	0.00	0.00	0.00	0.00	5.01	0.00	0.00	0.00	0.00
Pennsylvania	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	29.2	0.00	0.00
Rhode Island	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
South Carolina	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.48
South Dakota	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tennessee*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Texas	0.00	0.00	0.00	0.00	0.00	42.6	0.00	0.00	0.00	61.9	0.00
Utah	4.36	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vermont*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Virginia*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.98	0.00	0.00
Washington	0.00	0.00	0.00	0.00	0.00	0.00	26.2	0.00	0.00	0.00	0.00
West Virginia*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wisconsin*	0.00	0.00	0.00	32.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	63.6	3.44	35.5	41.2	136	112	33.4	3.22	80.5	63.4	212

Table 2. Estimated self-supplied domestic groundwater withdrawals by state and aquifer for calendar year 2005.—Continued

[Withdrawals are in million gallons per day (Mgal/d). Shading indicates combination of principal aquifer. Glacial aquifer system is aquifer composed of glacial deposits. Asterisk (*) next to a state name indicates data provided by water-use specialists at the U.S. Geological Survey Water Science Center. Values for total self-supplied domestic groundwater withdrawals are from Kenny and others (2009). Figures may not sum to totals because of independent rounding]

Self-supplied domestic withdrawals, in million gallons per day											
State	Glacial aquifer system	Hawaiian volcanic- rock aquifers	Mississippi Embayment- Texas Coastal Uplands aquifer system	New England crystalline- rock aquifers	Northern Atlantic Coastal Plain aquifer system	Piedmont and Blue Ridge carbonate and crystalline- rock aquifers	Rio Grande aquifer system	Snake River basin-fill and basaltic-rock aquifers	Valley and Ridge aquifers	State total for 20 aquifers	Total self- supplied domestic groundwater withdrawals
Alabama	0.00	0.00	0.53	0.00	0.00	11.5	0.00	0.00	8.08	27.7	39.1
Alaska	10.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	10.4	13.4
Arizona	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.8	27.2
Arkansas	0.00	0.00	2.70	0.00	0.00	0.00	0.00	0.00	0.00	2.70	17.8
California	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	196	429
Colorado	0.00	0.00	0.00	0.00	0.00	0.00	1.27	0.00	0.00	1.27	34.4
Connecticut	14.2	0.00	0.00	28.3	0.00	0.00	0.00	0.00	0.00	59.8	63.1
Delaware	0.00	0.00	0.00	0.00	4.86	0.67	0.00	0.00	0.00	5.53	6.43
Florida*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	174	190
Georgia*	0.00	0.00	0.00	0.00	0.00	61.2	0.00	0.00	6.16	104	120
Hawaii	0.00	12.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.2	12.2
Idaho	2.82	0.00	0.00	0.00	0.00	0.00	0.00	33.9	0.00	40.6	86.6
Illinois*	72.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	76.8	101
Indiana*	124	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	124	124
Iowa	7.17	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	7.17	34.6
Kansas	0.71	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.71	14.9
Kentucky	0.97	0.00	0.99	0.00	0.00	0.00	0.00	0.00	0.00	1.96	22.2
Louisiana*	0.00	0.00	7.50	0.00	0.00	0.00	0.00	0.00	0.00	41.4	44.0
Maine	28.0	0.00	0.00	6.03	0.00	0.00	0.00	0.00	0.00	34.0	34.1
Maryland	0.00	0.00	0.00	0.00	33.3	28.1	0.00	0.00	3.87	65.2	74.3
Massachusetts	32.7	0.00	0.00	1.19	0.00	0.00	0.00	0.00	0.00	34.0	40.5
Michigan*	184	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	187	251
Minnesota	31.2	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31.2	77.8
Mississippi	0.00	0.00	17.8	0.00	0.00	0.00	0.00	0.00	0.00	44.0	56.4
Missouri*	1.15	0.00	0.30	0.00	0.00	0.00	0.00	0.00	0.00	1.45	59.5
Montana	2.44	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	2.44	22.4
Nebraska	5.42	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	5.42	52.1
Nevada	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	20.5	37.4
New Hampshire	41.6	0.00	0.00	0.03	0.00	0.00	0.00	0.00	0.00	41.6	41.6
New Jersey*	3.58	0.00	0.00	0.00	38.4	9.21	0.00	0.00	8.86	77.7	79.5
New Mexico	0.00	0.00	0.00	0.00	0.00	0.00	10.4	0.00	0.00	10.6	32.0
New York	60.8	0.00	0.00	0.00	15.1	0.00	0.00	0.00	0.00	76.4	140
North Carolina	0.00	0.00	0.00	0.00	14.0	118	0.00	0.00	0.00	144	161
North Dakota	3.06	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	3.06	8.90
Ohio	57.3	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	57.3	146
Oklahoma*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	25.1
Oregon	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.05	0.00	0.05	69.5
Pennsylvania	5.27	0.00	0.00	0.00	0.05	30.7	0.00	0.00	40.0	105	152
Rhode Island	6.09	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00	6.10	6.10
South Carolina	0.00	0.00	0.00	0.00	0.00	47.8	0.00	0.00	0.00	50.2	127
South Dakota	0.82	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.82	7.67
Tennessee*	0.00	0.00	6.99	0.00	0.00	1.06	0.00	0.00	11.9	19.9	36.7
Texas	0.00	0.00	63.4	0.00	0.00	0.00	6.35	0.00	0.00	174	257
Utah	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	11.8
Vermont*	0.62	0.00	0.00	13.1	0.00	0.00	0.00	0.00	0.00	13.7	13.7
Virginia*	0.00	0.00	0.00	0.00	34.2	51.1	0.00	0.00	25.8	119	126
Washington	11.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	37.8	86.0
West Virginia*	0.00	0.00	0.00	0.00	0.00	0.61	0.00	0.00	6.16	6.77	32.8
Wisconsin*	32.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	64.6	87.3
Total	741	12.2	100	48.7	140	360	18.0	34.0	110	2,340	3,740

8 Estimates for Domestic Withdrawals and Population Served for Selected Principal Aquifers, 2005

Table 3. Estimated self-supplied domestic population served by state and aquifer for calendar year 2005.

[Self-supplied domestic population in thousands. Shading indicates combination of principal aquifer. Glacial aquifer system is aquifer composed of glacial deposits. Asterisk (*) next to a state name indicates data provided by water-use specialists at the U.S. Geological Survey Water Science Center. Values for total self-supply domestic groundwater served are from Kenny and others (2009). Figures may not sum to totals because of independent rounding]

State	Self-supplied domestic population served, in thousand people										
	Basin and Range basin-fill and carbonate aquifers	Biscayne aquifer	California Coastal Basin aquifers	Cambrian-Ordovician aquifer system	Central Valley aquifer system	Coastal Lowlands aquifer system	Columbia Plateau basin-fill and basaltic rock aquifers	Denver basin aquifer system	Early Mesozoic basin aquifers	Edwards-Trinity aquifer system	Floridan aquifer system and overlying Surficial aquifer system
Alabama	0.00	0.00	0.00	0.00	0.00	73.0	0.00	0.00	0.00	0.00	0.00
Alaska	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Arizona	94.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Arkansas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.52	0.00
California	208	0.00	310	0.00	437	0.00	0.00	0.00	0.00	0.00	0.00
Colorado	0.00	0.00	0.00	0.00	0.00	0.00	0.00	26.8	0.00	0.00	0.00
Connecticut	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	230	0.00	0.00
Delaware	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Florida*	0.00	36.1	0.00	0.00	0.00	21.9	0.00	0.00	0.00	0.00	1,550
Georgia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	332
Hawaii	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Idaho	5.43	0.00	0.00	0.00	0.00	0.00	15.0	0.00	0.00	0.00	0.00
Illinois	0.00	0.00	0.00	46.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Indiana	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Iowa	0.00	0.00	0.00	7.63	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kansas	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Kentucky	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Louisiana	0.00	0.00	0.00	0.00	0.00	433	0.00	0.00	0.00	0.00	0.00
Maine	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Maryland	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Massachusetts	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.37	0.00	0.00
Michigan	0.00	0.00	0.00	37.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Minnesota	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Mississippi	0.00	0.00	0.00	0.00	0.00	262	0.00	0.00	0.00	0.00	0.00
Missouri	0.00	0.00	0.00	17.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Montana	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nebraska	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Nevada	99.8	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
New Hampshire	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
New Jersey*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	212	0.00	0.00
New Mexico	1.62	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
New York	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	6.95	0.00	0.00
North Carolina	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	110	0.00	54.4
North Dakota	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Ohio	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Oklahoma*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.3	0.00
Oregon	0.66	0.00	0.00	0.00	0.00	0.00	34.0	0.00	0.00	0.00	0.00
Pennsylvania	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	488	0.00	0.00
Rhode Island	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
South Carolina	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	24.8
South Dakota	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Tennessee	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Texas	0.00	0.00	0.00	0.00	0.00	534	0.00	0.00	0.00	534	0.00
Utah	22.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Vermont*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Virginia*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	106	0.00	0.00
Washington	0.00	0.00	0.00	0.00	0.00	0.00	210	0.00	0.00	0.00	0.00
West Virginia	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Wisconsin*	0.00	0.00	0.00	593	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Total	432	36.1	310	702	437	1,320	258	26.8	1,150	552	1,960

Table 3. Estimated self-supplied domestic population served by state and aquifer for calendar year 2005.—Continued

[Self-supplied domestic population in thousands. Shading indicates combination of principal aquifer. Glacial aquifer system is aquifer composed of glacial deposits. Asterisk (*) next to a state name indicates data provided by water-use specialists at the U.S. Geological Survey Water Science Center. Values for total self-supply domestic groundwater served are from Kenny and others (2009). Figures may not sum to totals because of independent rounding.]

Self-supplied domestic population served, in thousand people											
State	Glacial aquifer system	Hawaiian volcanic-rock aquifers	Mississippi Embayment-Texas Coastal Uplands aquifer system	New England crystalline-rock aquifers	Northern Atlantic Coastal Plain aquifer system	Piedmont and Blue Ridge carbonate and crystalline-rock aquifers	Rio Grande aquifer system	Snake River basin-fill and basaltic-rock aquifers	Valley and Ridge aquifers	Total by state for 20 aquifers	Total self-supply domestic population served
Alabama	0.00	0.00	7.18	0.00	0.00	216	0.00	0.00	51.4	348	521
Alaska	174	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	174	235
Arizona	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	94.4	218
Arkansas	0.00	0.00	30.2	0.00	0.00	0.00	0.00	0.00	0.00	30.7	200
California	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	955	2,710
Colorado	0.00	0.00	0.00	0.00	0.00	0.00	8.36	0.00	0.00	35.2	299
Connecticut	190	0.00	0.00	378	0.00	0.00	0.00	0.00	0.00	798	841
Delaware	0.00	0.00	0.00	0.00	68.8	8.30	0.00	0.00	0.00	77.0	80.4
Florida*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1,610	1,790
Georgia	0.00	0.00	0.00	0.00	0.00	488	0.00	0.00	94.7	915	1,600
Hawaii	0.00	74.0	0.00	0.00	0.00	0.00	0.00	0.00	0.00	74.0	74.0
Idaho	17.4	0.00	0.00	0.00	0.00	0.00	0.00	168	0.00	206	424
Illinois	806	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	853	1,130
Indiana	1,620	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1,620	1,630
Iowa	110	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	118	531
Kansas	9.66	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	9.66	149
Kentucky	19.4	0.00	19.6	0.00	0.00	0.00	0.00	0.00	0.00	39.1	696
Louisiana	0.00	0.00	80.5	0.00	0.00	0.00	0.00	0.00	0.00	514	551
Maine	505	0.00	0.00	70.1	0.00	0.00	0.00	0.00	0.00	575	575
Maryland	0.00	0.00	0.00	0.00	416	351	0.00	0.00	36.3	803	929
Massachusetts	418	0.00	0.00	16.6	0.00	0.00	0.00	0.00	0.00	436	527
Michigan	1,200	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1,240	2,910
Minnesota	446	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	446	1,110
Mississippi	0.00	0.00	177	0.00	0.00	0.00	0.00	0.00	0.00	440	555
Missouri	17.0	0.00	8.50	0.00	0.00	0.00	0.00	0.00	0.00	42.5	850
Montana	31.1	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	31.1	301
Nebraska	33.4	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	33.4	313
Nevada	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	99.8	182
New Hampshire	554	0.00	0.00	0.49	0.00	0.00	0.00	0.00	0.00	554	555
New Jersey*	42.1	0.00	0.00	0.00	476	110	0.00	0.00	104	944	961
New Mexico	0.00	0.00	0.00	0.00	0.00	0.00	112	0.00	0.00	114	377
New York	810	0.00	0.00	0.00	202	0.00	0.00	0.00	0.00	1,020	1,870
North Carolina	0.00	0.00	0.00	0.00	199	1,690	0.00	0.00	0.00	2,060	2,300
North Dakota	36.6	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	36.6	105
Ohio	764	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	764	1,990
Oklahoma*	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	16.3	295
Oregon	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.30	0.00	35.0	707
Pennsylvania	87.8	0.00	0.00	0.00	0.77	517	0.00	0.00	667	1,760	2,540
Rhode Island	85.7	0.00	0.00	0.19	0.00	0.00	0.00	0.00	0.00	86.0	85.9
South Carolina	0.00	0.00	0.00	0.00	0.00	478	0.00	0.00	0.00	502	1,270
South Dakota	11.9	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	12.0	110
Tennessee	0.00	0.00	96.8	0.00	0.00	14.6	0.00	0.00	164	276	509
Texas	0.00	0.00	552	0.00	0.00	0.00	55.2	0.00	0.00	1,680	2,230
Utah	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	22.0	68.5
Vermont*	7.92	0.00	0.00	178	0.00	0.00	0.00	0.00	0.00	185	185
Virginia*	0.00	0.00	0.00	0.00	455	734	0.00	0.00	344	1,640	1,680
Washington	160	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	370	904
West Virginia	0.00	0.00	0.00	0.00	0.00	1.00	0.00	0.00	77.6	78.6	420
Wisconsin*	652	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	1,240	1,670
Total	8,820	74.0	972	642	1,820	4,610	175	168	1,540	26,000	42,900

Summary

This report represents the most recent assessment of estimated self-supplied domestic withdrawals and population served for 20 aquifers in the United States. These data were compiled to support regional National Water-Quality Assessment Program studies, which focuses on groundwater quality of principal aquifers in the U.S., which are important sources of water to both public supply and private domestic uses. Estimated groundwater withdrawals for public-supply, self-supplied industrial, and irrigation uses from more than 60 principal aquifers were compiled using 2000 data, but estimates for aquifer withdrawal or populations served are not available for the self-supplied domestic uses. This report summarizes the most currently available (calendar year 2005) water-use estimates from the National Water Use Information Program for self-supplied domestic groundwater withdrawals and population served allocated to 20 aquifers. Estimates of withdrawals from the 20 aquifers were provided by USGS water-use specialists, or were determined using well information available in USGS databases, or geographic area-weighted processes.

The 20 aquifers represent about 63 percent of the total self-supplied domestic groundwater withdrawals, and about 61 percent of the total population served by those withdrawals in the United States for calendar year 2005. The Glacial aquifer system had the largest withdrawals and supplied the most people among all the aquifers. The four aquifers with the largest withdrawals and the largest population served were the Glacial aquifer system, Piedmont and Blue Ridge crystalline and carbonate-rock aquifers, the Floridan aquifer system and the overlying Surficial aquifer system, and the Northern Atlantic Coastal Plain aquifer system. Combined, these four aquifers accounted for more than 60 percent of the total self-supplied domestic withdrawals, and about 66 percent of the total population served by those withdrawals from the 20 aquifers. Three aquifers in four States accounted for the largest withdrawals (greater than 100 Mgal/d)—the Glacial aquifer system in Michigan (184 Mgal/d) and Indiana (124 Mgal/d), the Floridan aquifer system combined with the overlying Surficial aquifer system in Florida (168 Mgal/d), and the Central Valley aquifer system in California (136 Mgal/d). More than 1 million people in Florida, Indiana, and Michigan used groundwater from the Floridan and the overlying Surficial aquifer systems or the Glacial aquifer system. All withdrawals and population served in six states are supplied by four aquifers as follows: Hawaii is supplied entirely by the Hawaiian volcanic-rock aquifers, Indiana is supplied entirely by the Glacial aquifer system, and Maine, New Hampshire, Rhode Island, and Vermont each are supplied entirely by the Glacial aquifer system and the New England crystalline-rock aquifers.

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