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Estimated Use of Water in the United States in 2015

Circular 1441
Supersedes USGS Open-File Report 2017–1131

U.S. Department of the Interior
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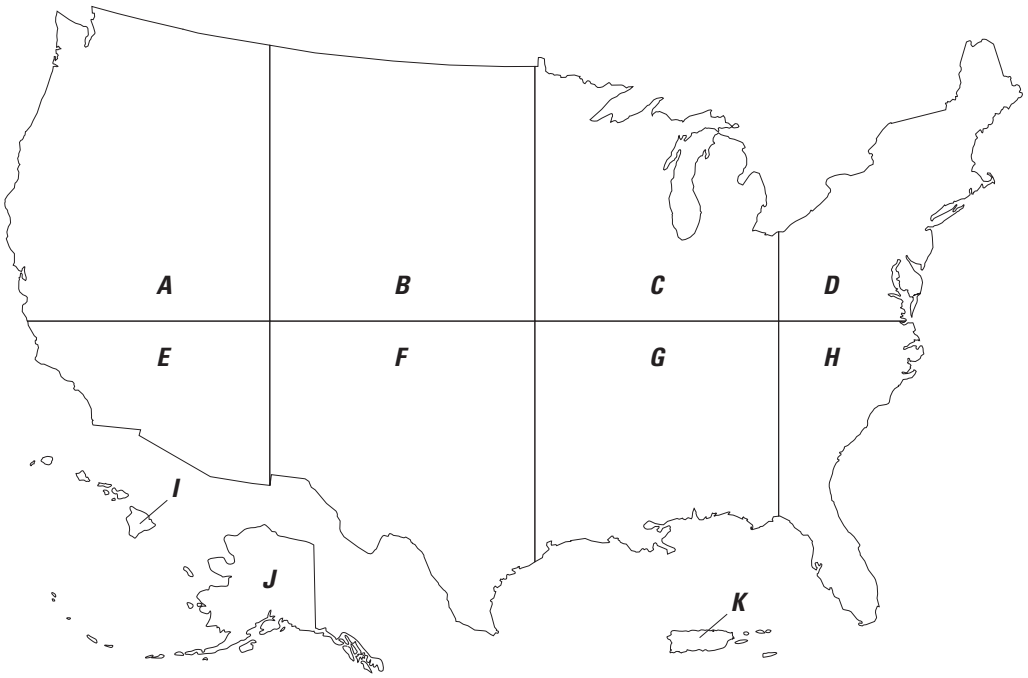

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By Cheryl A. Dieter, Molly A. Maupin, Rodney R. Caldwell, Melissa A. Harris, Tamara I. Ivahnenko, John K. Lovelace, Nancy L. Barber, and Kristin S. Linsey

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Conversion Factors

U.S. customary units to International System of Units

Multiply	By	To obtain
	Length	
inch (in.)	2.54	centimeter (cm)
inch (in.)	25.4	millimeter (mm)
	Area	
acre	4,047	square meter (m^2)
acre	0.4047	hectare (ha)
acre	0.001562	square mile (mi^2)
	Volume	
acre-foot (acre-ft)	1,233	cubic meter (m^3)
acre-foot (acre-ft)	325,851	gallon (gal)
acre-foot (acre-ft)	43,560	cubic foot (ft^3)
cubic foot (ft^3)	7.48	gallon (gal)
gallon (gal)	3.785	liter (L)
gallon (gal)	3.785	cubic decimeter (dm^3)
million gallons (Mgal)	3,785	cubic meter (m^3)
million gallons (Mgal)	3.07	acre-foot (acre-ft)
	Flow rate	
acre-foot per year (acre-ft/yr)	1,233	cubic meter per year (m^3/yr)
billion gallons per day (Bgal/d)	1.3815	billion cubic meters per year
gallon per day (gal/d)	3.785	liter per day (L/d)
million gallons per day (Mgal/d)	0.04381	cubic meter per second (m^3/s)
million gallons per day (Mgal/d)	1.547	cubic foot per second (ft^3/s)
million gallons per day (Mgal/d)	1.121	thousand acre-foot per year (acre-ft/yr)
million gallons per day (Mgal/d)	1.3815	million cubic meters per year
thousand acre-feet per year (acre-ft/yr)	0.8921	million gallons per day (Mgal/d)
	Energy	
gigawatt-hour (gWh)	3,600,000	Megajoule (MJ)
kilowatt-hour (kWh)	3,600,000	joule (J)

Temperature in degrees Fahrenheit (°F) may be converted to degrees Celsius (°C) as follows:

$$°C = (°F - 32) / 1.8.$$

Abbreviations

CONUS	Contiguous United States
EPA	U.S. Environmental Protection Agency
ET	Evapotranspiration
GPCD	gallons per capita per day
MODIS	Moderate Resolution Imaging Spectroradiometer
NWC	National Water Census
NWIS	National Water Information System
NWUSP	National Water Use Science Project
SDWIS	Safe Drinking Water Information System
SECURE	Science and Engineering to Comprehensively Understand and Responsibly Enhance
SSEBop	Operational Simplified Surface Energy Balance
USDA	U.S. Department of Agriculture
USDA NASS	U.S. Department of Agriculture, National Agricultural Statistics Service
USDOE EIA	U.S. Department of Energy, Energy Information Administration
USGS	U.S. Geological Survey
WAUSP	Water Availability and Use Science Program
WUDR	U.S. Geological Survey Water Use Data and Research Financial Assistance Program

Estimated Use of Water in the United States in 2015

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Abstract

Water use in the United States in 2015 was estimated to be about 322 billion gallons per day (Bgal/d), which was 9 percent less than in 2010. The 2015 estimates put total withdrawals at the lowest level since before 1970, following the same overall trend of decreasing total withdrawals observed from 2005 to 2010. Freshwater withdrawals were 281 Bgal/d, or 87 percent of total withdrawals, and saline-water withdrawals were 41.0 Bgal/d, or 13 percent of total withdrawals. Fresh surface-water withdrawals (198 Bgal/d) were 14 percent less than in 2010, and fresh groundwater withdrawals (82.3 Bgal/day) were about 8 percent greater than in 2010. Saline surface-water withdrawals were 38.6 Bgal/d, or 14 percent less than in 2010. Total saline groundwater withdrawals in 2015 were 2.34 Bgal/d, mostly for mining use.

Thermoelectric power and irrigation remained the two largest uses of water in 2015, and total withdrawals decreased for thermoelectric power but increased for irrigation. Withdrawals in 2015 for thermoelectric power were 18 percent less and withdrawals for irrigation were 2 percent greater than in 2010. Similarly, other uses showed reductions compared to 2010, specifically public supply (–7 percent), self-supplied domestic (–8 percent), self-supplied industrial (–9 percent), and aquaculture (–16 percent). In addition to irrigation (2 percent), mining (1 percent) reported larger withdrawals in 2015 than in 2010. Livestock withdrawals remained essentially the same in 2015 compared to 2010 (0 percent change). Thermoelectric power, irrigation, and public-supply withdrawals accounted for 90 percent of total withdrawals in 2015.

Withdrawals for thermoelectric power were 133 Bgal/d in 2015 and represented the lowest levels since before 1970. Surface-water withdrawals accounted for more than 99 percent of total thermoelectric-power withdrawals, and 72 percent of those surface-water withdrawals were from freshwater sources. Saline surface-water withdrawals for thermoelectric power accounted for 97 percent of total saline surface-water withdrawals for all uses. Thermoelectric-power withdrawals accounted for 41 percent of total withdrawals for all uses, and freshwater withdrawals for thermoelectric power accounted for 34 percent of the total freshwater withdrawals for all uses. Total consumptive use for thermoelectric power was 4.31 Bgal/d in 2015 or 3 percent of the total thermoelectric-power withdrawals.

Irrigation withdrawals were 118 Bgal/d in 2015, an increase of 2 percent from 2010 (116 Bgal/d), but were approximately equal to withdrawals estimated in the 1960s. Irrigation withdrawals, all freshwater, accounted for 42 percent of total freshwater withdrawals for all uses and 64 percent of total freshwater withdrawals for all uses excluding thermoelectric power. Surface-water withdrawals (60.9 Bgal/d) accounted for 52 percent of the total irrigation withdrawals, or about 8 percent less than in 2010. Groundwater withdrawals for irrigation were 57.2 Bgal/d in 2015, about 16 percent more than in 2010. About 63,500 thousand acres (or 63.5 million acres) were irrigated in 2015, an increase from 2010 of about 1,130 thousand acres (2 percent). The number of acres irrigated using sprinkler and microirrigation systems accounted for 63 percent of the total irrigated lands in 2015. Total consumptive use for irrigation was 73.2 Bgal/d in 2015 or 62 percent of the total use (withdrawals and reclaimed wastewater).

Public-supply withdrawals in 2015 were 39.0 Bgal/d, or 7 percent less than in 2010, continuing the declines observed from 2005 to 2010. Total population in the United States increased from 312.6 million people in 2010 to 325.0 million people in 2015, an increase of 4 percent. Public-supply withdrawals accounted for 14 percent of the total freshwater withdrawals for all uses and 21 percent of freshwater withdrawals for all uses, excluding thermoelectric power. The number of people that received potable water from public-supply facilities in 2015 was 283 million, or about 87 percent of the total United States population. This percentage is 1 percent greater than in 2010. Self-supplied domestic withdrawals were 3.26 Bgal/d, or 8 percent less than in 2010. More than 98 percent of the self-supplied domestic withdrawals were from groundwater sources.

Self-supplied industrial withdrawals were 14.8 Bgal/d in 2015, a 9 percent decline from 2010, continuing the downward trend since the peak of 47 Bgal/d in 1970. Total self-supplied industrial withdrawals were 5 percent of total withdrawals for all uses and 8 percent of total withdrawals for all uses,

excluding thermoelectric power. Most of the total self-supplied industrial withdrawals were from surface-water sources (82 percent), and nearly all (94 percent) of those surface-water withdrawals were from freshwater sources. Nearly all of the groundwater withdrawals for self-supplied industrial use (98 percent) were from freshwater sources.

Total aquaculture withdrawals were 7.55 Bgal/d in 2015, or 16 percent less than in 2010, and surface water was the primary source (79 percent). Most of the surface-water withdrawals occurred at facilities that operated flow-through raceways, which returned the water to the source directly after use. Aquaculture withdrawals accounted for 2 percent of the total withdrawals for all uses and 4 percent of the total withdrawals for all uses, excluding thermoelectric.

Total mining withdrawals in 2015 were 4.00 Bgal/d, or about 1 percent of total withdrawals from all uses and 2 percent of total withdrawals from all uses, excluding thermoelectric. Mining withdrawals increased 1 percent from 2010 to 2015. Groundwater withdrawals accounted for 72 percent of the total mining withdrawals, and most of the groundwater was saline (65 percent). Most (77 percent) of the surface-water withdrawals for mining was freshwater.

Livestock withdrawals in 2015 were 2.00 Bgal/d, the same as in 2010. All livestock withdrawals were from freshwater sources, mostly from groundwater (62 percent). Livestock withdrawals accounted for about 1 percent of total freshwater withdrawals for all uses, excluding thermoelectric power.

In 2015, more than 50 percent of the total withdrawals in the United States were accounted for by 12 States (California, Texas, Idaho, Florida, Arkansas, New York, Illinois, Colorado, North Carolina, Michigan, Montana, and Nebraska). California accounted for almost 9 percent of the total withdrawals and 9 percent of freshwater withdrawals in the United States, predominantly for irrigation. Texas accounted for almost 7 percent of total withdrawals, predominantly for thermoelectric power, irrigation, and public supply. Florida accounted for 23 percent of the total saline-water withdrawals in the United States, mostly from surface-water sources for thermoelectric power. Texas and California accounted for 59 percent of the total saline groundwater withdrawals in the United States, mostly for mining.

Introduction

This report, "Estimated use of water in the United States in 2015," is the 14th in a series of U.S. Geological Survey (USGS) Circular reports that have been published every 5 years since 1950. The 65-year span of national reports represents the longest compilation record of water-use data by a Federal agency in the United States. Estimates of withdrawals enable the depiction of trends in total water use for the Nation among different geographic areas, categories of use, and sources over time. The USGS is dedicated to providing reliable scientific information that accurately describes current and historical conditions and enables a better understanding of the Earth's water resources. Water-use information is a critical component of water budgets, which are essential to surface-water and groundwater availability studies. This

Public supply water tank, winner of the "2015 Tank of the Year" presented by Tnemec Company, Inc. Photograph provided by the City of Cocoa, Florida, used with permission.

State Seal Spring is used for domestic drinking water in Saratoga County, New York. Photograph by Tamara Ivahnenko, USGS.

information is also essential to accurately understand how future water demands will be met while maintaining adequate water quality and quantities for human and ecosystem needs in the United States.

The USGS National Water Use Science Project (NWUSP), a component of the Water Availability and Use Science Program (WAUSP), facilitates the 5-year compilation of water use estimates for the United States as part of the National Water Census (NWC). The NWC, implemented as part of the SECURE (Science and Engineering to Comprehensively Understand and Responsibly Enhance) Water Act (Subtitle F of Public Law 111-11, the Omnibus Public Land Management Act), provides data and tools designed to support water managers in the accurate assessment of water availability at regional and national scales (https://water.usgs.gov/watercensus/). Over time, the NWUSP has met various challenges in estimating water use in the United States (https://water.usgs.gov/watuse/) and as a result has reduced some data collections over time to address limitations of available resources for analysis and limitations of capabilities for accurate interpolations.

USGS NWC-supported projects with direct relevance to water use and the NWUSP 2015 compilation efforts are focused on several categories of water use, including thermoelectric power and public supply. For thermoelectric power, thermoelectric withdrawals in the United States for 2010 acquired from three Federal datasets were evaluated and compared (Harris and Diehl, 2017). For public supply, work continues to construct a site-specific database of public-supply withdrawal, distribution, use, and return data for each State. The NWUSP is in the process of developing methods and tools to estimate groundwater withdrawals from major aquifer systems for every county in the United States.

The SECURE Water Act authorized a program to support water-use and availability activities related to data collection and methods research and development at the State level. The USGS Water-Use Data and Research program (WUDR) began to provide financial assistance through cooperative agreements with State water-resource agencies in 2015 (https://water.usgs.gov/wausp/wudr/index.html). The goal of the USGS WUDR is to improve water-use data for the United States at the State level, which will allow better, more accurate estimates of water use in the United States and provide information needed to manage water resources, and (or) forecast future water-use needs. The WUDR Program promotes cooperative work with the State agencies. Data from funded projects will be incorporated into USGS databases.

Data dissemination capabilities and data-collection efforts have improved over the course of each 5-year compilation. The online resource, "USGS Water Use Data for the Nation," (https://waterdata.usgs.gov/nwis/wu) provides the best available county water-use data (1985–2015). These county-level estimates are the foundation for the statewide totals presented in each 5-year compilation report and are stored, updated, and disseminated using the USGS National Water Information System (NWIS) database. Data are retrievable as county, State, and national totals for each category of use as reported in the 5-year compilation reports. Because data are updated periodically and revised during interim years, the website can enable quick and easy access to the most current water-use data. A companion data release of 2015 county-level data is available through the USGS ScienceBase catalog at https://doi.org/10.5066/F7TB15V5 (Dieter and others, 2018).

Alligators in a holding pool, St. Tammany Parish, Louisiana, is an example of aquaculture water use. Photograph by Pierre Sargent, USGS.

Factors such as demographics, new manufacturing and cooling-system technologies, economic trends, legal decisions, and climatic fluctuations have varying effects on water use. Between 2010 and 2015, population in the United States increased 4 percent, or approximately 12 million people, from 313 million people in 2010 to 325 million people in 2015. The Southern and Western States had the largest estimated increases in population from 2010 to 2015 as a result of large estimated increases in population in Texas, California, and Florida (U.S. Census Bureau, 2017). A few Eastern States had estimated decreases in population (Puerto Rico, West Virginia, and Vermont) (U.S. Census Bureau, 2017). Population growth puts additional pressure on existing public utilities and increases demand on sometimes already limited water supplies. In parts of the United States, communities have sought additional water sources or instituted water-conservation measures to meet increasing demands. New cooling-system technologies and wastewater-management practices at thermoelectric powerplants and industrial facilities are examples of water-saving practices that are being implemented. Powerplants have reduced the demand for cooling water by implementing more efficient cooling systems, such as changing to recirculating systems (also referred to as recirculation systems) or building new plants with dry-cooling systems. Industrial facilities are using more efficient water-conserving manufacturing technologies, driven by the need to reduce costs associated with water/energy production needs. Increases in industrial reuse and recycling of wastewater help to reduce withdrawals from the available resources and treated discharges to surface waters over time.

Climate fluctuations affect water use, particularly for irrigation, power generation, and public supply. According to the National Oceanic and Atmospheric Administration's Annual Climate Report for 2015, the contiguous United States (CONUS) experienced average annual air temperatures 2.4 degrees Fahrenheit above the 20th century average in every State, and precipitation was 4.53 inches greater than the 20th century average (National Oceanic and Atmospheric Administration, 2016a). The winter temperature was greater than the average for the CONUS. The winter was abnormally cold in the Northeast and Midwest and warm in the West. Boston, Massachusetts, received a record 110.6 inches of snow. Fourteen States in central and southeastern CONUS experienced wetter than normal conditions, including Texas and Oklahoma, both of which had record wet years, relieving them of drought conditions that began in 2010. Florida experienced record warm temperatures 3.3 degrees Fahrenheit greater than the long-term average. California's near-record warm temperatures and low precipitation in the winter caused drought conditions, including low reservoir levels in the State (National Oceanic and Atmospheric Administration National Centers for Environmental Information, 2016a).

Purpose and Scope

This report presents average daily withdrawals (in millions of gallons per day, Mgal/d) for calendar year 2015, by source (groundwater and surface water) and quality (fresh and saline) for the 50 States, the District of Columbia, Puerto Rico, and the U.S. Virgin Islands (hereafter referred to as "States" for brevity). Withdrawals are reported by category of use: public supply, domestic (including self-supplied domestic and deliveries from public supply), irrigation, livestock, aquaculture, self-supplied industrial (referred to as "industrial" for brevity), mining, and self-supplied thermoelectric power (referred to as "thermoelectric power" for brevity). Saline water is defined as water containing dissolved solids of 1,000 milligrams per liter or more. All withdrawals for the public supply, domestic, irrigation, and livestock categories are reported as totals, although in some areas water is treated to reduce salinity for these uses. Aquaculture totals include a small amount of saline surface-water withdrawals for four States. Both freshwater and saline-water withdrawals are reported for industrial, mining, and thermoelectric-power uses. In addition to withdrawals, average daily consumptive-use estimates (in Mgal/d) for irrigation and thermoelectric power for 2015 are presented in this report.

Irrigation in Montana. Photograph by Rodney Caldwell, USGS.

The series of 5-year national water-use estimates compiled by the USGS serves as one of the few sources of information about regional and national trends in water withdrawals. These historical reports (MacKichan, 1951, 1957; MacKichan and Kammerer, 1961; Murray, 1968; Murray and Reeves, 1972, 1977; Solley and others, 1983, 1988, 1993, 1998; Hutson and others, 2004; Kenny and others, 2009; Maupin and others, 2014) are available online at https://water.usgs.gov/watuse/50years.html. Statewide data between 1950 and 2015 produced for the 5-year national water-use estimates are available online at https://waterdata.usgs.gov/nwis/wu. County-level data are available only for 1985–2015 from the same website.

Terminology Used in This Report

A glossary of the terms and units used in this report is located at the end of the report and is available online at https://water.usgs.gov/watuse/wuglossary.html. Terms and units depicting withdrawals and ancillary data for the 5-year compilations have not changed since 2000. Withdrawal for each category of use represents the total amount of water removed from the water source for a particular use. Additional water may be used for the category from public-supply deliveries or from reclaimed wastewater. In most cases, some fraction of the total withdrawal will be returned to a water source after use and will be available for other subsequent uses. Estimates of reclaimed wastewater use were compiled by some States for the industrial, thermoelectric-power, and irrigation categories. Available reclaimed wastewater use data are included in the tables and graphics for the thermoelectric-power and irrigation categories, but not for industrial because of the small volumes of water compared to the totals and the incomplete reporting across the Nation.

The amount of water that is not readily available for another use because it is evaporated, transpired, incorporated into products or crops, consumed by livestock or humans, or otherwise removed from the immediate water environment is termed consumptive use. Estimates of return flows and consumptive use were discontinued after 1995, primarily because of resource and data constraints. This report reinstates the consumptive-use estimates for the thermoelectric-power and irrigation categories.

Rates of water use (withdrawals, deliveries from public supply, consumptive use) are expressed in terms of Mgal/d and thousands of acre-feet per year (acre-ft/yr). The term billion of gallons per day (Bgal/d) is used in the "Abstract" and "Trends in Water Use" sections of this report to more simply express large numbers for total uses. Units of million or billion of gallons per day do not represent actual daily rates, but rather are used to express total amounts as an average daily rate over a single year (annually). Water demands fluctuate seasonally and may be very different between hot summer months and cold winter months. Therefore, withdrawal estimates in this report represent the total annual withdrawals averaged over 365 days.

Water-use values and population data are rounded to three significant figures, except for population values in the "Trends in Water Use" section, which are rounded to four significant figures. All values are rounded independently, so the sums of individual rounded numbers may not equal the totals. The percentage of changes discussed in the text are calculated from the unrounded data and are expressed as integers. In discussions of States that compose the majority of withdrawals for a given category, the State names are listed in order of decreasing magnitude of withdrawals.

Changes for the 2015 Report

A matrix showing the different categories of use and how the terminology has changed over time is available online at https://water.usgs.gov/watuse/WU-Category-Changes.html. Links to definitions of water-use categories are included in the matrix. This report includes the same categories of use that were reported in 2005 and 2010, and every category of use includes data from every State. Deliveries from public supply for domestic use were again compiled in 2015, but public-supply deliveries for commercial, industrial, and thermoelectric-power uses were not compiled for all States. This report reinstates consumptive-use estimates for the thermoelectric power and irrigation categories, which were discontinued after 1995, primarily because of resource and data constraints.

Data were not compiled for hydrologic units (watersheds). Data were not compiled for commercial water use, hydroelectric-power generation, wastewater treatment (returns), consumptive use (except for the categories of thermoelectric power and irrigation), or irrigation conveyance losses. Some of these additional data may have been collected for individual States but are not compiled as a national dataset or included in this report.

The "Trends in Water Use" section of this report includes national totals for withdrawals by category of use and source of water from 1950 to 2015. Totals have changed for some categories and years because of revisions to individual State data during interim years. Because of these revisions, some of the percentage changes in this report will be slightly different from data published previously by Maupin and others (2014).

Sources of Data and Methods of Analysis

Data presented in this report were compiled from various sources, depending on the category of use and the information available for each State. USGS personnel in each State determined the best sources of information available, then compiled or estimated the data and prepared documentation of the sources and methods used to determine the water-use totals. Data in this report may have been derived from reported, estimated, or calculated means using different

Mining in Chaffee County, Colorado. Photograph by Robert Stogner, used with permission.

sources and methods and, therefore, will have varying levels of accuracy. Because the largest users and the most prominent categories of use within each State have the greatest effect on the totals, obtaining reliable information for these large users and categories was the primary focus of the compilation effort.

Sources of information used in the compilation include national datasets, State agency data, and local contacts. National datasets available to each State include U.S. Census Bureau population estimates (U.S. Census Bureau, 2016), U.S. Department of Agriculture (USDA) Farm and Ranch Irrigation Survey, USDA Census of Agriculture, USDA National Agricultural Statistics Service (NASS) crop and livestock estimates, USDA Cropland Data Layer, and U.S. Department of Energy, Energy Information Administration (USDOE EIA) facility reports.

In addition to the nationally available datasets listed above, category-specific data were compiled and (or) estimated by the NWUSP and provided to USGS personnel to help refine estimates for thermoelectric power, irrigation, livestock, mining, and aquaculture. For thermoelectric power, cooling-system classifications for powerplants, modeled withdrawals, and consumptive use were provided from internal USGS sources (Diehl and others, 2013; Diehl and Harris, 2014) using USDOE EIA and project ancillary data. To estimate irrigation consumptive use, estimates of evapotranspiration derived from 1-kilometer scale Moderate Resolution Imaging Spectroradiometer (MODIS) satellite data using the Operational Simplified Surface Energy Balance (SSEBop) model (Senay and others, 2013) were provided for each State. Datasets and sources of information used to produce the national estimates for the livestock, aquaculture, and mining categories include the USDA NASS, USDOE EIA, FracFocus Chemical Disclosure Registry, USGS National Minerals Information Center, and various State agencies responsible for oil and gas development or underground-injection control programs. Sources of information are discussed in greater detail in the individual category sections of this report.

Many of these supporting data, such as those from USDA NASS and USDOE EIA, are collected annually. Other data are provided for years other than 2015 but were used to develop the 2015 estimates in some States because they were the most complete data available. For example, the USDA Census of Agriculture is produced in years ending in 2 and 7, and the USDA Farm and Ranch Irrigation Survey is produced in years ending in 3 and 8. Correlation of water-use data in this report with specific climatic conditions for 2015 is not recommended because data for years other than 2015 may have been used to develop some water-use estimates.

Guidelines for preparing the 2015 water-use estimates were distributed to USGS contact personnel through workshops, web-based seminars, and written documents. These guidelines have been published as USGS Open-File Report 2017–1029, "Guidelines for preparation of State water-use estimates for 2015" (Bradley, 2017), available at https://doi.org/10.3133/ofr20171029. Reports published for individual States by USGS offices as part of the NWUSP, as well as a list of contact personnel, also are available online at https://water.usgs.gov/watuse/.

Total Water Use

322,000 million gallons per day

Total water withdrawals in the United States for 2015 were estimated for eight categories of use: public supply, self-supplied domestic, irrigation, livestock, aquaculture, industrial, mining, and thermoelectric power (fig. 1). The three largest categories were thermoelectric power, irrigation, and public supply, accounting for 90 percent of the national total. The remaining categories of self-supplied domestic, industrial, aquaculture, mining, and livestock together were 10 percent of total water withdrawals estimated in this report.

Total estimates of State populations and withdrawals by source for 2015 are listed in table 1. The total estimated population in the United States in 2015 was 325 million, and total freshwater and saline-water withdrawals were estimated to be 322,000 Mgal/d, or 361,000 thousand acre-ft/yr. Freshwater withdrawals of 281,000 Mgal/d made up 87 percent of the total, and saline-water withdrawals made up the remaining 13 percent (41,000 Mgal/d). Most freshwater withdrawals were used for irrigation, and most saline-water withdrawals were seawater and brackish coastal water used for thermoelectric power. Total surface-water withdrawals were estimated to be 237,000 Mgal/d, or 74 percent of total withdrawals. About 84 percent (198,000 Mgal/d) of total surface-water withdrawals were freshwater. Total groundwater withdrawals were 84,700 Mgal/d, of which 97 percent (82,300 Mgal/d) was freshwater.

Total withdrawals by category and State are listed in table 2*A*, in million gallons per day, and in table 2*B*, in thousand acre-feet per year. A geographic representation of total withdrawals in the United States is shown in figure 2 with a stacked bar chart that illustrates a west to east representation of withdrawals by category and State. Total surface-water and groundwater, and total freshwater and saline-water, withdrawals by State are shown in figure 3.

Withdrawals for thermoelectric power were the largest nationwide (tables 2*A* and 2*B*) and are predominant in the east, whereas irrigation withdrawals are greatest in the west (fig. 2). Total withdrawals for thermoelectric power (133,000 Mgal/d) are mostly derived from freshwater sources (72 percent), and total freshwater withdrawals for thermoelectric power accounted for 34 percent of the total freshwater withdrawals for all categories nationwide. Total saline-water withdrawals for thermoelectric power accounted for about 92 percent of total saline-water withdrawals for all categories nationwide. Irrigation withdrawals (all freshwater) totaled 118,000 Mgal/d and accounted for 42 percent of total freshwater withdrawals for all categories nationwide. Total withdrawals for public supply (39,000 Mgal/d, and 99 percent freshwater) represented nearly 14 percent of the total freshwater withdrawals for all categories nationwide (table 2).

In 2015, more than 50 percent of the total withdrawals in the United States were accounted for by 12 States: California, Texas, Idaho, Florida, Arkansas, New York, Illinois, Colorado, North Carolina, Michigan, Montana, and Nebraska. Total withdrawals in California accounted for about 9 percent of the total withdrawals for all categories nationwide. California's freshwater withdrawals were 9 percent of total freshwater withdrawals for all categories nationwide, predominantly for irrigation. Total withdrawals in Texas accounted for about 7 percent of total withdrawals for all categories nationwide, and its freshwater withdrawals accounted for about 7 percent of total freshwater withdrawals for all categories nationwide, predominantly for thermoelectric. Idaho's freshwater withdrawals for irrigation were the second largest nationwide, and aquaculture withdrawals (all freshwater) were the largest nationwide. Combined, these two categories of use in Idaho accounted for 6 percent of total freshwater withdrawals nationwide. Florida had the largest saline withdrawals and accounted for 23 percent of total saline withdrawals for all categories nationwide; Florida's saline surface-water withdrawals were used mostly for thermoelectric power. Florida, New York, and Maryland accounted for more than 50 percent of total saline surface-water withdrawals nationwide, predominantly for thermoelectric power. Texas and California accounted for about 60 percent of the total saline groundwater withdrawals nationwide, mostly for mining.

Water withdrawals by use and State are listed for surface water in tables 3*A* and 3*B* and for groundwater in tables 4*A* and 4*B*. In 2015, more surface water than groundwater was withdrawn for all categories of use except domestic, livestock, and mining; however, irrigation is nearly evenly split between surface water and groundwater. Thermoelectric power accounted for about 48 percent of the total fresh surface-water withdrawals and irrigation accounted for about 31 percent. The largest surface-water withdrawals were in Texas, Idaho, Florida, California, New York, and North Carolina, cumulatively accounting for about 29 percent of total surface-water withdrawals for all categories nationwide. Large quantities of fresh surface water were withdrawn for thermoelectric power in Texas, Illinois, Michigan, and Alabama. Large saline surface-water withdrawals for thermoelectric power occurred in Florida, New York, Maryland, and New Jersey, which cumulatively accounted for 61 percent of the national total saline surface-water withdrawals.

Of the total fresh groundwater withdrawals nationwide (82,300 Mgal/d), irrigation accounted for 70 percent, primarily in California, Arkansas, Nebraska, Idaho, and Texas. Fresh groundwater irrigation withdrawals in these five States cumulatively accounted for 46 percent of the total fresh groundwater withdrawals for all categories nationwide. Nearly all groundwater withdrawals (97 percent) were from freshwater, predominantly used for irrigation. Saline groundwater withdrawals were predominantly used for mining (80 percent) and occurred in Texas, California, and Oklahoma. Irrigation used greater than three times more fresh groundwater than public supply, which was the next largest use of fresh groundwater in the Nation.

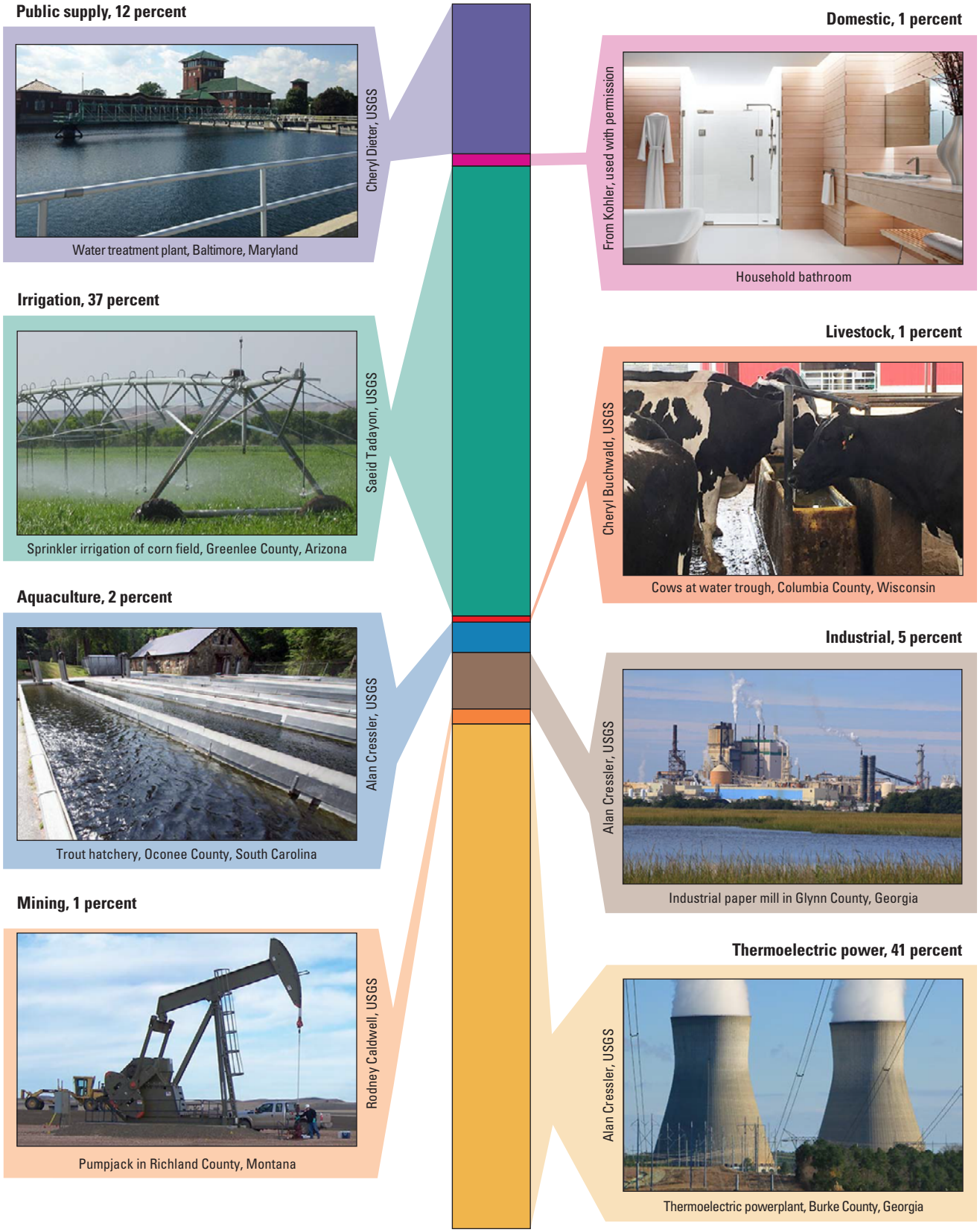


Figure 1. Total water withdrawals by category, 2015.

Table 1. Total water withdrawals by source and State, 2015.

[Values may not sum to totals because of independent rounding]

State	Population (thousands)	Withdrawals (million gallons per day)									Withdrawals (thousand acre-feet per year)		
		By source and type						Total			Total		
		Groundwater			Surface water								
		Fresh	Saline	Total	Fresh	Saline	Total	Fresh	Saline	Total	Fresh	Saline	Total
Alabama	4,860	501	0	501	7,750	0	7,750	8,250	0	8,250	9,250	0	9,250
Alaska	738	226	89.2	315	408	43.2	451	633	132	766	710	148	858
Arizona	6,830	2,760	0	2,760	3,220	0	3,220	5,980	0	5,980	6,700	0	6,700
Arkansas	2,980	9,590	0	9,590	4,250	0	4,250	13,800	0	13,800	15,500	0	15,500
California	39,100	17,100	359	17,400	8,540	2,800	11,300	25,600	3,160	28,800	28,700	3,550	32,200
Colorado	5,460	1,500	24.2	1,530	8,800	0	8,800	10,300	24.2	10,300	11,500	27.1	11,600
Connecticut	3,590	128	0	128	489	2,510	3,000	617	2,510	3,130	691	2,820	3,510
Delaware	946	170	0	170	364	256	620	534	256	790	598	287	886
District of Columbia	672	0	0	0	0.05	0	0.05	0.05	0	0.05	0.06	0	0.06
Florida	20,300	3,580	198	3,770	2,110	9,400	11,500	5,690	9,600	15,300	6,370	10,800	17,100
Georgia	10,200	1,150	0	1,150	2,130	102	2,230	3,280	102	3,380	3,680	114	3,790
Hawaii	1,430	338	20.2	359	344	357	702	683	377	1,060	766	423	1,190
Idaho	1,650	5,350	0	5,350	12,400	0	12,400	17,700	0	17,700	19,900	0	19,900
Illinois	12,900	870	21.0	891	9,600	0	9,600	10,500	21.0	10,500	11,700	23.5	11,800
Indiana	6,620	699	0	699	6,480	0	6,480	7,180	0	7,180	8,050	0	8,050
Iowa	3,120	630	0	630	2,060	0	2,060	2,690	0	2,690	3,010	0	3,010
Kansas	2,910	2,840	6.18	2,840	1,180	0	1,180	4,010	6.18	4,020	4,500	6.93	4,510
Kentucky	4,430	207	0	207	2,630	0	2,630	2,830	0	2,830	3,180	0	3,180
Louisiana	4,670	1,740	0	1,740	6,740	261	7,000	8,480	261	8,750	9,510	293	9,800
Maine	1,330	84.8	0	84.8	300	124	424	385	124	509	431	139	570
Maryland	6,010	295	0	295	935	5,300	6,230	1,230	5,300	6,530	1,380	5,940	7,320
Massachusetts	6,790	380	0	380	540	488	1,030	920	488	1,410	1,030	547	1,580
Michigan	9,920	766	0.58	767	9,290	0	9,290	10,100	0.58	10,100	11,300	0.65	11,300
Minnesota	5,490	776	0	776	2,450	0	2,450	3,230	0	3,230	3,620	0	3,620
Mississippi	2,990	2,240	12.9	2,260	427	2.07	429	2,670	15.0	2,690	2,990	16.8	3,010
Missouri	6,080	1,740	0	1,740	6,690	0	6,690	8,430	0	8,430	9,450	0	9,450
Montana	1,030	188	16.3	205	9,610	0	9,610	9,800	16.3	9,810	11,000	18.3	11,000
Nebraska	1,900	5,810	6.41	5,820	3,680	0	3,680	9,490	6.41	9,500	10,600	7.19	10,600
Nevada	2,890	1,360	82.2	1,440	1,520	0	1,520	2,880	82.2	2,960	3,230	92.2	3,320
New Hampshire	1,330	80.4	0	80.4	162	693	855	242	693	935	271	777	1,050
New Jersey	8,960	569	0	569	1,310	3,430	4,740	1,880	3,430	5,310	2,110	3,840	5,950
New Mexico	2,090	1,350	89.4	1,440	1,460	0	1,460	2,810	89.4	2,900	3,150	100	3,250
New York	19,800	890	0.95	890	4,420	5,480	9,910	5,310	5,480	10,800	5,960	6,150	12,100
North Carolina	10,000	520	0	520	8,400	1,360	9,750	8,920	1,360	10,300	10,000	1,520	11,500
North Dakota	757	187	15.1	202	1,190	0	1,190	1,380	15.1	1,400	1,550	16.9	1,560
Ohio	11,600	866	0	866	5,660	0	5,660	6,520	0	6,520	7,310	0	7,310
Oklahoma	3,910	960	155	1,110	848	0	848	1,810	155	1,960	2,030	173	2,200
Oregon	4,030	1,480	0	1,480	5,100	0	5,100	6,580	0	6,580	7,370	0	7,370
Pennsylvania	12,800	622	5.60	628	5,410	0	5,410	6,030	5.60	6,040	6,760	6.28	6,770
Rhode Island	1,060	32.7	0	32.7	88.8	222	311	122	222	343	136	249	385
South Carolina	4,900	365	0	365	5,810	0	5,810	6,170	0	6,170	6,920	0	6,920
South Dakota	881	238	0	238	162	0	162	400	0	400	448	0	448
Tennessee	6,600	430	0	430	5,990	0	5,990	6,420	0	6,420	7,200	0	7,200
Texas	27,500	6,170	1,030	7,200	12,700	1,360	14,100	18,900	2,390	21,300	21,200	2,670	23,800
Utah	3,000	1,050	93.2	1,150	2,820	257	3,080	3,880	350	4,230	4,340	392	4,740
Vermont	626	36.7	0	36.7	54.2	0	54.2	90.9	0	90.9	102	0	102
Virginia	8,380	284	14.3	298	4,030	2,400	6,430	4,310	2,420	6,730	4,830	2,710	7,540
Washington	7,170	1,530	0	1,530	2,730	0	2,730	4,260	0	4,260	4,770	0	4,770
West Virginia	1,840	130	4.57	134	2,190	0	2,190	2,320	4.57	2,320	2,600	5.12	2,600
Wisconsin	5,770	772	0	772	4,980	0	4,980	5,760	0	5,760	6,450	0	6,450
Wyoming	586	652	96.8	748	7,400	0	7,400	8,050	96.8	8,140	9,020	108	9,130
Puerto Rico	3,470	120	0	120	549	1,700	2,250	669	1,700	2,370	750	1,910	2,660
U.S. Virgin Islands	104	2.67	0	2.67	2.70	99.9	103	5.37	99.9	105	6.02	112	118
TOTAL	325,000	82,300	2,340	84,700	198,000	38,600	237,000	281,000	41,000	322,000	315,000	45,900	361,000

Table 2*A*. Total water withdrawals by water-use category, 2015, in million gallons per day.

[Values may not sum to totals because of independent rounding. Values for public supply and aquaculture include fresh and saline-water withdrawals]

State	Public supply	Domestic	Irrigation	Livestock	Aquaculture	Industrial		Mining		Thermoelectric power		Total		
	Total	Fresh	Fresh	Fresh	Total	Fresh	Saline	Fresh	Saline	Fresh	Saline	Fresh	Saline	Total
Alabama	762	36.7	223	26.2	49.4	494	0	30.2	0	6,630	0	8,250	0	8,250
Alaska	99.2	11.4	1.52	0.13	410	8.35	1.83	36.4	131	66.7	0	633	132	766
Arizona	1,200	24.0	4,530	38.9	34.5	6.12	0	68.3	0	83.5	0	5,980	0	5,980
Arkansas	363	12.8	11,600	34.1	251	157	0	3.07	0	1,440	0	13,800	0	13,800
California	5,150	127	19,000	183	727	399	0	45.8	272	36.4	2,840	25,600	3,160	28,800
Colorado	844	35.4	9,000	33.3	260	84.1	0	7.70	24.2	37.2	0	10,300	24.2	10,300
Connecticut	240	30.8	11.3	1.15	25.2	181	41.6	4.25	0	126	2,470	617	2,510	3,130
Delaware	86.4	14.5	113	1.34	1.98	302	0	0.65	0	14.4	256	534	256	790
District of Columbia	0	0	0.05	0	0	0	0	0	0	0	0	0.05	0	0.05
Florida	2,380	177	2,450	26.1	15.0	245	1.08	130	0	434	9,420	5,690	9,600	15,300
Georgia	1,070	104	738	44.9	85.1	475	0	19.8	0	741	102	3,280	102	3,380
Hawaii	267	8.10	385	1.61	18.6	0.24	0	0.92	0	1.48	377	683	377	1,060
Idaho	276	70.2	15,300	50.8	1,960	57.6	0	23.1	0	1.79	0	17,700	0	17,700
Illinois	1,480	92.1	234	36.2	10.7	431	0	55.0	21.0	8,140	0	10,500	21.0	10,500
Indiana	628	127	133	39.2	14.5	2,290	0	126	0	3,820	0	7,180	0	7,180
Iowa	390	32.0	35.0	165	19.7	288	0	75.5	0	1,680	0	2,690	0	2,690
Kansas	351	17.7	2,680	104	6.39	38.1	0	5.99	0	817	0	4,010	6.18	4,020
Kentucky	553	22.1	39.6	40.8	48.4	225	0	40.6	0	1,860	0	2,830	0	2,830
Louisiana	709	39.3	1,050	6.35	493	2,140	0	6.24	0	4,040	261	8,480	261	8,750
Maine	85.0	31.6	18.9	2.05	54.0	182	42.9	6.33	0	5.30	80.7	385	124	509
Maryland	750	114	64.1	8.00	7.98	49.4	1.37	16.8	0	220	5,300	1,230	5,300	6,530
Massachusetts	648	35.1	139	1.03	9.93	27.9	0	9.60	0	50.1	487	920	488	1,410
Michigan	1,030	187	332	23.7	73.8	518	0	85.7	0.58	7,800	0	10,100	0.58	10,100
Minnesota	515	82.2	276	58.9	16.5	259	0	9.20	0	2,010	0	3,230	0	3,230
Mississippi	400	48.1	1,770	17.1	127	182	0	9.45	6.58	118	8.42	2,670	15.0	2,690
Missouri	797	57.5	1,370	63.7	164	85.2	0	29.6	0	5,860	0	8,430	0	8,430
Montana	153	23.7	9,450	42.2	17.1	9.67	0	21.6	16.3	75.7	0	9,800	16.3	9,810
Nebraska	275	19.0	6,090	110	26.5	44.3	0	9.60	6.41	2,920	0	9,490	6.41	9,500
Nevada	531	35.8	2,070	4.94	34.0	5.71	0	195	11.3	8.73	70.9	2,880	82.2	2,960
New Hampshire	95.5	29.7	5.20	0.84	17.2	12.6	0	6.13	0	74.8	693	242	693	935
New Jersey	1,180	90.7	93.9	0.88	9.78	94.1	0	58.3	0	361	3,430	1,880	3,430	5,310
New Mexico	262	24.6	2,370	32.0	24.1	3.40	0	56.8	89.4	33.5	0	2,810	89.4	2,900
New York	2,420	187	53.5	25.7	60.4	312	8.43	40.2	0.95	2,210	5,470	5,310	5,480	10,800
North Carolina	938	169	325	66.5	1,000	193	0	38.3	0	6,180	1,360	8,920	1,360	10,300
North Dakota	84.2	3.69	233	20.8	5.32	19.6	0	30.7	15.1	983	0	1,380	15.1	1,400
Ohio	1,310	139	55.0	24.6	39.3	348	0	129	0	4,480	0	6,520	0	6,520
Oklahoma	611	30.3	931	70.6	3.29	52.0	0	37.4	155	71.7	0	1,810	155	1,960
Oregon	567	73.9	5,160	16.3	634	105	0	11.3	0	11.4	0	6,580	0	6,580
Pennsylvania	1,390	208	34.3	39.5	96.0	645	0	38.1	5.60	3,580	0	6,030	5.60	6,040
Rhode Island	97.5	6.57	4.25	0.12	6.81	2.05	0.03	2.92	0	1.33	222	122	222	343
South Carolina	633	118	126	9.87	6.69	286	0	10.1	0	4,980	0	6,170	0	6,170
South Dakota	72.0	5.56	211	47.9	28.5	24.4	0	8.65	0	2.39	0	400	0	400
Tennessee	850	42.8	63.8	23.4	56.9	734	0	31.4	0	4,620	0	6,420	0	6,420
Texas	2,890	137	5,490	276	23.2	323	601	131	1,000	9,640	757	18,900	2,390	21,300
Utah	627	10.4	3,030	15.9	83.1	54.2	79.0	3.47	258	61.0	8.46	3,880	350	4,230
Vermont	42.7	11.0	3.11	5.87	12.0	11.0	0	4.56	0	0.80	0	90.9	0	90.9
Virginia	697	125	51.7	27.0	113	370	5.15	24.9	0	2,910	2,400	4,310	2,420	6,730
Washington	867	110	2,520	29.7	245	412	0	17.0	0	52.2	0	4,260	0	4,260
West Virginia	185	31.3	4.15	5.08	39.3	424	3.05	53.3	1.52	1,570	0	2,320	4.57	2,320
Wisconsin	479	76.4	460	74.5	48.2	382	0	29.3	0	4,210	0	5,760	0	5,760
Wyoming	101	8.93	7,790	16.2	28.8	8.04	0	44.5	96.8	51.8	0	8,050	96.8	8,140
Puerto Rico	576	0.52	75.7	5.83	0.63	3.67	0	2.02	0	4.65	1,700	669	1,700	2,370
U.S. Virgin Islands	4.27	3.78	0	0.02	0	0.52	0	0	0.02	0.14	96.5	5.37	99.9	105
TOTAL	39,000	3,260	118,000	2,000	7,550	14,000	786	1,880	2,120	95,100	37,800	281,000	41,000	322,000

Table 2*B*. Total water withdrawals by water-use category, 2015, in thousand acre-feet per year.

[Values may not sum to totals because of independent rounding. Values for public supply and aquaculture include fresh and saline-water withdrawals]

State	Public supply	Domestic	Irrigation	Livestock	Aquaculture	Industrial		Mining		Thermoelectric power		Total		
	Total	Fresh	Fresh	Fresh	Total	Fresh	Saline	Fresh	Saline	Fresh	Saline	Fresh	Saline	Total
Alabama	854	41.1	250	29.4	55.4	554	0	33.9	0	7,430	0	9,250	0	9,250
Alaska	111	12.8	1.70	0.15	459	9.36	2.05	40.8	146	74.8	0	710	148	858
Arizona	1,340	26.9	5,080	43.6	38.7	6.86	0	76.6	0	93.6	0	6,700	0	6,700
Arkansas	407	14.4	13,000	38.2	282	176	0	3.44	0	1,620	0	15,500	0	15,500
California	5,770	142	21,300	205	815	447	0	51.3	305	40.8	3,180	28,700	3,550	32,200
Colorado	946	39.6	10,100	37.3	292	94.2	0	8.63	27.1	41.7	0	11,500	27.1	11,600
Connecticut	269	34.6	12.7	1.29	28.2	203	46.7	4.76	0	142	2,770	691	2,820	3,510
Delaware	96.8	16.3	127	1.50	2.22	338	0	0.73	0	16.1	287	598	287	886
District of Columbia	0	0	0.06	0	0	0	0	0	0	0	0	0.06	0	0.06
Florida	2,670	198	2,740	29.2	16.8	275	1.21	146	0	487	10,600	6,370	10,800	17,100
Georgia	1,200	117	827	50.3	95.4	533	0	22.2	0	831	114	3,680	114	3,790
Hawaii	299	9.08	432	1.80	20.9	0.27	0	1.03	0	1.66	423	766	423	1,190
Idaho	309	78.6	17,100	56.9	2,200	64.6	0	25.9	0	2.01	0	19,900	0	19,900
Illinois	1,650	103	262	40.6	12.0	483	0	61.7	23.5	9,120	0	11,700	23.5	11,800
Indiana	704	143	149	43.9	16.2	2,560	0	141	0	4,280	0	8,050	0	8,050
Iowa	438	35.8	39.2	185	22.1	322	0	84.7	0	1,890	0	3,010	0	3,010
Kansas	394	19.8	3,000	117	7.16	42.7	0	6.71	0	916	0	4,500	6.93	4,510
Kentucky	620	24.8	44.3	45.7	54.3	252	0	45.5	0	2,090	0	3,180	0	3,180
Louisiana	795	44.1	1,180	7.12	553	2,400	0	7.00	0	4,520	293	9,510	293	9,800
Maine	95.2	35.5	21.2	2.30	60.5	204	48.1	7.10	0	5.94	90.4	431	139	570
Maryland	840	128	71.8	8.97	8.95	55.4	1.54	18.8	0	247	5,940	1,380	5,940	7,320
Massachusetts	726	39.4	155	1.15	11.1	31.2	0	10.8	0	56.2	546	1,030	547	1,580
Michigan	1,160	210	372	26.6	82.8	581	0	96.0	0.65	8,750	0	11,300	0.65	11,300
Minnesota	578	92.2	310	66.0	18.5	290	0	10.3	0	2,260	0	3,620	0	3,620
Mississippi	449	54.0	1,980	19.2	142	204	0	10.6	7.38	132	9.44	2,990	16.8	3,010
Missouri	894	64.4	1,540	71.4	184	95.5	0	33.1	0	6,560	0	9,450	0	9,450
Montana	172	26.6	10,600	47.3	19.2	10.8	0	24.2	18.3	84.8	0	11,000	18.3	11,000
Nebraska	308	21.3	6,830	123	29.7	49.6	0	10.8	7.19	3,270	0	10,600	7.19	10,600
Nevada	596	40.1	2,320	5.54	38.2	6.40	0	219	12.6	9.79	79.5	3,230	92.2	3,320
New Hampshire	107	33.3	5.83	0.94	19.2	14.2	0	6.87	0	83.9	777	271	777	1,050
New Jersey	1,320	102	105	0.99	11.0	106	0	65.3	0	404	3,840	2,110	3,840	5,950
New Mexico	293	27.6	2,660	35.9	27.0	3.81	0	63.7	100	37.5	0	3,150	100	3,250
New York	2,720	210	60.0	28.8	67.7	350	9.45	45.1	1.06	2,480	6,140	5,960	6,150	12,100
North Carolina	1,050	189	364	74.6	1,120	217	0	42.9	0	6,930	1,520	10,000	1,520	11,500
North Dakota	94.4	4.14	261	23.3	5.96	22.0	0	34.4	16.9	1,100	0	1,550	16.9	1,560
Ohio	1,460	156	61.6	27.6	44.1	390	0	145	0	5,030	0	7,310	0	7,310
Oklahoma	685	34.0	1,040	79.2	3.69	58.3	0	42.0	173	80.4	0	2,030	173	2,200
Oregon	636	82.8	5,780	18.2	710	117	0	12.7	0	12.7	0	7,370	0	7,370
Pennsylvania	1,560	233	38.5	44.3	108	723	0	42.7	6.28	4,010	0	6,760	6.28	6,770
Rhode Island	109	7.36	4.76	0.13	7.63	2.30	0.03	3.27	0	1.49	249	136	249	385
South Carolina	710	133	141	11.1	7.50	321	0	11.3	0	5,580	0	6,920	0	6,920
South Dakota	80.7	6.23	236	53.6	31.9	27.4	0	9.70	0	2.68	0	448	0	448
Tennessee	952	48.0	71.6	26.3	63.8	822	0	35.2	0	5,180	0	7,200	0	7,200
Texas	3,230	153	6,150	309	26.0	362	674	147	1,130	10,800	849	21,200	2,670	23,800
Utah	702	11.6	3,390	17.8	93.1	60.7	88.5	3.89	289	68.4	9.48	4,340	392	4,740
Vermont	47.8	12.3	3.49	6.58	13.5	12.3	0	5.11	0	0.90	0	102	0	102
Virginia	782	140	57.9	30.3	127	415	5.77	27.9	0	3,270	2,690	4,830	2,710	7,540
Washington	971	123	2,830	33.3	275	462	0	19.1	0	58.5	0	4,770	0	4,770
West Virginia	207	35.1	4.65	5.69	44.1	476	3.42	59.8	1.70	1,760	0	2,600	5.12	2,600
Wisconsin	537	85.7	515	83.5	54.0	429	0	32.8	0	4,710	0	6,450	0	6,450
Wyoming	114	10.0	8,730	18.1	32.3	9.01	0	49.8	108	58.1	0	9,020	108	9,130
Puerto Rico	646	0.58	84.8	6.54	0.71	4.11	0	2.26	0	5.21	1,910	750	1,910	2,660
U.S. Virgin Islands	4.79	4.24	0	0.02	0	0.58	0	0	0.02	0.16	108	6.02	112	118
TOTAL	43,700	3,650	132,000	2,240	8,460	15,700	881	2,110	2,370	107,000	42,400	315,000	45,900	361,000

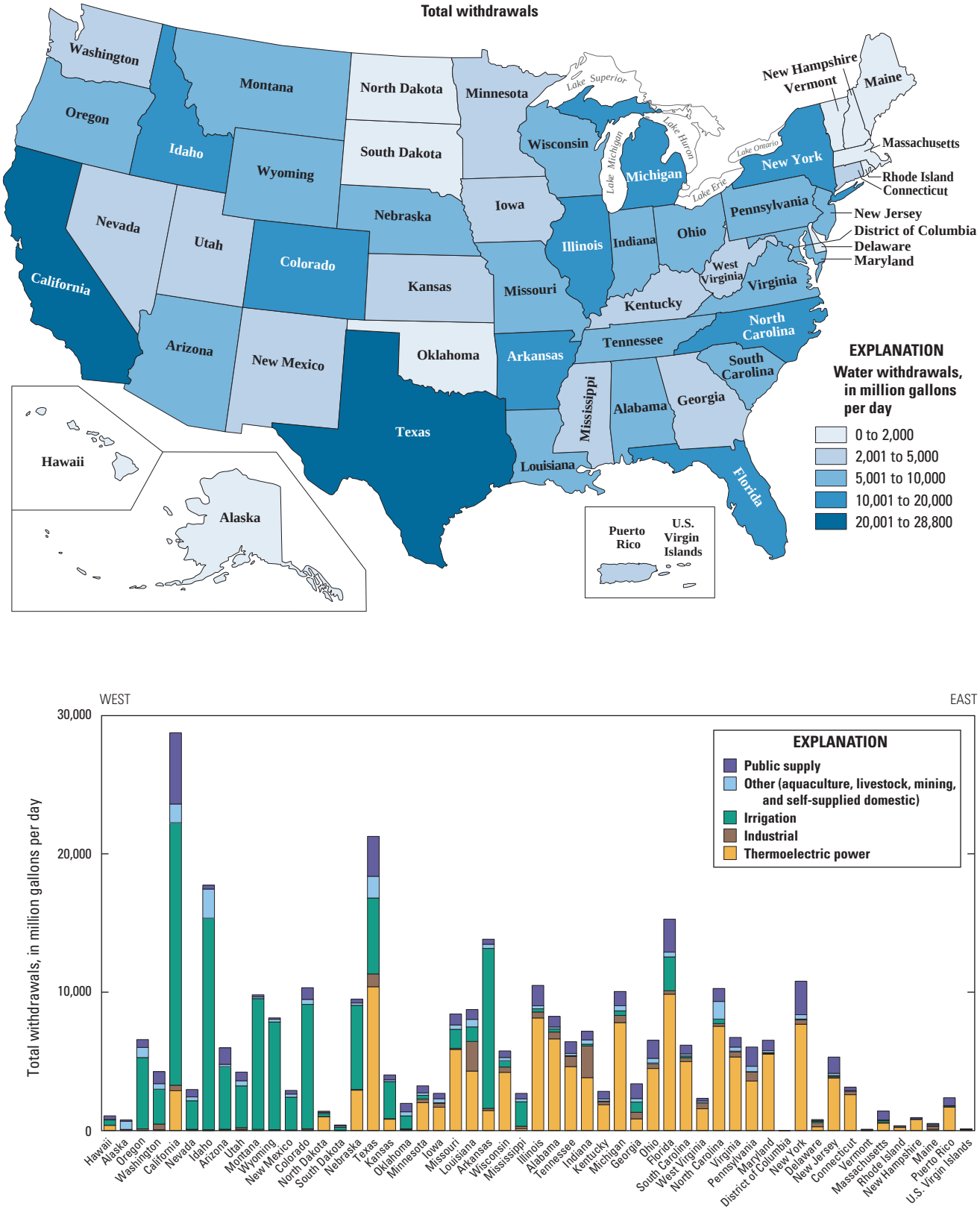


Figure 2. Total water withdrawals by State, and bar chart showing categories by State from west to east, 2015.

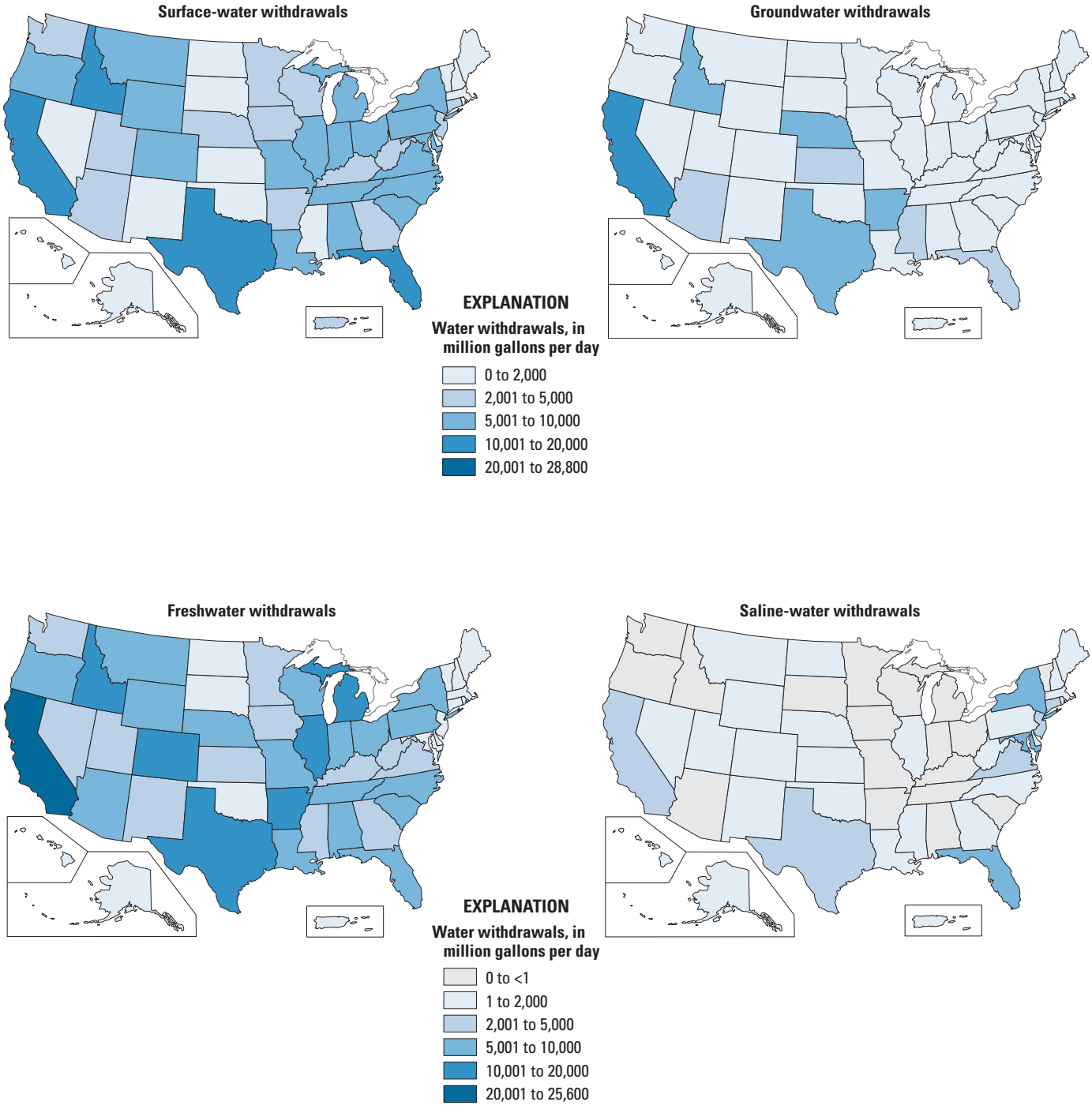


Figure 3. Surface-water and groundwater withdrawals, and freshwater and saline-water withdrawals, 2015.

Table 3*A*. Surface-water withdrawals by water-use category, 2015, in million gallons per day.

[Values may not sum to totals because of independent rounding. Values for public supply and aquaculture include fresh and saline-water withdrawals]

State	Public supply	Domes-tic	Irriga-tion	Live-stock	Aqua-culture	Industrial		Mining		Thermoelectric power		Total		
	Total	Fresh	Fresh	Fresh	Total	Fresh	Saline	Fresh	Saline	Fresh	Saline	Fresh	Saline	Total
Alabama	490	0	124	14.7	22.2	461	0	8.45	0	6,630	0	7,750	0	7,750
Alaska	61.4	1.59	0.02	0.09	240	1.65	1.83	36.4	41.4	66.1	0	408	43.2	451
Arizona	626	0	2,560	0	10.7	0	0	0	0	25.8	0	3,220	0	3,220
Arkansas	269	0	2,290	20.5	98.9	127	0	2.93	0	1,440	0	4,250	0	4,250
California	2,780	18.5	5,130	101	480	1.13	0	15.6	0.01	16.7	2,800	8,540	2,800	11,300
Colorado	735	0	7,690	10.6	244	79.9	0	2.46	0	34.1	0	8,800	0	8,800
Connecticut	197	0	8.29	0	16.0	141	41.6	3.43	0	126	2,470	489	2,510	3,000
Delaware	40.6	0	17.5	0	0	291	0	0.31	0	14.3	256	364	256	620
District of Columbia	0	0	0.05	0	0	0	0	0	0	0	0	0.05	0	0.05
Florida	307	0	1,290	0.35	2.10	63.6	1.08	40.7	0	406	9,400	2,110	9,400	11,500
Georgia	839	0	175	17.4	70.6	283	0	3.89	0	738	102	2,130	102	2,230
Hawaii	14.6	7.44	311	1.10	10.0	0	0	0.03	0	0	357	344	357	702
Idaho	29.2	0	10,400	9.57	1,920	12.7	0	21.8	0	0	0	12,400	0	12,400
Illinois	1,110	0	14.6	0	5.47	299	0	40.4	0	8,130	0	9,600	0	9,600
Indiana	288	0	40.0	13.0	8.00	2,210	0	121	0	3,800	0	6,480	0	6,480
Iowa	76.8	0	2.84	41.0	12.2	195	0	74.4	0	1,660	0	2,060	0	2,060
Kansas	214	0	122	20.4	3.23	7.63	0	0.55	0	809	0	1,180	0	1,180
Kentucky	465	7.63	36.7	38.7	47.8	148	0	22.9	0	1,860	0	2,630	0	2,630
Louisiana	355	0	333	3.19	156	1,890	0	4.59	0	4,000	261	6,740	261	7,000
Maine	57.5	0	13.8	0.51	43.1	176	42.9	4.88	0	4.38	80.7	300	124	424
Maryland	656	0	15.8	2.15	2.07	38.6	1.37	3.09	0	218	5,300	935	5,300	6,230
Massachusetts	449	0	24.1	0.39	1.80	12.7	0	4.09	0	49.0	487	540	488	1,030
Michigan	821	0	70.6	2.33	72.8	453	0	69.7	0	7,800	0	9,290	0	9,290
Minnesota	179	0	33.9	0	14.8	210	0	5.57	0	2,010	0	2,450	0	2,450
Mississippi	53.4	0	130	10.3	39.3	109	0	1.24	0	84.0	2.07	427	2.07	429
Missouri	516	0	75.3	47.6	157	42.8	0	8.47	0	5,840	0	6,690	0	6,690
Montana	69.9	1.12	9,390	29.9	13.6	4.45	0	20.5	0	74.9	0	9,610	0	9,610
Nebraska	57.2	0	674	20.4	16.0	2.32	0	9.54	0	2,900	0	3,680	0	3,680
Nevada	390	0	1,090	0	22.4	4.69	0	8.13	0	1.69	0	1,520	0	1,520
New Hampshire	60.1	0	4.11	0.21	10.7	8.41	0	4.37	0	73.7	693	162	693	855
New Jersey	797	0	38.8	0	0	64.1	0	56.8	0	358	3,430	1,310	3,430	4,740
New Mexico	78.3	0	1,320	2.25	5.45	0	0	17.4	0	27.3	0	1,460	0	1,460
New York	1,810	0	35.7	8.89	49.5	283	8.43	34.6	0	2,200	5,470	4,420	5,480	9,910
North Carolina	780	0	241	14.6	990	178	0	8.26	0	6,180	1,360	8,400	1,360	9,750
North Dakota	48.8	0	130	8.30	5.32	13.5	0	4.50	0	983	0	1,190	0	1,190
Ohio	857	2.72	37.1	16.8	26.0	210	0	37.6	0	4,470	0	5,660	0	5,660
Oklahoma	509	0	144	43.3	3.23	44.7	0	33.2	0	70.2	0	848	0	848
Oregon	420	7.54	3,940	13.2	601	101	0	2.85	0	9.79	0	5,100	0	5,100
Pennsylvania	1,160	0	16.8	3.17	47.2	599	0	5.21	0	3,570	0	5,410	0	5,410
Rhode Island	83.7	0	0.47	0.01	0.09	1.51	0.03	1.74	0	1.33	222	88.8	222	311
South Carolina	518	0	38.3	5.51	6.08	260	0	1.79	0	4,980	0	5,810	0	5,810
South Dakota	24.0	0	71.2	28.6	24.9	6.04	0	5.06	0	2.39	0	162	0	162
Tennessee	594	0	27.4	11.5	45.2	682	0	14.2	0	4,620	0	5,990	0	5,990
Texas	1,710	0	1,010	137	11.6	223	598	15.9	0.01	9,600	757	12,700	1,360	14,100
Utah	267	0	2,490	8.44	0	16.8	42.4	1.80	214	38.3	0	2,820	257	3,080
Vermont	28.8	0	2.09	1.46	7.84	9.46	0	4.33	0	0.26	0	54.2	0	54.2
Virginia	614	0	43.8	20.5	113	304	5.15	18.7	0	2,910	2,400	4,030	2,400	6,430
Washington	345	0	1,800	8.82	194	329	0	3.61	0	44.4	0	2,730	0	2,730
West Virginia	147	0	3.75	3.38	31.2	399	0	29.5	0	1,570	0	2,190	0	2,190
Wisconsin	214	0	173	7.44	22.6	336	0	28.8	0	4,200	0	4,980	0	4,980
Wyoming	46.8	0	7,250	10.0	23.9	2.21	0	11.4	0	50.5	0	7,400	0	7,400
Puerto Rico	510	0	34.1	1.60	0.63	0	0	0.18	0	2.83	1,700	549	1,700	2,250
U.S. Virgin Islands	3.36	2.55	0	0.01	0	0	0	0	0.02	0.14	96.5	2.70	99.9	103
TOTAL	23,800	49.1	60,900	760	5,950	11,300	743	877	256	94,700	37,600	198,000	38,600	237,000

Table 3*B*. Surface-water withdrawals by water-use category, 2015, in thousand acre-feet per year.

[Values may not sum to totals because of independent rounding. Values for public supply and aquaculture include fresh and saline-water withdrawals]

State	Public supply	Domes-tic	Irriga-tion	Live-stock	Aqua-culture	Industrial		Mining		Thermoelectric power		Total		
	Total	Fresh	Fresh	Fresh	Total	Fresh	Saline	Fresh	Saline	Fresh	Saline	Fresh	Saline	Total
Alabama	549	0	139	16.4	24.8	517	0	9.47	0	7,430	0	8,680	0	8,680
Alaska	68.8	1.78	0.02	0.10	269	1.85	2.05	40.8	46.4	74.1	0	457	48.4	505
Arizona	702	0	2,870	0	12.0	0	0	0	0	28.9	0	3,610	0	3,610
Arkansas	301	0	2,560	23.0	111	143	0	3.28	0	1,620	0	4,760	0	4,760
California	3,120	20.8	5,750	113	538	1.27	0	17.4	0.01	18.8	3,140	9,580	3,140	12,700
Colorado	824	0	8,620	11.8	274	89.5	0	2.76	0	38.3	0	9,860	0	9,860
Connecticut	221	0	9.29	0	18.0	158	46.7	3.85	0	142	2,770	548	2,820	3,360
Delaware	45.5	0	19.6	0	0	326	0	0.35	0	16.0	287	408	287	695
District of Columbia	0	0	0.06	0	0	0	0	0	0	0	0	0.06	0	0.06
Florida	344	0	1,450	0.39	2.35	71.3	1.21	45.7	0	455	10,500	2,370	10,500	12,900
Georgia	941	0	196	19.5	79.1	317	0	4.36	0	827	114	2,380	114	2,500
Hawaii	16.4	8.34	349	1.23	11.2	0	0	0.03	0	0	400	386	400	787
Idaho	32.7	0	11,600	10.7	2,150	14.2	0	24.4	0	0	0	13,900	0	13,900
Illinois	1,240	0	16.3	0	6.13	335	0	45.3	0	9,120	0	10,800	0	10,800
Indiana	323	0	44.8	14.5	8.97	2,470	0	135	0	4,260	0	7,260	0	7,260
Iowa	86.1	0	3.18	46.0	13.7	218	0	83.4	0	1,860	0	2,310	0	2,310
Kansas	240	0	136	22.9	3.62	8.55	0	0.62	0	907	0	1,320	0	1,320
Kentucky	522	8.55	41.2	43.4	53.6	166	0	25.7	0	2,080	0	2,940	0	2,940
Louisiana	398	0	373	3.58	175	2,120	0	5.15	0	4,480	293	7,560	293	7,850
Maine	64.5	0	15.5	0.57	48.3	198	48.1	5.47	0	4.91	90.4	336	139	475
Maryland	735	0	17.7	2.41	2.32	43.3	1.54	3.46	0	244	5,940	1,050	5,940	6,990
Massachusetts	503	0	27.0	0.44	2.02	14.2	0	4.58	0	55.0	546	605	547	1,150
Michigan	920	0	79.2	2.61	81.6	508	0	78.1	0	8,740	0	10,400	0	10,400
Minnesota	201	0	38.0	0	16.6	235	0	6.24	0	2,250	0	2,750	0	2,750
Mississippi	59.8	0	145	11.5	44.1	122	0	1.39	0	94.2	2.32	479	2.32	481
Missouri	578	0	84.4	53.3	176	48.0	0	9.49	0	6,550	0	7,500	0	7,500
Montana	78.3	1.26	10,500	33.5	15.3	4.99	0	23.0	0	84.0	0	10,800	0	10,800
Nebraska	64.2	0	755	22.9	17.9	2.60	0	10.7	0	3,250	0	4,130	0	4,130
Nevada	437	0	1,230	0	25.1	5.26	0	9.11	0	1.89	0	1,700	0	1,700
New Hampshire	67.4	0	4.61	0.24	12.0	9.43	0	4.90	0	82.6	777	181	777	958
New Jersey	893	0	43.5	0	0	71.8	0	63.6	0	402	3,840	1,470	3,840	5,310
New Mexico	87.8	0	1,490	2.52	6.11	0	0	19.6	0	30.6	0	1,630	0	1,630
New York	2,030	0	40.0	9.97	55.4	317	9.45	38.8	0	2,470	6,140	4,960	6,150	11,100
North Carolina	875	0	270	16.3	1,110	200	0	9.26	0	6,930	1,520	9,410	1,520	10,900
North Dakota	54.7	0	146	9.30	5.96	15.1	0	5.04	0	1,100	0	1,340	0	1,340
Ohio	960	3.05	41.6	18.8	29.2	235	0	42.2	0	5,010	0	6,340	0	6,340
Oklahoma	571	0	161	48.5	3.62	50.1	0	37.2	0	78.6	0	950	0	950
Oregon	471	8.45	4,420	14.8	674	114	0	3.19	0	11.0	0	5,710	0	5,710
Pennsylvania	1,310	0	18.9	3.55	52.9	671	0	5.84	0	4,000	0	6,060	0	6,060
Rhode Island	93.8	0	0.53	0.01	0.10	1.69	0.03	1.95	0	1.49	249	99.6	249	348
South Carolina	581	0	43.0	6.18	6.82	292	0	2.01	0	5,580	0	6,510	0	6,510
South Dakota	26.9	0	79.8	32.0	27.9	6.77	0	5.67	0	2.68	0	182	0	182
Tennessee	666	0	30.7	12.9	50.7	765	0	16.0	0	5,180	0	6,720	0	6,720
Texas	1,920	0	1,140	154	13.0	250	670	17.8	0.01	10,800	849	14,300	1,520	15,800
Utah	300	0	2,790	9.46	0	18.8	47.5	2.02	240	42.9	0	3,160	288	3,450
Vermont	32.2	0	2.34	1.64	8.79	10.6	0	4.85	0	0.29	0	60.8	0	60.8
Virginia	689	0	49.0	23.0	127	341	5.77	20.9	0	3,270	2,690	4,520	2,690	7,210
Washington	387	0	2,020	9.89	218	369	0	4.05	0	49.8	0	3,060	0	3,060
West Virginia	165	0	4.20	3.79	35.0	447	0	33.1	0	1,760	0	2,450	0	2,450
Wisconsin	240	0	194	8.34	25.4	376	0	32.3	0	4,710	0	5,590	0	5,590
Wyoming	52.5	0	8,130	11.2	26.8	2.48	0	12.7	0	56.6	0	8,290	0	8,290
Puerto Rico	571	0	38.2	1.79	0.71	0	0	0.20	0	3.17	1,910	616	1,910	2,520
U.S. Virgin Islands	3.77	2.86	0	0.01	0	0	0	0	0.02	0.16	108	3.03	112	115
TOTAL	26,700	55.0	68,300	852	6,670	12,700	833	983	287	106,000	42,200	222,000	43,300	266,000

Table 4*A*. Groundwater withdrawals by water-use category, 2015, in million gallons per day.

[Values may not sum to totals because of independent rounding. Values for public supply and aquaculture include fresh and saline-water withdrawals]

State	Public supply	Domestic	Irrigation	Livestock	Aquaculture	Industrial		Mining		Thermoelectric power		Total		
	Total	Fresh	Fresh	Fresh	Total	Fresh	Saline	Fresh	Saline	Fresh	Saline	Fresh	Saline	Total
Alabama	272	36.7	98.8	11.5	27.2	32.7	0	21.8	0	0	0	501	0	501
Alaska	37.8	9.83	1.50	0.04	169	6.70	0	0	89.2	0.63	0	226	89.2	315
Arizona	569	24.0	1,970	38.9	23.8	6.12	0	68.3	0	57.7	0	2,760	0	2,760
Arkansas	94.2	12.8	9,280	13.6	152	29.5	0	0.14	0	3.13	0	9,590	0	9,590
California	2,370	108	13,900	82.0	247	397	0	30.2	272	19.6	35.1	17,100	359	17,400
Colorado	109	35.4	1,310	22.7	16.0	4.22	0	5.24	24.2	3.03	0	1,500	24.2	1,530
Connecticut	43.0	30.8	3.02	1.15	9.15	40.1	0	0.82	0	0	0	128	0	128
Delaware	45.8	14.5	95.4	1.34	1.98	10.7	0	0.34	0	0.13	0	170	0	170
District of Columbia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Florida	2,080	177	1,150	25.7	12.8	181	0	89.1	0	27.8	28.5	3,580	198	3,770
Georgia	231	104	564	27.5	14.5	193	0	15.9	0	3.43	0	1,150	0	1,150
Hawaii	252	0.66	73.8	0.51	8.58	0.24	0	0.89	0	1.48	20.2	338	20.2	359
Idaho	247	70.2	4,900	41.2	46.2	45.0	0	1.35	0	1.79	0	5,350	0	5,350
Illinois	367	92.1	219	36.2	5.23	132	0	14.6	21.0	4.21	0	870	21.0	891
Indiana	339	127	93.1	26.2	6.46	79.9	0	5.52	0	20.8	0	699	0	699
Iowa	314	32.0	32.2	124	7.46	92.8	0	1.08	0	27.0	0	630	0	630
Kansas	137	17.7	2,560	83.5	3.16	30.5	0	5.44	0	7.81	0	2,840	6.18	2,840
Kentucky	87.4	14.5	2.84	2.07	0.58	77.3	0	17.6	0	4.96	0	207	0	207
Louisiana	354	39.3	720	3.16	337	250	0	1.65	0	37.0	0	1,740	0	1,740
Maine	27.5	31.6	5.06	1.54	10.9	5.83	0	1.45	0	0.92	0	84.8	0	84.8
Maryland	93.9	114	48.3	5.85	5.91	10.8	0	13.7	0	2.30	0	295	0	295
Massachusetts	199	35.1	114	0.64	8.13	15.2	0	5.51	0	1.10	0	380	0	380
Michigan	209	187	261	21.4	1.06	64.6	0	16.0	0.58	5.61	0	766	0.58	767
Minnesota	336	82.2	242	58.9	1.72	49.0	0	3.63	0	1.77	0	776	0	776
Mississippi	347	48.1	1,640	6.85	87.5	72.8	0	8.21	6.58	33.7	6.35	2,240	12.9	2,260
Missouri	282	57.5	1,300	16.1	6.77	42.4	0	21.1	0	13.8	0	1,740	0	1,740
Montana	83.3	22.6	59.6	12.3	3.49	5.22	0	1.06	16.3	0.80	0	188	16.3	205
Nebraska	218	19.0	5,420	89.7	10.5	42.0	0	0.06	6.41	16.8	0	5,810	6.41	5,820
Nevada	142	35.8	972	4.94	11.6	1.02	0	187	11.3	7.04	70.9	1,360	82.2	1,440
New Hampshire	35.4	29.7	1.09	0.63	6.46	4.21	0	1.76	0	1.10	0	80.4	0	80.4
New Jersey	379	90.7	55.1	0.88	9.78	30.0	0	1.48	0	2.08	0	569	0	569
New Mexico	184	24.6	1,050	29.8	18.7	3.40	0	39.4	89.4	6.13	0	1,350	89.4	1,440
New York	614	187	17.8	16.8	11.0	29.4	0	5.64	0.95	7.30	0	890	0.95	890
North Carolina	158	169	83.8	51.9	13.3	15.0	0	30.0	0	0.18	0	520	0	520
North Dakota	35.4	3.69	102	12.5	0	6.18	0	26.2	15.1	0.42	0	187	15.1	202
Ohio	450	137	17.9	7.83	13.3	138	0	91.3	0	11.0	0	866	0	866
Oklahoma	102	30.3	787	27.4	0.06	7.27	0	4.22	155	1.59	0	960	155	1,110
Oregon	147	66.4	1,220	3.02	32.8	3.45	0	8.45	0	1.57	0	1,480	0	1,480
Pennsylvania	227	208	17.5	36.3	48.8	45.9	0	32.9	5.60	5.38	0	622	5.60	628
Rhode Island	13.8	6.57	3.78	0.11	6.72	0.54	0	1.18	0	0	0	32.7	0	32.7
South Carolina	115	118	87.9	4.36	0.61	26.3	0	8.28	0	4.52	0	365	0	365
South Dakota	48.0	5.56	139	19.3	3.57	18.4	0	3.59	0	0	0	238	0	238
Tennessee	256	42.8	36.4	12.0	11.7	51.6	0	17.1	0	2.18	0	430	0	430
Texas	1,170	137	4,480	138	11.6	99.8	3.28	116	1,000	37.7	0	6,170	1,030	7,200
Utah	359	10.4	537	7.46	83.1	37.4	36.6	1.67	43.7	22.7	8.46	1,050	93.2	1,150
Vermont	13.9	11.0	1.02	4.41	4.17	1.51	0	0.23	0	0.54	0	36.7	0	36.7
Virginia	82.8	125	7.93	6.52	0.15	66.0	0	6.20	0	1.08	2.72	284	14.3	298
Washington	521	110	720	20.8	50.6	83.5	0	13.4	0	7.77	0	1,530	0	1,530
West Virginia	37.7	31.3	0.40	1.70	8.10	25.7	3.05	23.8	1.52	1.19	0	130	4.57	134
Wisconsin	265	76.4	287	67.0	25.5	46.8	0	0.42	0	3.21	0	772	0	772
Wyoming	54.5	8.93	537	6.17	4.92	5.83	0	33.1	96.8	1.31	0	652	96.8	748
Puerto Rico	66.6	0.52	41.6	4.23	0	3.67	0	1.84	0	1.82	0	120	0	120
U.S. Virgin Islands	0.91	1.23	0	0.01	0	0.52	0	0	0	0	0	2.67	0	2.67
TOTAL	15,200	3,210	57,200	1,240	1,600	2,670	42.9	1,010	1,860	425	172	82,300	2,340	84,700

Table 4*B*. Groundwater withdrawals by water-use category, 2015, in thousand acre-feet per year.

[Values may not sum to totals because of independent rounding. Values for public supply and aquaculture include fresh and saline-water withdrawals]

State	Public supply	Domes-tic	Irriga-tion	Live-stock	Aqua-culture	Industrial		Mining		Thermoelectric power		Total		
	Total	Fresh	Fresh	Fresh	Total	Fresh	Saline	Fresh	Saline	Fresh	Saline	Fresh	Saline	Total
Alabama	305	41.1	111	12.9	30.6	36.6	0	24.4	0	0	0	561	0	561
Alaska	42.4	11.0	1.68	0.04	190	7.51	0	0	100	0.71	0	253	100	353
Arizona	638	26.9	2,210	43.6	26.7	6.86	0	76.6	0	64.7	0	3,090	0	3,090
Arkansas	106	14.4	10,400	15.2	171	33.1	0	0.16	0	3.51	0	10,700	0	10,700
California	2,650	121	15,500	92.0	276	446	0	33.9	305	22.0	39.4	19,100	403	19,500
Colorado	122	39.6	1,460	25.4	17.9	4.73	0	5.87	27.1	3.40	0	1,680	27.1	1,710
Connecticut	48.2	34.6	3.39	1.29	10.3	44.9	0	0.92	0	0	0	144	0	144
Delaware	51.3	16.3	107	1.50	2.22	12.0	0	0.38	0	0.15	0	191	0	191
District of Columbia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Florida	2,330	198	1,290	28.8	14.4	203	0	99.9	0	31.2	32.0	4,010	222	4,230
Georgia	259	117	632	30.9	16.3	216	0	17.9	0	3.85	0	1,290	0	1,290
Hawaii	283	0.74	82.7	0.57	9.62	0.27	0	1.00	0	1.66	22.7	379	22.7	402
Idaho	276	78.6	5,490	46.2	51.8	50.4	0	1.51	0	2.01	0	6,000	0	6,000
Illinois	411	103	245	40.6	5.86	148	0	16.4	23.5	4.72	0	976	23.5	999
Indiana	380	143	104	29.4	7.24	89.6	0	6.19	0	23.3	0	783	0	783
Iowa	352	35.8	36.1	139	8.36	104	0	1.21	0	30.2	0	706	0	706
Kansas	153	19.8	2,870	93.6	3.54	34.2	0	6.10	0	8.76	0	3,180	6.93	3,190
Kentucky	98.0	16.2	3.18	2.32	0.65	86.6	0	19.8	0	5.56	0	232	0	232
Louisiana	397	44.1	807	3.54	378	280	0	1.85	0	41.4	0	1,950	0	1,950
Maine	30.8	35.5	5.67	1.73	12.2	6.54	0	1.63	0	1.03	0	95.0	0	95.0
Maryland	105	128	54.1	6.56	6.63	12.2	0	15.3	0	2.58	0	330	0	330
Massachusetts	224	39.4	128	0.72	9.11	17.0	0	6.18	0	1.23	0	426	0	426
Michigan	235	210	293	24.0	1.19	72.4	0	18.0	0.65	6.29	0	859	0.65	860
Minnesota	377	92.2	272	66.0	1.93	54.9	0	4.07	0	1.98	0	870	0	870
Mississippi	389	54.0	1,840	7.68	98.1	81.6	0	9.20	7.38	37.8	7.12	2,520	14.5	2,530
Missouri	316	64.4	1,460	18.1	7.59	47.5	0	23.6	0	15.4	0	1,950	0	1,950
Montana	93.4	25.3	66.8	13.8	3.91	5.85	0	1.19	18.3	0.90	0	211	18.3	229
Nebraska	244	21.3	6,070	101	11.8	47.0	0	0.07	7.19	18.9	0	6,520	7.19	6,520
Nevada	159	40.1	1,090	5.54	13.0	1.14	0	210	12.6	7.89	79.5	1,530	92.2	1,620
New Hampshire	39.7	33.3	1.22	0.71	7.24	4.72	0	1.97	0	1.23	0	90.1	0	90.1
New Jersey	424	102	61.8	0.99	11.0	33.7	0	1.66	0	2.33	0	637	0	637
New Mexico	206	27.6	1,180	33.4	20.9	3.81	0	44.1	100	6.87	0	1,520	100	1,620
New York	688	210	20.0	18.8	12.3	32.9	0	6.32	1.06	8.18	0	997	1.06	998
North Carolina	177	189	93.9	58.2	14.9	16.8	0	33.7	0	0.20	0	583	0	583
North Dakota	39.6	4.14	115	14.0	0	6.93	0	29.3	16.9	0.47	0	209	16.9	226
Ohio	504	153	20.0	8.78	14.9	155	0	102	0	12.3	0	970	0	970
Oklahoma	114	34.0	882	30.7	0.07	8.15	0	4.73	173	1.78	0	1,080	173	1,250
Oregon	165	74.4	1,360	3.39	36.8	3.87	0	9.47	0	1.76	0	1,660	0	1,660
Pennsylvania	255	233	19.6	40.7	54.7	51.5	0	36.9	6.28	6.03	0	698	6.28	704
Rhode Island	15.4	7.36	4.24	0.12	7.53	0.61	0	1.32	0	0	0	36.6	0	36.6
South Carolina	129	133	98.5	4.89	0.68	29.5	0	9.28	0	5.07	0	410	0	410
South Dakota	53.8	6.23	156	21.6	4.00	20.6	0	4.02	0	0	0	267	0	267
Tennessee	287	48.0	40.8	13.4	13.1	57.8	0	19.2	0	2.44	0	482	0	482
Texas	1,320	153	5,020	155	13.0	112	3.68	130	1,130	42.2	0	6,920	1,150	8,070
Utah	403	11.6	602	8.36	93.1	41.9	41.0	1.87	49.0	25.5	9.48	1,180	105	1,290
Vermont	15.6	12.3	1.14	4.94	4.67	1.69	0	0.26	0	0.61	0	41.2	0	41.2
Virginia	92.9	140	8.89	7.31	0.17	74.0	0	6.95	0	1.21	3.05	318	16.0	334
Washington	584	123	807	23.4	56.8	93.6	0	15.1	0	8.71	0	1,710	0	1,710
West Virginia	42.2	35.1	0.45	1.91	9.08	28.8	3.42	26.7	1.70	1.33	0	146	5.12	151
Wisconsin	297	85.7	322	75.2	28.6	52.4	0	0.47	0	3.60	0	865	0	865
Wyoming	61.1	10.0	602	6.92	5.52	6.54	0	37.1	108	1.47	0	731	108	839
Puerto Rico	74.7	0.58	46.6	4.74	0	4.11	0	2.06	0	2.04	0	135	0	135
U.S. Virgin Islands	1.02	1.38	0	0.01	0	0.58	0	0	0	0	0	2.99	0	2.99
TOTAL	17,100	3,600	64,100	1,390	1,800	2,990	48.1	1,130	2,090	477	193	92,300	2,620	94,900

12 percent

Public Supply

39,000 million gallons per day

Public supply refers to water withdrawn by public and private water suppliers that provide water to at least 25 people or have a minimum of 15 connections. Public-supply water is delivered to users for domestic, commercial, thermoelectric, irrigation, and industrial purposes; it also is used for public services and system losses.

Data on population, public supply and self-served domestic populations, public-supply withdrawals with deliveries to domestic users, and self-supplied domestic withdrawals for 2015 were published by the USGS in Dieter and Maupin (2017) and Dieter and others (2017). Data and interpretations of the data presented in Dieter and Maupin (2017) and Dieter and others (2017) are superseded by this report and the concurrent data release (Dieter and others, 2018). Specifically, some county-level data have been revised for public-supply and self-supplied domestic populations (Florida and Georgia), public-supply withdrawals (Georgia, Nevada, Tennessee, and Utah), and self-supplied domestic withdrawals (Utah and U.S. Virgin Islands). Changes to public-supply deliveries for domestic uses also were made (Utah). Changes to public-supply population served, withdrawals (public supply and self-supplied domestic), and deliveries have caused changes to calculated values of county per capita rates (Florida, Utah, U.S. Virgin Islands).

In some States, public-supply water sources include desalinated seawater or brackish groundwater that has been treated to reduce dissolved solids. A combined total of 7.21 Mgal/d saline surface-water withdrawals for public-supply use were reported for the U.S. Virgin Islands, Texas, Florida, and Massachusetts. A combined total of 263 Mgal/d saline groundwater withdrawals for public-supply use were identified for Florida, California, Texas, Virginia, Kansas, and Utah. Saline withdrawals for public supply were identified for only eight States and represent less than 1 percent of total public-supply withdrawals; therefore, they are not listed separately in table 5 but are included in the estimated withdrawals. Discussions of public supply withdrawals below include these saline withdrawals.

A total of 39,000 Mgal/d (table 5), or 43,700 thousand acre-ft/yr (table 2*B*), of water were withdrawn for public supply in 2015. This amount is 7 percent less than the estimated amount of water withdrawn for public supply in 2010, continuing the decline in public-supply withdrawals observed from 2005 to 2010 (Maupin and others, 2014). Total public-supply withdrawals in 2015 were at the lowest levels since 1995 (approximately 40,200 Mgal/d) (Maupin and others, 2014). Public supply represents about 14 percent of total freshwater withdrawals and 21 percent of all withdrawals, excluding thermoelectric power.

An estimated 283 million people relied on public-supply water for household use in 2015. This number represents about 87 percent of the total United States population. About 33 percent of all public-supply withdrawals were made in the four States with the largest populations: California, Texas, New York, and Florida (fig. 4). Populations in the District of Columbia and Puerto Rico are supplied almost completely by public-supply systems, whereas only one-half of the populations in the U.S. Virgin Islands and Maine are supplied by public-supply systems. Sixty-one percent of water withdrawn for public supply in 2015 was from surface sources, such as lakes and streams; the other 39 percent was from groundwater.

Public-supply water tower in Baltimore County, Maryland.

Some States in the Nation, because of population, withdraw more than 1,000 Mgal/d of water for distribution or rely primarily on either surface water or groundwater as a source for public-supply potable water. Five States—California, New York, Texas, Pennsylvania, and Illinois—each withdrew more than 1,000 Mgal/d of surface water for public supply in 2015 and together accounted for 36 percent of the total surface-water withdrawals for public supply. In 36 States, including Puerto Rico and the U.S. Virgin Islands, surface-water sources provided more than one-half of

Water treatment plant, Baltimore, Maryland. Photograph by Cheryl A. Dieter, USGS.

the total public-supply withdrawals. Three States—California, Florida, and Texas—each withdrew more than 1,000 Mgal/d of groundwater for public supply in 2015 and accounted for 37 percent of total groundwater withdrawals for public supply (table 5; fig. 4). States that relied on groundwater for 75 percent or more of their public-supply withdrawals were Hawaii, Idaho, Florida, Mississippi, Iowa, and Nebraska.

Most of the public-supply withdrawals are delivered to customers for domestic, commercial, and industrial needs. Part of the total is used for public services, such as public pools, parks, firefighting, water and wastewater treatment, and municipal buildings, and some is unaccounted for because of leaks, flushing, tower maintenance, and other system losses. Public-supply deliveries to commercial, industrial, and thermoelectric-power users have not been reported by the USGS NWUSP since 1995. However, public-supply deliveries to domestic users are included in these data, which when combined with the self-supplied domestic withdrawals, completes the amount of water withdrawn directly for human consumption. Domestic deliveries represent the largest single component of public-supply withdrawals, averaging 60 percent of the total nationally. Estimates of public-supply deliveries for domestic use, by State, representing indoor and outdoor water uses at occupied residences, are identified in table 5. Estimates for commercial and industrial deliveries, public use, and system losses were not available for all States and, therefore, are included in table 5 as an aggregate number ("All other uses and system losses"). Some States reported public-supply deliveries to thermoelectric powerplants for 2015, and these data are presented in the "Thermoelectric Power" section of this report and are included in table 5.

Methods for estimating public-supply withdrawals, source of water, population served, and domestic deliveries varied by State. Common sources of information about withdrawals by source included data collected from water suppliers by State water regulatory agencies or through surveys. Estimates of the population served by public supply were derived using various sources, including reports from State agencies, the U.S. Environmental Protection Agency (EPA) Safe Drinking Water Information System (SDWIS) database, U.S. Census data, and information on service connections from public suppliers. Methods for estimating domestic deliveries included surveys of public-supply sales information, calculations using coefficients for per capita use, and development of average percentages of deliveries to various customer categories (Bradley, 2017).

Table 5. Public-supply water withdrawals, 2015.

[Values may not sum to totals because of independent rounding. Values for public supply include fresh and saline-water withdrawals. Abbreviations: Mgal/d, million gallons per day; —, not estimated; n/a, not applicable]

State	Population (thousands)			Withdrawals (Mgal/d)			Public-supply deliveries		
	Total	Served by public supply		By source		Total	Domestic use (Mgal/d)	Thermoelectric-power generation use (Mgal/d)	All other uses and system losses (Mgal/d)
		Population	Population (percent)	Ground-water	Surface water				
Alabama	4,860	4,320	89	272	490	762	320	—	441
Alaska	738	550	74	37.8	61.4	99.2	61.6	0.60	37.0
Arizona	6,830	6,610	97	569	626	1,200	963	0.50	231
Arkansas	2,980	2,830	95	94.2	269	363	252	—	111
California	39,100	37,700	96	2,370	2,780	5,150	3,230	38.9	1,880
Colorado	5,460	5,170	95	109	735	844	637	13.7	194
Connecticut	3,590	2,730	76	43.0	197	240	96.0	4.65	139
Delaware	946	764	81	45.8	40.6	86.4	61.1	—	25.2
District of Columbia	672	672	100	0	0	0	44.8	0	n/a
Florida	20,300	17,800	88	2,080	307	2,380	1,500	8.88	874
Georgia	10,200	8,700	85	231	839	1,070	661	—	409
Hawaii	1,430	1,380	96	252	14.6	267	198	—	68.9
Idaho	1,650	1,260	76	247	29.2	276	234	—	41.7
Illinois	12,900	11,700	91	367	1,110	1,480	937	—	539
Indiana	6,620	4,940	75	339	288	628	376	—	252
Iowa	3,120	2,630	84	314	76.8	390	171	0.16	219
Kansas	2,910	2,760	95	137	214	351	175	0.25	176
Kentucky	4,430	3,980	90	87.4	465	553	279	—	274
Louisiana	4,670	4,180	89	354	355	709	497	—	212
Maine	1,330	669	50	27.5	57.5	85.0	35.5	2.05	47.4
Maryland	6,010	4,580	76	93.9	656	750	320	—	430
Massachusetts	6,790	6,180	91	199	449	648	347	47.0	254
Michigan	9,920	7,330	74	209	821	1,030	481	—	550
Minnesota	5,490	4,310	79	336	179	515	236	—	279
Mississippi	2,990	2,560	85	347	53.4	400	251	0.01	149
Missouri	6,080	5,260	86	282	516	797	482	1.64	313
Montana	1,030	728	71	83.3	69.9	153	86.2	—	67.0
Nebraska	1,900	1,720	91	218	57.2	275	129	—	146
Nevada	2,890	2,700	93	142	390	531	330	0.49	201
New Hampshire	1,330	833	63	35.4	60.1	95.5	50.0	0.53	45.0
New Jersey	8,960	7,990	89	379	797	1,180	626	0.71	549
New Mexico	2,090	1,790	86	184	78.3	262	145	0.26	116
New York	19,800	17,300	87	614	1,810	2,420	1,230	17.1	1,180
North Carolina	10,000	7,640	76	158	780	938	534	8.33	395
North Dakota	757	711	94	35.4	48.8	84.2	56.8	0.05	27.3
Ohio	11,600	9,750	84	450	857	1,310	589	4.19	713
Oklahoma	3,910	3,550	91	102	509	611	247	6.96	357
Oregon	4,030	3,400	84	147	420	567	355	4.53	207
Pennsylvania	12,800	9,330	73	227	1,160	1,390	522	—	869
Rhode Island	1,060	943	89	13.8	83.7	97.5	56.0	1.44	40.0
South Carolina	4,900	3,710	76	115	518	633	371	3.93	258
South Dakota	881	752	85	48.0	24.0	72.0	43.7	—	28.2
Tennessee	6,600	6,010	91	256	594	850	486	—	363
Texas	27,500	26,200	95	1,170	1,710	2,890	2,120	48.3	712
Utah	3,000	2,930	98	359	267	627	496	1.33	129
Vermont	626	382	61	13.9	28.8	42.7	16.6	—	26.1
Virginia	8,380	6,820	81	82.8	614	697	546	0.29	151
Washington	7,170	6,150	86	521	345	867	631	1.63	234
West Virginia	1,840	1,450	79	37.7	147	185	116	0.62	68.7
Wisconsin	5,770	4,170	72	265	214	479	240	0.23	239
Wyoming	586	467	80	54.5	46.8	101	82.3	—	19.0
Puerto Rico	3,470	3,470	100	66.6	510	576	338	0.97	237
U.S. Virgin Islands	104	51.9	50	0.91	3.36	4.27	2.74	—	1.53
TOTAL	325,000	283,000	87	15,200	23,800	39,000	23,300	220	15,500

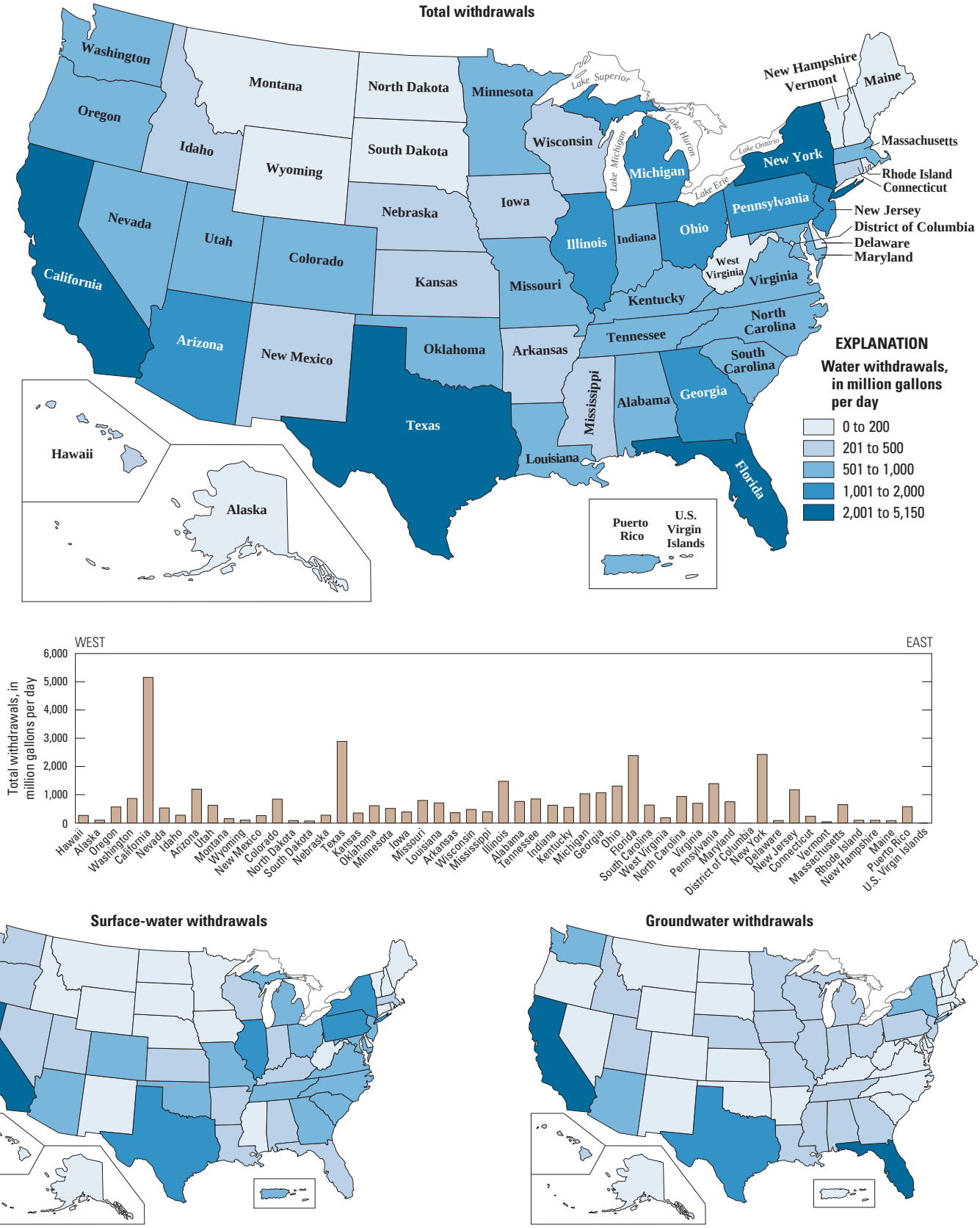


Figure 4. Public-supply withdrawals by source and State, 2015.

1 percent

Domestic

3,260 million gallons per day (self-supplied)
23,300 million gallons per day (public-supply deliveries)

Domestic water use includes indoor and outdoor uses at residences. Common indoor water uses are drinking, food preparation, washing clothes and dishes, bathing, and flushing toilets. Common outdoor uses are watering lawns and gardens or maintaining pools, ponds, or other landscape features in a domestic environment. Domestic water is either self-supplied or provided by public suppliers. Water for self-supplied domestic use is typically withdrawn from a private source, such as a well, or captured as rainwater in a cistern. Domestic deliveries are provided to homes by public suppliers. The proportion of total domestic water use from public-supply deliveries (88 percent) and self-supplied domestic withdrawals (12 percent) in the United States is shown in figure 5.

The estimated self-supplied and public-supplied populations in each State are listed in table 6, as well as the amounts used by each segment of the population for domestic needs and the respective per capita use in gallons per day (gallons per capita per day, GPCD). Domestic self-supplied withdrawals and public-supplied deliveries are combined in table 6 to show the total estimated domestic use in 2015 and the total per capita use in gallons per day calculated for all domestic use.

An estimated 42.5 million people in the United States, or 13 percent of the population, provided their own water for domestic use in 2015. These self-supplied withdrawals were estimated to be 3,260 Mgal/d (3,650 thousand acre-ft/yr), or about 1 percent of total withdrawals for all uses in 2015. Nearly all (98 percent) of these self-supplied withdrawals were from fresh groundwater sources. Self-supplied domestic withdrawals are rarely metered or reported; typically, this usage is calculated by multiplying an estimate of the population not served by public supply by a coefficient for daily per capita use. For some States, these coefficients were county-specific averages derived from observed residential water use and population estimates in nearby areas served by public suppliers. Other States used the same coefficient for all counties, commonly one used by State regulatory or planning agencies.

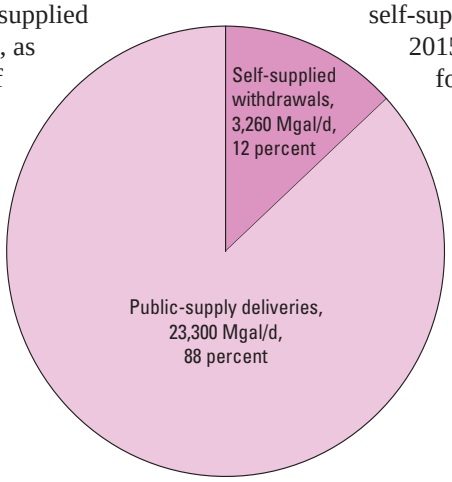


Figure 5. Total domestic water use from public-supply deliveries and self-supplied withdrawals, 2015. (Mgal/d, million gallons per day)

Self-supplied domestic per capita use ranged from 36 GPCD in Connecticut to 186 GPCD in Nevada. Generally, per capita use is least in the Northern and Eastern States and greatest in the Mountain and Western States where outdoor watering is more common. The national average self-supplied domestic per capita use in 2015 was 77 GPCD (table 6).

Most people in the United States used water provided by public suppliers. Domestic deliveries by public water suppliers totaled 23,300 Mgal/d in 2015 and represented water provided to 283 million people at single-family and multifamily dwellings. The District of Columbia and Puerto Rico have populations that are almost entirely supplied by public-supply systems. The District of Columbia had zero self-supplied domestic withdrawals estimated in 2015, and less than 1 Mgal/d was estimated for Puerto Rico in 2015. Per capita water use for domestic deliveries ranged from 35 GPCD in Connecticut to 186 GPCD in Idaho. The national average was 82 GPCD for public-supplied domestic water use in 2015. This per capita usage is less than the rate of 101 GPCD observed in 1995, 100 GPCD in 2005, and 88 GPCD in 2010. Domestic deliveries from public supply were not compiled nationally in 2000.

Combined self-supplied domestic withdrawals and public-supply deliveries totaled 26,600 Mgal/d in 2015, with 23,300 Mgal/d from public-supply deliveries (88 percent) and 3,260 Mgal/d from self-supplied withdrawals (12 percent), and the national average per capita use was 82 GPCD. The corresponding average per capita use for total domestic use in 2005 was 98 GPCD, and in 2010, it was 87 GPCD. The geographic distribution of total domestic water use by State is shown in figure 6*A*. The self-supplied domestic population in each State, in thousands of people and as a percentage of total State population, is shown in figure 6*B*. Self-supplied domestic populations were largest in Pennsylvania, Michigan, and New York. States where nearly one-half the population has a self-supplied water source were U.S. Virgin Islands and Maine.

Table 6. Domestic water withdrawals and deliveries, 2015.

[Values may not sum to totals because of independent rounding. Abbreviations: gal/d, gallons per day; Mgal/d, million gallons per day]

State	Self-supplied domestic						Public supply			Total domestic use		
	Self-supplied population (thousands)	Percent of total population	Withdrawals (Mgal/d)			Self-supplied per capita use (gal/d)	Population served (thousands)	Water deliveries (Mgal/d)	Public-supply per capita use (gal/d)	Total population (thousands)	Water use (withdrawals and deliveries) (Mgal/d)	Total domestic per capita use (gal/d)
			By source		Total							
			Groundwater	Surface water								
Alabama	539	11	36.7	0	36.7	68	4,320	320	74	4,860	357	73
Alaska	189	26	9.83	1.59	11.4	60	550	61.6	112	738	73.0	99
Arizona	218	3	24.0	0	24.0	110	6,610	963	146	6,830	987	145
Arkansas	144	5	12.8	0	12.8	89	2,830	252	89	2,980	265	89
California	1,440	4	108	18.5	127	88	37,700	3,230	86	39,100	3,350	86
Colorado	286	5	35.4	0	35.4	123	5,170	637	123	5,460	672	123
Connecticut	861	24	30.8	0	30.8	36	2,730	96.0	35	3,590	127	35
Delaware	182	19	14.5	0	14.5	80	764	61.1	80	946	75.7	80
District of Columbia	0	0	0	0	0	0	672	44.8	67	672	44.8	67
Florida	2,460	12	177	0	177	72	17,800	1,500	84	20,300	1,680	83
Georgia	1,510	15	104	0	104	69	8,700	661	76	10,200	765	75
Hawaii	56.3	4	0.66	7.44	8.10	144	1,380	198	144	1,430	206	144
Idaho	396	24	70.2	0	70.2	177	1,260	234	186	1,650	304	184
Illinois	1,150	9	92.1	0	92.1	80	11,700	937	80	12,900	1,030	80
Indiana	1,680	25	127	0	127	76	4,940	376	76	6,620	503	76
Iowa	494	16	32.0	0	32.0	65	2,630	171	65	3,120	203	65
Kansas	149	5	17.7	0	17.7	118	2,760	175	63	2,910	192	66
Kentucky	441	10	14.5	7.63	22.1	50	3,980	279	70	4,430	301	68
Louisiana	492	11	39.3	0	39.3	80	4,180	497	119	4,670	537	115
Maine	660	50	31.6	0	31.6	48	669	35.5	53	1,330	67.1	51
Maryland	1,420	24	114	0	114	80	4,580	320	70	6,010	433	72
Massachusetts	616	9	35.1	0	35.1	57	6,180	347	56	6,790	382	56
Michigan	2,600	26	187	0	187	72	7,330	481	66	9,920	668	67
Minnesota	1,180	21	82.2	0	82.2	70	4,310	236	55	5,490	318	58
Mississippi	435	15	48.1	0	48.1	111	2,560	251	98	2,990	299	100
Missouri	821	14	57.5	0	57.5	70	5,260	482	92	6,080	540	89
Montana	305	29	22.6	1.12	23.7	78	728	86.2	118	1,030	110	106
Nebraska	171	9	19.0	0	19.0	111	1,720	129	75	1,900	148	78
Nevada	193	7	35.8	0	35.8	186	2,700	330	122	2,890	365	126
New Hampshire	497	37	29.7	0	29.7	60	833	50.0	60	1,330	79.7	60
New Jersey	966	11	90.7	0	90.7	94	7,990	626	78	8,960	717	80
New Mexico	292	14	24.6	0	24.6	84	1,790	145	81	2,090	170	81
New York	2,500	13	187	0	187	75	17,300	1,230	71	19,800	1,410	71
North Carolina	2,410	24	169	0	169	70	7,640	534	70	10,000	703	70
North Dakota	46.4	6	3.69	0	3.69	80	711	56.8	80	757	60.5	80
Ohio	1,860	16	137	2.72	139	75	9,750	589	60	11,600	729	63
Oklahoma	357	9	30.3	0	30.3	85	3,550	247	69	3,910	277	71
Oregon	632	16	66.4	7.54	73.9	117	3,400	355	105	4,030	429	107
Pennsylvania	3,470	27	208	0	208	60	9,330	522	56	12,800	731	57
Rhode Island	113	11	6.57	0	6.57	58	943	56.0	59	1,060	62.6	59
South Carolina	1,180	24	118	0	118	100	3,710	371	100	4,900	490	100
South Dakota	129	15	5.56	0	5.56	43	752	43.7	58	881	49.3	56
Tennessee	594	9	42.8	0	42.8	72	6,010	486	81	6,600	529	80
Texas	1,320	5	137	0	137	104	26,200	2,120	81	27,500	2,260	82
Utah	61.4	2	10.4	0	10.4	169	2,930	496	169	3,000	506	169
Vermont	244	39	11.0	0	11.0	45	382	16.6	43	626	27.5	44
Virginia	1,560	19	125	0	125	80	6,820	546	80	8,380	671	80
Washington	1,020	14	110	0	110	107	6,150	631	103	7,170	741	103
West Virginia	392	21	31.3	0	31.3	80	1,450	116	80	1,840	147	80
Wisconsin	1,600	28	76.4	0	76.4	48	4,170	240	58	5,770	317	55
Wyoming	119	20	8.93	0	8.93	75	467	82.3	176	586	91.3	156
Puerto Rico	4.71	0	0.52	0	0.52	110	3,470	338	98	3,470	339	98
U.S. Virgin Islands	51.6	50	1.23	2.55	3.78	73	51.9	2.74	53	104	6.52	63
TOTAL	42,500	13	3,210	49.1	3,260	77	283,000	23,300	82	325,000	26,600	82

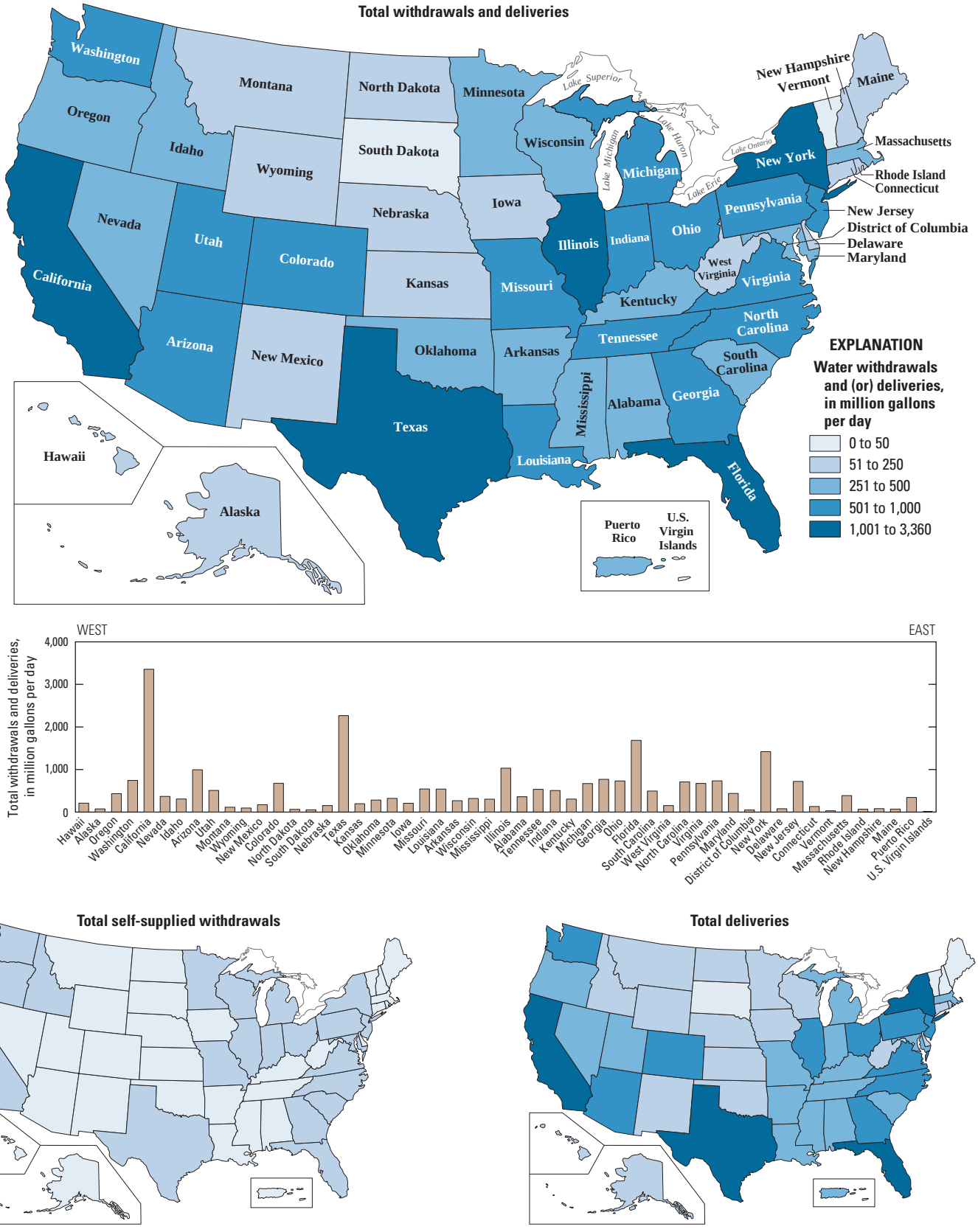


Figure 6*A*. Domestic withdrawals and deliveries by State, 2015.

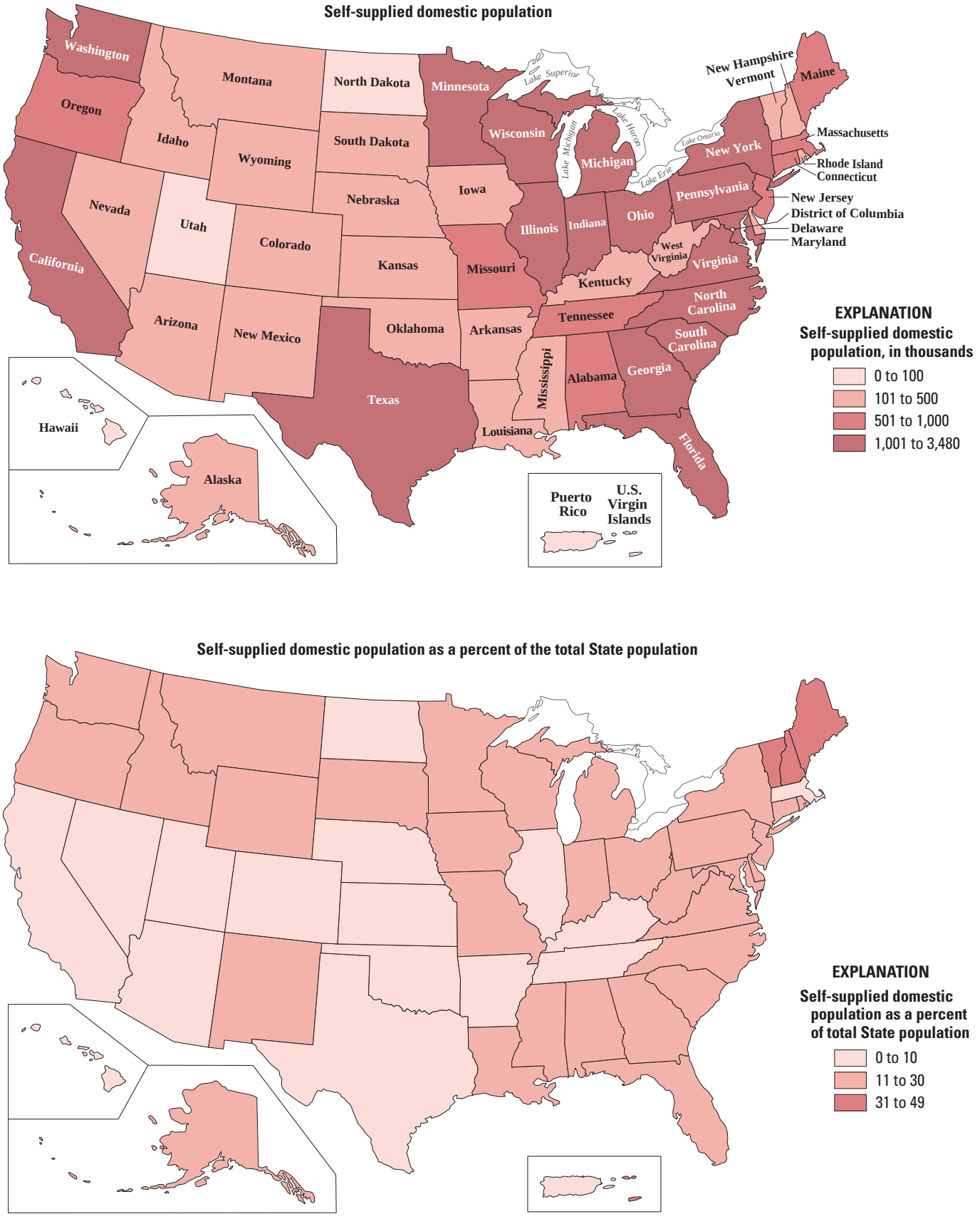
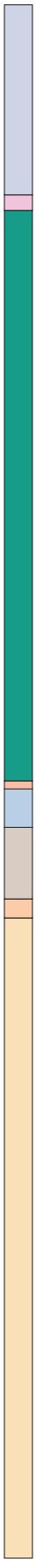


Figure 6*B*. Self-supplied domestic population and percentage of total population by State, 2015.



Irrigation

118,000 million gallons per day

Irrigation water use includes water that is applied by an irrigation system to sustain plant growth in agricultural and horticultural practices. In addition to the irrigation of crops, irrigation of golf courses, parks, nurseries, turf farms, cemeteries, and other self-supplied landscape-watering uses are included in the estimates. Irrigation also includes water that is used for other related processes, including pre-growing season application, frost protection, chemical application, weed control, field preparation, crop cooling, harvesting, dust suppression, and leaching salts from the root zone. Irrigation withdrawals generally are accounted for at the point of diversion (wells, springs, streams, ponds) and include water that was originally withdrawn from the source and water that is lost in conveyance prior to application on fields, as well as water that may subsequently return to a surface-water body as runoff after application, water consumed as evapotranspiration (ET) from plants and evaporation on ground surfaces, or water that recharges aquifers as it seeps past the root zone. Irrigation water use includes self-supplied withdrawals and deliveries from irrigation companies or districts, cooperatives, or governmental entities. All irrigation groundwater and surface-water withdrawals are considered freshwater. Included separately in the irrigation category is reclaimed wastewater from nearby treatment facilities or industries that is used as a source of irrigation water. Irrigated acres are reported for three types of irrigation methods: sprinkler, microirrigation, and surface (flood) systems.

Sources of data for irrigation withdrawals and irrigated acres included State and Federal crop reporting programs, irrigation districts, canal companies, incorporated management areas, satellite data depicting 2015 cropland landscapes, and evapotranspiration estimates. Withdrawals were estimated using information on irrigated crop acreages by crop type and specific crop water-consumption coefficients, or irrigation-system application rates, as well as soil-moisture balance models. Estimation methods varied from one State to the next and sometimes between geographic areas within a State. Estimation methods ideally included adjustments for climate, system efficiencies, conveyance losses, and other irrigation practices, such as pre-growing season irrigation, salt leaching, or frost protection. Other methods for estimating irrigation withdrawals included extrapolation of sample data on crop water-application rates or power-consumption coefficients. Although estimation methods vary by State and within States, irrigation estimates for the Nation provide a cohesive dataset with which to compare agricultural water use spatially and over time.

Irrigation withdrawals, reclaimed wastewater, and irrigated land by type of irrigation system are listed by State in table 7. For 2015, total groundwater and surface-water irrigation withdrawals were 118,000 Mgal/d, or 132,000 thousand acre-ft/yr, which accounted for 42 percent of total freshwater withdrawals and 64 percent of total freshwater withdrawals for all categories, excluding thermoelectric

Flood irrigation of cotton, Graham County, Arizona. Photograph by Saeid Tadayon, USGS.

Table 7. Irrigation water use, 2015.

[Values may not sum to totals because of independent rounding. Abbreviations: Mgal/d, million gallons per day; thousand acre-ft/yr, thousand acre-feet per year; —, not estimated]

State	Irrigated land (thousand acres)				Withdrawals (Mgal/d)			Reclaimed wastewater (Mgal/d)	Consumptive use (Mgal/d)	Withdrawals (thousand acre-ft/yr)			Reclaimed wastewater (thousand acre-ft/yr)	Consumptive use (thousand acre-ft/yr)
	By type of irrigation			Total	By source		Total			By source		Total		
	Sprinkler	Microirrigation	Surface		Groundwater	Surface water				Groundwater	Surface water			
Alabama	189	0	0	189	98.8	124	223	—	223	111	139	250	—	250
Alaska	2.95	0	0.07	3.02	1.50	0.02	1.52	—	1.39	1.68	0.02	1.70	—	1.56
Arizona	252	57.4	730	1,040	1,970	2,560	4,530	106	3,660	2,210	2,870	5,080	119	4,100
Arkansas	348	0	4,080	4,430	9,280	2,290	11,600	0	7,580	10,400	2,560	13,000	0	8,500
California	1,690	3,530	4,110	9,320	13,900	5,130	19,000	289	14,700	15,500	5,750	21,300	324	16,500
Colorado	1,430	2.70	1,600	3,040	1,310	7,690	9,000	4.28	2,650	1,460	8,620	10,100	4.80	2,970
Connecticut	17.5	0.71	0	18.2	3.02	8.29	11.3	—	10.7	3.39	9.29	12.7	—	12.0
Delaware	127	1.06	0	128	95.4	17.5	113	—	94.7	107	19.6	127	—	106
District of Columbia	0.12	0	0	0.12	0	0.05	0.05	—	0.04	0	0.06	0.06	—	0.04
Florida	590	720	716	2,030	1,150	1,290	2,450	195	1,700	1,290	1,450	2,740	219	1,900
Georgia	1,390	55.0	0	1,450	564	175	738	—	738	632	196	827	—	827
Hawaii	11.6	123	0	135	73.8	311	385	—	323	82.7	349	432	—	362
Idaho	2,570	3.08	1,220	3,790	4,900	10,400	15,300	—	8,920	5,490	11,600	17,100	—	10,000
Illinois	625	0	0	625	219	14.6	234	1.62	219	245	16.3	262	1.82	245
Indiana	449	0	0	449	93.1	40.0	133	—	120	104	44.8	149	—	134
Iowa	165	0	0	165	32.2	2.84	35.0	—	28.1	36.1	3.18	39.2	—	31.5
Kansas	2,990	39.8	92.7	3,120	2,560	122	2,680	3.94	2,200	2,870	136	3,000	4.42	2,460
Kentucky	68.4	10.3	0.63	79.3	2.84	36.7	39.6	—	35.7	3.18	41.2	44.3	—	40.0
Louisiana	90.2	0	881	972	720	333	1,050	—	700	807	373	1,180	—	784
Maine	40.0	0.05	0.81	40.9	5.06	13.8	18.9	—	18.0	5.67	15.5	21.2	—	20.2
Maryland	110	8.95	0.68	120	48.3	15.8	64.1	—	56.9	54.1	17.7	71.8	—	63.8
Massachusetts	25.7	2.06	12.7	40.5	114	24.1	139	—	29.8	128	27.0	155	—	33.4
Michigan	563	32.7	1.68	598	261	70.6	332	—	299	293	79.2	372	—	335
Minnesota	667	0	26.5	694	242	33.9	276	0	218	272	38.0	310	0	245
Mississippi	393	0	1,260	1,650	1,640	130	1,770	—	1,350	1,840	145	1,980	—	1,510
Missouri	492	53.6	635	1,180	1,300	75.3	1,370	—	436	1,460	84.4	1,540	—	489
Montana	1,280	0.64	1,190	2,470	59.6	9,390	9,450	—	2,370	66.8	10,500	10,600	—	2,660
Nebraska	7,350	16.6	2,210	9,580	5,420	674	6,090	—	5,540	6,070	755	6,830	—	6,210
Nevada	365	0.18	332	698	972	1,090	2,070	5.75	1,560	1,090	1,230	2,320	6.45	1,750
New Hampshire	6.46	0.84	0.25	7.55	1.09	4.11	5.20	—	4.94	1.22	4.61	5.83	—	5.54
New Jersey	81.0	31.0	2.98	115	55.1	38.8	93.9	—	63.9	61.8	43.5	105	—	71.6
New Mexico	385	18.8	355	759	1,050	1,320	2,370	4.43	1,410	1,180	1,490	2,660	4.97	1,580
New York	84.9	15.6	1.07	102	17.8	35.7	53.5	—	51.0	20.0	40.0	60.0	—	57.1
North Carolina	222	6.39	0	228	83.8	241	325	—	325	93.9	270	364	—	364
North Dakota	226	0	52.1	278	102	130	233	0	81.3	115	146	261	0	91.2
Ohio	66.9	7.70	0	74.6	17.9	37.1	55.0	0	49.4	20.0	41.6	61.6	0	55.3
Oklahoma	471	23.9	58.0	553	787	144	931	0	761	882	161	1,040	0	853
Oregon	1,350	88.3	520	1,960	1,220	3,940	5,160	—	3,440	1,360	4,420	5,780	—	3,860
Pennsylvania	58.0	19.5	0.44	78.0	17.5	16.8	34.3	—	31.0	19.6	18.9	38.5	—	34.8
Rhode Island	5.69	0.83	0.02	6.54	3.78	0.47	4.25	—	4.04	4.24	0.53	4.76	—	4.53
South Carolina	176	10.9	6.03	193	87.9	38.3	126	0	126	98.5	43.0	141	0	141
South Dakota	213	0	59.3	273	139	71.2	211	0	110	156	79.8	236	0	124
Tennessee	124	10.3	15.9	150	36.4	27.4	63.8	—	51.1	40.8	30.7	71.6	—	57.3
Texas	4,150	468	1,040	5,660	4,480	1,010	5,490	45.3	4,280	5,020	1,140	6,150	50.8	4,800
Utah	609	0.94	689	1,300	537	2,490	3,030	13.0	2,060	602	2,790	3,390	14.6	2,310
Vermont	4.68	1.47	0.65	6.80	1.02	2.09	3.11	—	2.93	1.14	2.34	3.49	—	3.28
Virginia	95.5	11.1	0	107	7.93	43.8	51.7	—	44.0	8.89	49.0	57.9	—	49.3
Washington	1,260	76.4	223	1,560	720	1,800	2,520	0	1,990	807	2,020	2,830	0	2,230
West Virginia	4.14	0	1.67	5.81	0.40	3.75	4.15	—	3.52	0.45	4.20	4.65	—	3.95
Wisconsin	508	6.09	20.0	534	287	173	460	—	293	322	194	515	—	329
Wyoming	237	5.56	1,190	1,440	537	7,250	7,790	—	2,150	602	8,130	8,730	—	2,410
Puerto Rico	15.6	27.9	0.77	44.2	41.6	34.1	75.7	—	73.2	46.6	38.2	84.8	—	82.0
U.S. Virgin Islands	0	0	0	0	0	0	0	—	0	0	0	0	—	0
TOTAL	34,700	5,490	23,300	63,500	57,200	60,900	118,000	669	73,200	64,100	68,300	132,000	750	82,000

Irrigation well in Puerto Rico. Photograph by José A. Santiago-Saez, USGS.

power. Total irrigation withdrawals were about 2 percent more than in 2010. Withdrawals from surface-water sources were 60,900 Mgal/d, which accounted for 52 percent of the total irrigation withdrawals, and were about 8 percent less than in 2010. Groundwater withdrawals for 2015 were 57,200 Mgal/d, which accounts for 48 percent of the total irrigation withdrawals, and were 16 percent more than in 2010. About 63,500 thousand acres were irrigated in 2015, an increase of 1,130 thousand acres (2 percent) from 2010. About 34,700 thousand acres (55 percent) were irrigated with sprinkler systems, 23,300 thousand acres with surface (flood), and 5,490 thousand acres with microirrigation systems.

In addition to irrigation withdrawals from groundwater and surface-water sources, the use of reclaimed wastewater as a source of irrigation water was reported in 10 States (California, Florida, Arizona, Texas, Utah, Nevada, New Mexico, Colorado, Kansas, and Illinois) and accounts for 669 Mgal/d or less than 1 percent of the total irrigation water used. California, Florida, and Arizona were the largest users of reclaimed wastewater for irrigation with uses of 289, 195, and 106 Mgal/d, respectively. Although still a minor overall source of irrigation water in the Nation, reclaimed wastewater use increased from 472 Mgal/d in 2010 to 669 Mgal/d in 2015 (a 42-percent increase).

Five states (California, Idaho, Arkansas, Montana, and Colorado) accounted for 54 percent of the national total of irrigation withdrawals. The geographic distribution of total groundwater and surface-water withdrawals for irrigation is shown in figure 7. Most of the total irrigation withdrawals (81 percent) in the United States and irrigated acres (74 percent) were in the 17 conterminous Western States (west of the solid line in fig. 7). The 17 Western States cumulatively accounted for 91 percent of total surface-water irrigation withdrawals and 71 percent of total groundwater irrigation withdrawals in the Nation. Additionally, 9 of the 10 States with the highest irrigation withdrawals are Western States. Agricultural regions in the conterminous Western States are typically in areas where average annual precipitation is less than 20 inches, which is generally insufficient to support crops without supplemental water. Surface water accounted for 58 percent of the total withdrawals in the arid West, but groundwater was the dominant source of irrigation water in California, Nebraska, Texas, Kansas, South Dakota, and Oklahoma. Irrigation water is typically applied in the more humid conterminous Eastern States (east of the solid line in fig. 7), as well as in Hawaii and Puerto Rico, to supplement precipitation during critical periods of the growing season, increase yields of crops, and increase the number of plantings

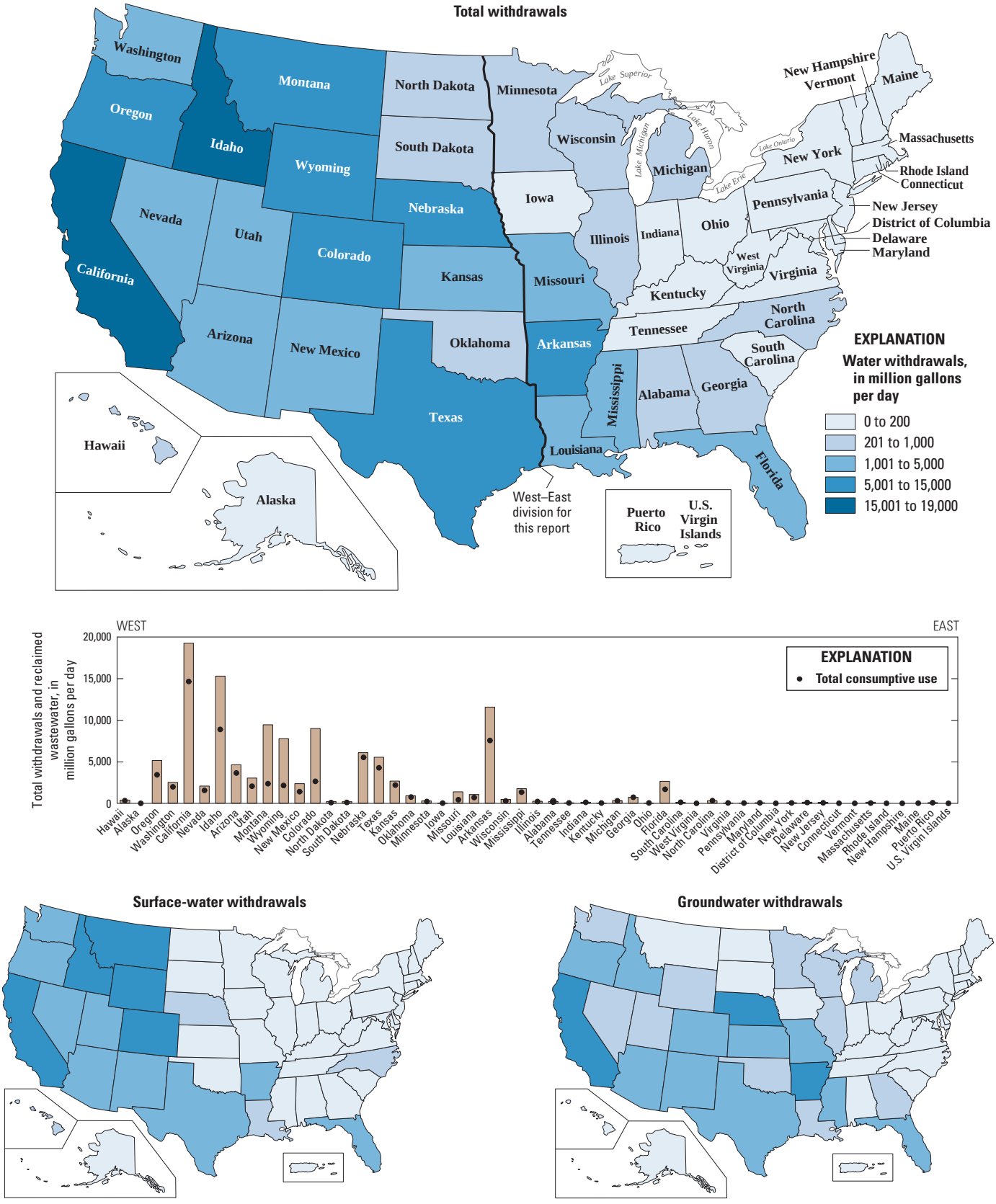


Figure 7. Irrigation water use by source and State, 2015.

per year. Notable Eastern States include Arkansas with the third largest withdrawals (11,600 Mgal/d) and fourth largest number of irrigated acres (4,430) and Florida with the fourteenth largest irrigation withdrawals (2,450 Mgal/d) and ninth largest number of irrigated acres (2,030).

Average application rates are calculated as a function of total irrigation withdrawals and total irrigated acres. The national application rate (total withdrawals for irrigation divided by the total acres irrigated) for 2015 was 2.09 acre-feet per acre, which is near that of the 2010 average of 2.08 acre-feet per acre. The median State application rate is 0.94 acre-feet per acre. The highest application rates occur in the arid Western States (Wyoming, Arizona, Idaho, and Montana had the highest application rates with values of 6.08, 4.89, and 4.52, and 4.29 acre-feet per acre, respectively) in order to meet the crop water requirements in these areas with limited precipitation. Many Western States rely on surface water as a primary source of irrigation water, and surface (flood) irrigation systems are common, which ultimately results in higher application rates. Additionally, surface water is often conveyed in canals and ditches and can lose substantial amounts of water via evaporation and infiltration before the remaining water reaches the irrigation systems and is applied to the land surface. Transmission losses are likely minimal for groundwater as water is commonly transferred from a well through pipes to an irrigation system. In addition, 33 percent of irrigated lands in the Western States is irrigated with relatively inefficient surface (flood) irrigation. Considerable amounts of excess applied water may result in return flow (surface runoff that reaches a surface-water source or infiltrates past the root zone to potentially recharge the groundwater system), thus returning to the local hydrologic system.

Although national total irrigation withdrawals were similar in 2010 and 2015, notable changes were observed at the State level. Of the States with the largest total irrigation withdrawals (greater than 5,000 Mgal/d), Arkansas, Montana, and Wyoming had notable increases of irrigation withdrawals, and Texas and California had notable decreases. Arkansas irrigation withdrawals increased 2,850 Mgal/d (33 percent) from 2010 to 2015, although total irrigated acres decreased 5 percent. Arkansas application rates increased from 2.09 acre-ft/acre in 2010 to 2.93 acre-ft/acre in 2015. Montana irrigation withdrawals increased 2,070 Mgal/d (28 percent) from 2010 to 2015, which corresponds with a 48 percent increase in estimated total irrigated acres during the same period. Because total irrigation withdrawals and total irrigated acres increased, application rates in Montana decreased from 4.95 acre-ft/acre in 2010 to 4.29 acre-ft/acre in 2015. Wyoming irrigation withdrawals increased 3,420 Mgal/d (78 percent), and irrigated acres increased 33 percent from 2010 to 2015. Despite the increase in irrigated acres, Wyoming application rates increased from 4.53 acre-ft/acre in 2010 to 6.08 acre-ft/acre in 2015. Texas irrigation withdrawals decreased 1,340 Mgal/d (20 percent), and irrigated acres decreased 4 percent from 2010 to 2015. Texas was nearing the end of a multiyear drought in 2015 and experienced very moist conditions in June 2015 (fig. 8*A*) and extreme drought conditions in September 2015 (fig. 8*B*) (National Oceanic and Atmospheric Administration, 2016b). Texas application rates decreased from 1.29 acre-ft/acre in 2010 to 1.09 acre-ft/acre in 2015. California irrigation withdrawals declined 4,070 Mgal/d (18 percent), and irrigated acres decreased by 10 percent from 2010, likely as a result of the intense drought conditions in the region in 2015 (fig. 8*A*). Historically (1950–2010), surface water has been the primary source of irrigation water in California. However, groundwater was the primary source of irrigation water in California in 2015, likely as a result of limited available surface-water resources during the period of intense drought (fig. 8*A*) (National Oceanic and Atmospheric Administration, 2016b).

Nationwide estimates of consumptive use of water withdrawn for irrigation are included in this report for the first time since 1995. Consumptive use of irrigation water represents the fraction of water that was originally withdrawn from a source for irrigation and is subsequently removed from availability owing to evaporation, transpiration, or incorporation into crops. Reliable estimates of consumptive use are oftentimes difficult to determine. In most States, consumptive use was based on coefficients, irrigation-system efficiencies, or theoretical crop requirements from various sources. The NWUSP provided USGS personnel with evapotranspiration estimates based on 1-kilometer scale MODIS satellite data that were analyzed through the SSEBop model (Senay and others, 2013) to aid in interpretation of consumptive use estimates on irrigated lands. Consumptive-use estimates in California, Colorado, Delaware, Kansas, Missouri, Montana, North Dakota, South Dakota, and Wyoming were based primarily on the SSEBop model data; however, other methods were used to estimate consumptive use for the other States.

Of the 118,000 Mgal/d of groundwater and surface water withdrawn and the 669 Mgal/d of reclaimed wastewater used in the United States for irrigation in 2015, it is estimated that 73,200 Mgal/d (62 percent of the total water used) was consumed. State estimates of consumptive use range from 22 percent to 100 percent of the withdrawn irrigation water and reclaimed wastewater used for irrigation. Four States (Alabama, Georgia, North Carolina, and South Carolina) assumed 100 percent consumptive use where consumptive use was set equal to the water withdrawn for irrigation. The four States with the lowest percentage of estimated consumptive use (less than 30 percent) include Massachusetts, Montana, Wyoming, and Colorado; therefore, it is estimated that less than 30 percent of the water originally used for irrigation was actually evaporated, evapotranspired, or incorporated into the irrigated crops in those States.

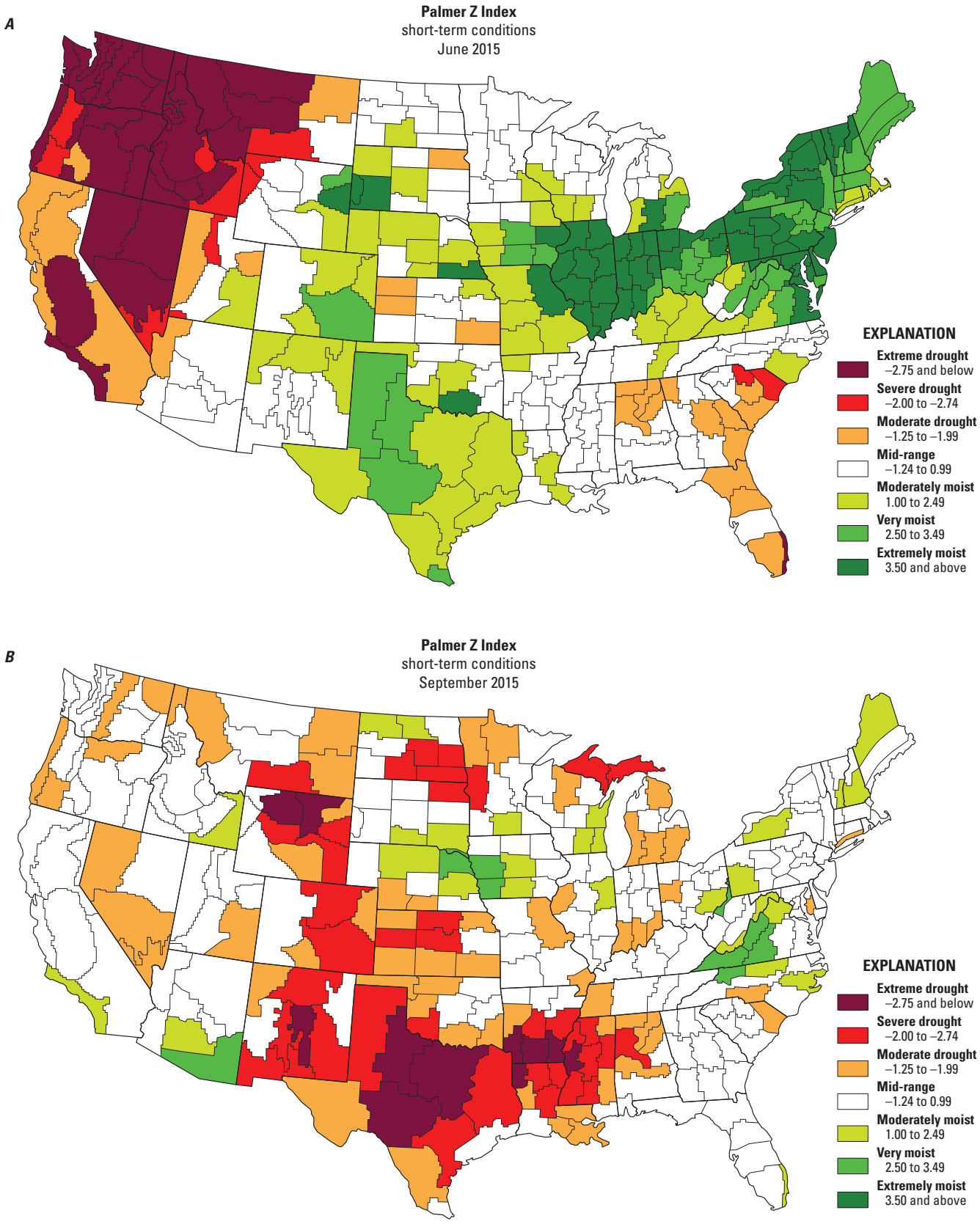


Figure 8. Drought index maps for the conterminous United States for *A*, June and *B*, September 2015. [Original map does not include Hawaii, Puerto Rico, or U.S. Virgin Islands. From National Oceanic and Atmospheric Administration, 2016b.]

Livestock

2,000 million gallons per day

Livestock water use is water associated with livestock watering, feedlots, dairy operations, and other on-farm needs. Livestock includes dairy cows and heifers, beef cattle and calves, sheep and lambs, goats, hogs and pigs, horses, and poultry. Other livestock water uses include cooling of facilities for the animals and products, dairy sanitation and wash down of facilities, animal waste-disposal systems, and incidental water losses. All withdrawals were considered freshwater and self-supplied. The livestock category excludes on-farm domestic use, lawn and garden watering, and irrigation water use.

Few State agencies require livestock operations to report water withdrawals; therefore, most estimates of livestock withdrawals were derived using animal population data and water-use coefficients, in gallons per head per day for each animal type. Animal population data generally are available from State agricultural agencies and the USDA NASS. Coefficients vary by State and, for many States, were provided by agricultural extension agents or water-permitting agencies. Coefficients may reflect facility maintenance needs and effects of climate on animal watering. Many of the 2015 withdrawals for livestock were estimated according to methods described by Lovelace (2009a), using livestock population data compiled for the USDA NASS 2012 Census of Agriculture (U.S. Department of Agriculture, 2014a) and water-use coefficients.

Livestock withdrawals for 2015 are listed by State in table 8. During 2015, withdrawals for livestock use were an estimated 2,000 Mgal/d, or 2,240 thousand acre-ft/yr (table 2*B*). Livestock withdrawals were about less than 1 percent of total freshwater withdrawals and about 1 percent of total freshwater withdrawals for all categories, excluding thermoelectric power. Groundwater was the source for 62 percent of total livestock withdrawals. Estimated total livestock withdrawals for 2015 were the same as 2010.

The geographic distribution of total, surface-water, and groundwater livestock withdrawals is shown in figure 9. Texas, California, Iowa, Nebraska, and Kansas each used more than 100 Mgal/d for livestock and together accounted for 42 percent of total livestock withdrawals in 2015. Texas, Iowa, Nebraska, Kansas, and California each used more than 80 Mgal/d of groundwater for livestock (table 8) and accounted for 42 percent of groundwater withdrawals for this use. Texas and California each used more than 100 Mgal/d of surface water for livestock, and accounted for 31 percent of surface-water withdrawals for livestock. It is likely that a large portion of the withdrawals for livestock was used for cattle, which typically require more water than other livestock species, with the exception of horses, and milk cows require additional water for sanitation of milking facilities and equipment (Lovelace, 2009a). In 2012, Texas, California, Iowa, Nebraska, and Kansas together accounted for 36 percent of all cattle and calves and 29 percent of all milk cows in the United States (U.S. Department of Agriculture, 2014a).

1 percent

Table 8. Livestock water withdrawals, 2015.

[Values may not sum to totals because of independent rounding]

State	Withdrawals (million gallons per day)		
	By source		Total
	Groundwater	Surface water	
Alabama	11.5	14.7	26.2
Alaska	0.04	0.09	0.13
Arizona	38.9	0	38.9
Arkansas	13.6	20.5	34.1
California	82.0	101	183
Colorado	22.7	10.6	33.3
Connecticut	1.15	0	1.15
Delaware	1.34	0	1.34
District of Columbia	0	0	0
Florida	25.7	0.35	26.1
Georgia	27.5	17.4	44.9
Hawaii	0.51	1.10	1.61
Idaho	41.2	9.57	50.8
Illinois	36.2	0	36.2
Indiana	26.2	13.0	39.2
Iowa	124	41.0	165
Kansas	83.5	20.4	104
Kentucky	2.07	38.7	40.8
Louisiana	3.16	3.19	6.35
Maine	1.54	0.51	2.05
Maryland	5.85	2.15	8.00
Massachusetts	0.64	0.39	1.03
Michigan	21.4	2.33	23.7
Minnesota	58.9	0	58.9
Mississippi	6.85	10.3	17.1
Missouri	16.1	47.6	63.7
Montana	12.3	29.9	42.2
Nebraska	89.7	20.4	110
Nevada	4.94	0	4.94
New Hampshire	0.63	0.21	0.84
New Jersey	0.88	0	0.88
New Mexico	29.8	2.25	32.0
New York	16.8	8.89	25.7
North Carolina	51.9	14.6	66.5
North Dakota	12.5	8.30	20.8
Ohio	7.83	16.8	24.6
Oklahoma	27.4	43.3	70.6
Oregon	3.02	13.2	16.3
Pennsylvania	36.3	3.17	39.5
Rhode Island	0.11	0.01	0.12
South Carolina	4.36	5.51	9.87
South Dakota	19.3	28.6	47.9
Tennessee	12.0	11.5	23.4
Texas	138	137	276
Utah	7.46	8.44	15.9
Vermont	4.41	1.46	5.87
Virginia	6.52	20.5	27.0
Washington	20.8	8.82	29.7
West Virginia	1.70	3.38	5.08
Wisconsin	67.0	7.44	74.5
Wyoming	6.17	10.0	16.2
Puerto Rico	4.23	1.60	5.83
U.S. Virgin Islands	0.01	0.01	0.02
TOTAL	1,240	760	2,000

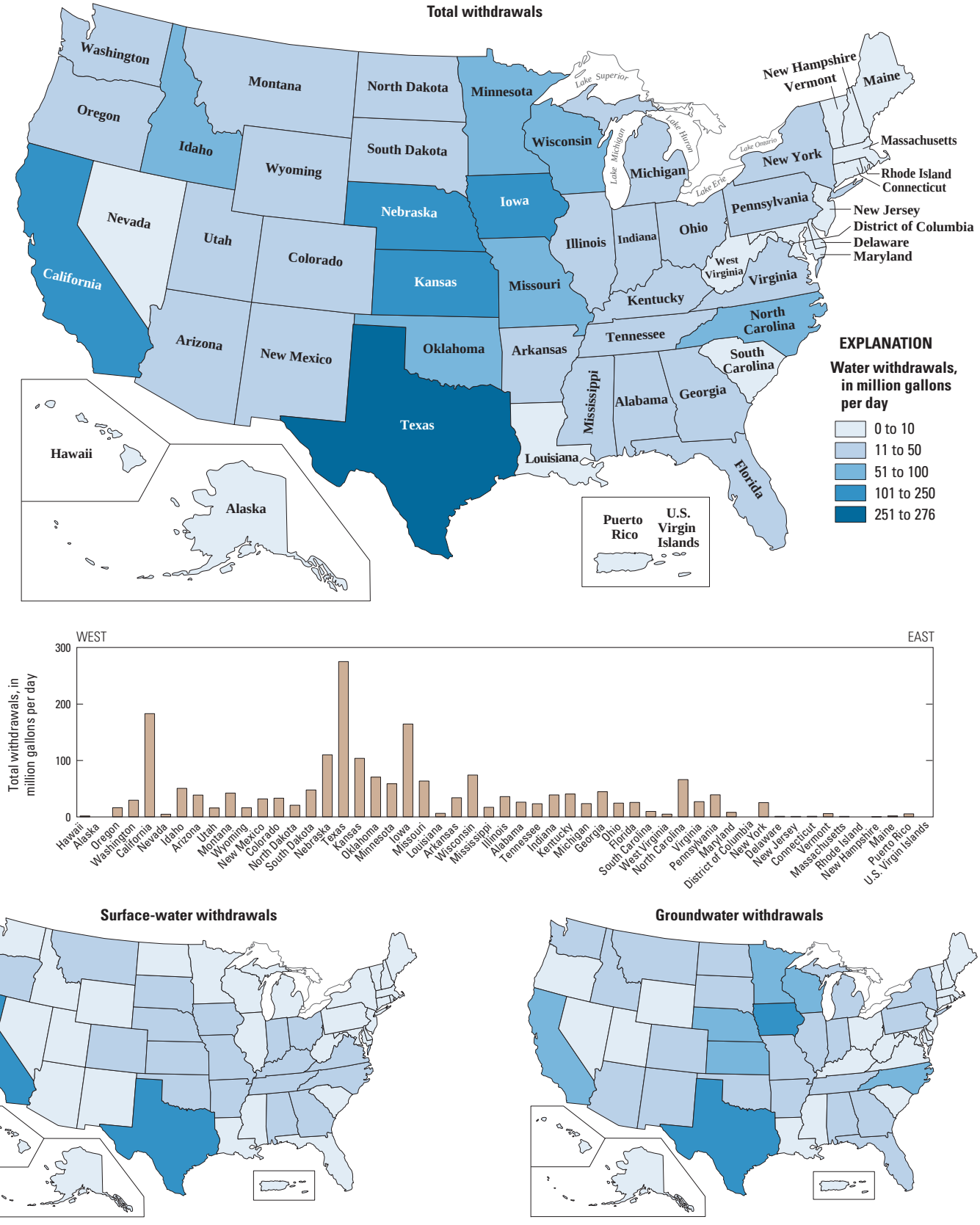


Figure 9. Livestock withdrawals by source and State, 2015.

Aquaculture

7,550 million gallons per day

Aquaculture water use is water associated with raising organisms that live in water, such as finfish and shellfish, for food, restoration, conservation, or sport. Aquaculture production occurs under controlled feeding, sanitation, and harvesting procedures primarily in ponds, flow-through raceways, and, to a lesser extent, cages, net pens, and closed-recirculation tanks. All aquaculture withdrawals were considered self-supplied.

Many of the 2015 withdrawals for aquaculture were estimated according to methods described by Lovelace (2009b), using aquaculture data compiled for the USDA NASS 2013 Census of Aquaculture (U.S. Department of Agriculture, 2014b) with standardized water-use coefficients and water-replacement rates. The USDA NASS 2013 data include statistics for various aquacultured species and aquaculture ponds, raceways, tanks, egg incubators, pens, and cages at commercial and noncommercial aquaculture operations. Several other sources of information were also used to estimate 2015 aquaculture withdrawals. These other sources include State permits from which estimates were derived from reported water withdrawals or return flows for aquaculture facilities. The EPA Permit Compliance System database also was a source of return-flow data that were used to estimate water withdrawals. Individual aquaculture operations, State regulatory agencies, State offices of the USDA NASS, and Cooperative Extension Service offices also provided information that was used to estimate aquaculture withdrawals in some States.

Total withdrawals for aquaculture during 2015, 7,550 Mgal/d, or 8,460 thousand acre-ft/yr (table 2*B*), are listed by State in table 9. Surface water was the source for about 79 percent of the withdrawals for this category. Much of the surface water was used for flow-through raceways and was returned to the source after use. A combined total of 6.30 Mgal/d saline surface-water withdrawals, less than 0.1 percent of total aquaculture withdrawals, was reported in Connecticut (3.02 Mgal/d), Florida (2.02 Mgal/d), Texas (0.86 Mgal/d), and Maine (0.40 Mgal/d); these amounts are not shown separately in table 9, but are included in the total. Aquaculture withdrawals were about 2 percent of total withdrawals and about 4 percent of total withdrawals for all categories, excluding thermoelectric power. Estimated aquaculture withdrawals in 2015 were 16 percent less than in 2010.

The geographic distribution of total, surface-water, and groundwater withdrawals for aquaculture is shown in figure 10. Idaho, North Carolina, California, and Oregon each used more than 500 Mgal/d for aquaculture, about 57 percent of the total and about 67 percent of the surface-water withdrawals for aquaculture. Louisiana, California, Alaska, and Arkansas each used more than 100 Mgal/d of groundwater and combined accounted for 57 percent of the total groundwater withdrawals for aquaculture.

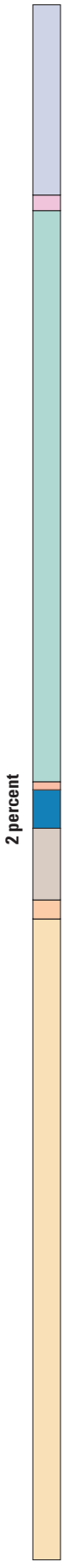


Table 9. Aquaculture water withdrawals, 2015.

[Values may not sum to totals because of independent rounding. Values include fresh and saline-water withdrawals]

State	Withdrawals (million gallons per day)		
	By source		Total
	Groundwater	Surface water	
Alabama	27.2	22.2	49.4
Alaska	169	240	410
Arizona	23.8	10.7	34.5
Arkansas	152	98.9	251
California	247	480	727
Colorado	16.0	244	260
Connecticut	9.15	16.0	25.2
Delaware	1.98	0	1.98
District of Columbia	0	0	0
Florida	12.8	2.10	15.0
Georgia	14.5	70.6	85.1
Hawaii	8.58	10.0	18.6
Idaho	46.2	1,920	1,960
Illinois	5.23	5.47	10.7
Indiana	6.46	8.00	14.5
Iowa	7.46	12.2	19.7
Kansas	3.16	3.23	6.39
Kentucky	0.58	47.8	48.4
Louisiana	337	156	493
Maine	10.9	43.1	54.0
Maryland	5.91	2.07	7.98
Massachusetts	8.13	1.80	9.93
Michigan	1.06	72.8	73.8
Minnesota	1.72	14.8	16.5
Mississippi	87.5	39.3	127
Missouri	6.77	157	164
Montana	3.49	13.6	17.1
Nebraska	10.5	16.0	26.5
Nevada	11.6	22.4	34.0
New Hampshire	6.46	10.7	17.2
New Jersey	9.78	0	9.78
New Mexico	18.7	5.45	24.1
New York	11.0	49.5	60.4
North Carolina	13.3	990	1,000
North Dakota	0	5.32	5.32
Ohio	13.3	26.0	39.3
Oklahoma	0.06	3.23	3.29
Oregon	32.8	601	634
Pennsylvania	48.8	47.2	96.0
Rhode Island	6.72	0.09	6.81
South Carolina	0.61	6.08	6.69
South Dakota	3.57	24.9	28.5
Tennessee	11.7	45.2	56.9
Texas	11.6	11.6	23.2
Utah	83.1	0	83.1
Vermont	4.17	7.84	12.0
Virginia	0.15	113	113
Washington	50.6	194	245
West Virginia	8.10	31.2	39.3
Wisconsin	25.5	22.6	48.2
Wyoming	4.92	23.9	28.8
Puerto Rico	0	0.63	0.63
U.S. Virgin Islands	0	0	0
TOTAL	1,600	5,950	7,550

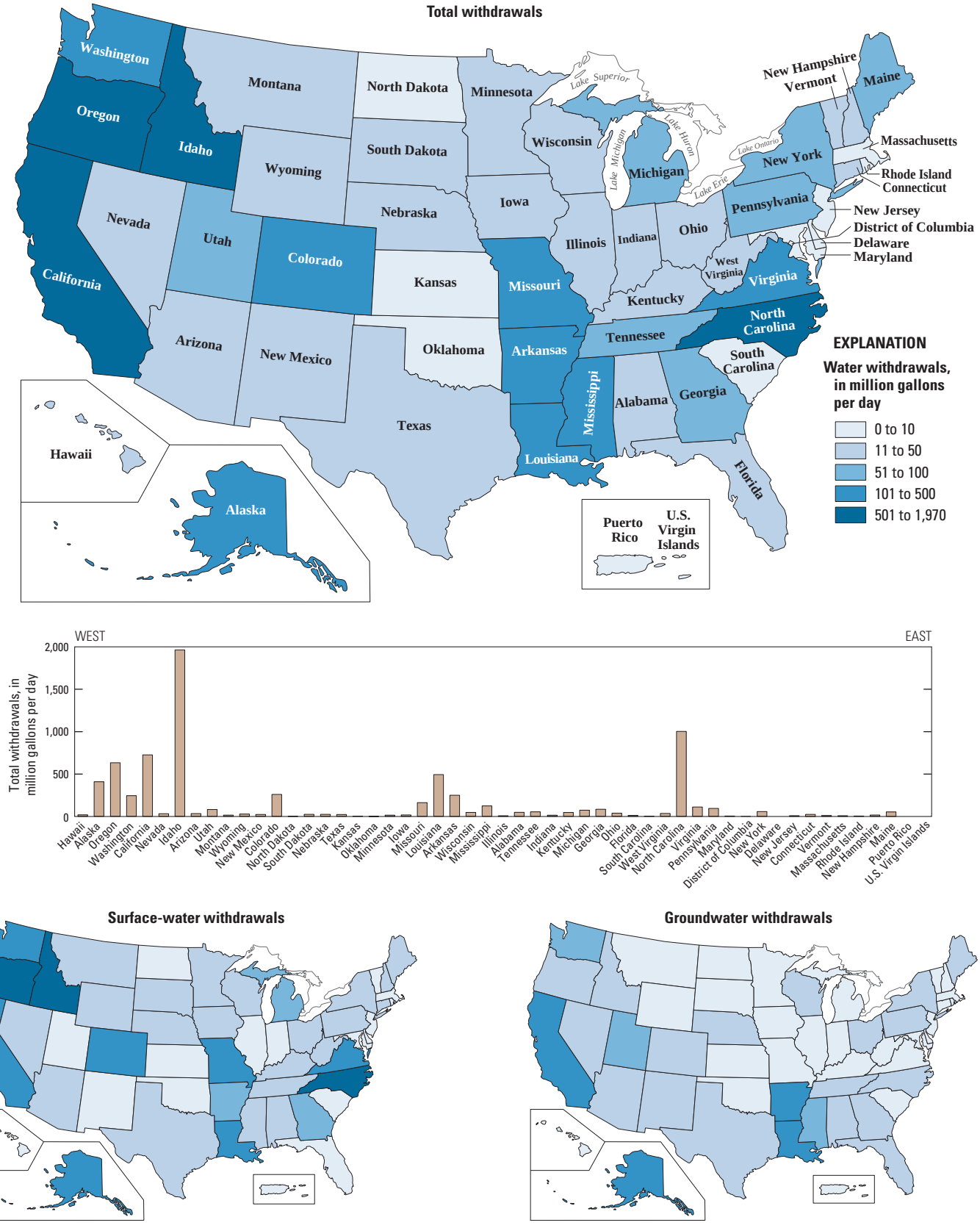


Figure 10. Aquaculture withdrawals by source and State, 2015.

Industrial

14,800 million gallons per day

Industrial withdrawals provide water for such purposes as fabricating, processing, washing, diluting, cooling, or transporting a product; incorporating water into a product; or sanitation needs within the manufacturing facility. Some industries that use large amounts of water produce such commodities as food, paper, chemicals, refined petroleum, or primary metals. Water for industrial use may be delivered from a public supplier or be self-supplied. In this report, industrial use refers to self-supplied industrial withdrawals only. Water withdrawals associated with industrial users that receive water from public suppliers are included in the Public Supply category (table 5, "All other uses and system losses" column). Withdrawals were reported as freshwater or saline water. As in the 2005 and 2010 reports, estimates for public-supply deliveries for industrial and consumptive uses for 2015 were not mandatory for 2015 and are not discussed in this report.

Industrial withdrawals are listed by State in table 10. For 2015, withdrawals were an estimated 14,800 Mgal/d, or 16,600 thousand acre-ft/yr (table 2*B*). Industrial withdrawals were about 5 percent of total withdrawals and about 8 percent of total withdrawals for all categories, excluding thermoelectric power. Surface water was the source for 82 percent of total industrial withdrawals; 94 percent of the surface-water withdrawals for industrial use was freshwater. More than 98 percent of the groundwater withdrawals for industrial use was freshwater. Industrial water withdrawals in the United States decreased 9 percent from 2010 to 2015.

The geographic distribution of total, total surface-water, and total groundwater withdrawals for industrial use is shown in figure 11. Indiana, Louisiana, and Texas accounted for 36 percent of total industrial withdrawals, and Indiana and Louisiana accounted for 36 percent of the total fresh surface-water withdrawals for industrial use. Leading sectors in these States likely contributing to water use in the industrial processes include auto manufacturing (Indiana), medical/orthopedic devices (Indiana), pharmaceuticals (Indiana) (Groenfeldt, 2015), petroleum refining (Louisiana and Texas), chemicals and petrochemicals (Texas and Louisiana) (Jones, 2015; Downie, 2016) and electronics (Texas) (Downie, 2016). Although it is not a leading sector in Indiana, metals are processed within the State to provide the materials, namely steel and aluminum, to support auto and appliance manufacture (Clark County Indiana Community Portal, 2018). The processing of these metals contributes to industrial water use in Indiana (Indiana Department of Natural Resources, 2016). Texas accounted for 81 percent of the saline surface-water industrial withdrawals, primarily from counties along the Gulf coast. The largest fresh groundwater industrial withdrawals were in California (397 Mgal/d), which accounted for 15 percent of the total national fresh groundwater industrial withdrawals (table 10). The largest groundwater saline withdrawals for industrial purposes in 2015 were in Utah (36.6 Mgal/d) (table 10), which accounted for 85 percent of saline groundwater withdrawals for industrial use in the United States (table 10). Texas and West Virginia each accounted for about one-half of the remaining 15 percent of saline groundwater withdrawals for industrial use (table 10).

5 percent

Pulp mill. Photograph by Alan Cressler, USGS.

Table 10. Industrial self-supplied water withdrawals, 2015.

[Values may not sum to totals because of independent rounding]

State	Withdrawals (million gallons per day)								
	By source and type						Total		
	Groundwater			Surface water					
	Fresh	Saline	Total	Fresh	Saline	Total	Fresh	Saline	Total
Alabama	32.7	0	32.7	461	0	461	494	0	494
Alaska	6.70	0	6.70	1.65	1.83	3.48	8.35	1.83	10.2
Arizona	6.12	0	6.12	0	0	0	6.12	0	6.12
Arkansas	29.5	0	29.5	127	0	127	157	0	157
California	397	0	397	1.13	0	1.13	399	0	399
Colorado	4.22	0	4.22	79.9	0	79.9	84.1	0	84.1
Connecticut	40.1	0	40.1	141	41.6	182	181	41.6	222
Delaware	10.7	0	10.7	291	0	291	302	0	302
District of Columbia	0	0	0	0	0	0	0	0	0
Florida	181	0	181	63.6	1.08	64.7	245	1.08	246
Georgia	193	0	193	283	0	283	475	0	475
Hawaii	0.24	0	0.24	0	0	0	0.24	0	0.24
Idaho	45.0	0	45.0	12.7	0	12.7	57.6	0	57.6
Illinois	132	0	132	299	0	299	431	0	431
Indiana	79.9	0	79.9	2,210	0	2,210	2,290	0	2,290
Iowa	92.8	0	92.8	195	0	195	288	0	288
Kansas	30.5	0	30.5	7.63	0	7.63	38.1	0	38.1
Kentucky	77.3	0	77.3	148	0	148	225	0	225
Louisiana	250	0	250	1,890	0	1,890	2,140	0	2,140
Maine	5.83	0	5.83	176	42.9	219	182	42.9	225
Maryland	10.8	0	10.8	38.6	1.37	40.0	49.4	1.37	50.8
Massachusetts	15.2	0	15.2	12.7	0	12.7	27.9	0	27.9
Michigan	64.6	0	64.6	453	0	453	518	0	518
Minnesota	49.0	0	49.0	210	0	210	259	0	259
Mississippi	72.8	0	72.8	109	0	109	182	0	182
Missouri	42.4	0	42.4	42.8	0	42.8	85.2	0	85.2
Montana	5.22	0	5.22	4.45	0	4.45	9.67	0	9.67
Nebraska	42.0	0	42.0	2.32	0	2.32	44.3	0	44.3
Nevada	1.02	0	1.02	4.69	0	4.69	5.71	0	5.71
New Hampshire	4.21	0	4.21	8.41	0	8.41	12.6	0	12.6
New Jersey	30.0	0	30.0	64.1	0	64.1	94.1	0	94.1
New Mexico	3.40	0	3.40	0	0	0	3.40	0	3.40
New York	29.4	0	29.4	283	8.43	291	312	8.43	320
North Carolina	15.0	0	15.0	178	0	178	193	0	193
North Dakota	6.18	0	6.18	13.5	0	13.5	19.6	0	19.6
Ohio	138	0	138	210	0	210	348	0	348
Oklahoma	7.27	0	7.27	44.7	0	44.7	52.0	0	52.0
Oregon	3.45	0	3.45	101	0	101	105	0	105
Pennsylvania	45.9	0	45.9	599	0	599	645	0	645
Rhode Island	0.54	0	0.54	1.51	0.03	1.54	2.05	0.03	2.08
South Carolina	26.3	0	26.3	260	0	260	286	0	286
South Dakota	18.4	0	18.4	6.04	0	6.04	24.4	0	24.4
Tennessee	51.6	0	51.6	682	0	682	734	0	734
Texas	99.8	3.28	103	223	598	821	323	601	924
Utah	37.4	36.6	74.0	16.8	42.4	59.2	54.2	79.0	133
Vermont	1.51	0	1.51	9.46	0	9.46	11.0	0	11.0
Virginia	66.0	0	66.0	304	5.15	309	370	5.15	375
Washington	83.5	0	83.5	329	0	329	412	0	412
West Virginia	25.7	3.05	28.7	399	0	399	424	3.05	427
Wisconsin	46.8	0	46.8	336	0	336	382	0	382
Wyoming	5.83	0	5.83	2.21	0	2.21	8.04	0	8.04
Puerto Rico	3.67	0	3.67	0	0	0	3.67	0	3.67
U.S. Virgin Islands	0.52	0	0.52	0	0	0	0.52	0	0.52
TOTAL	2,670	42.9	2,710	11,300	743	12,100	14,000	786	14,800

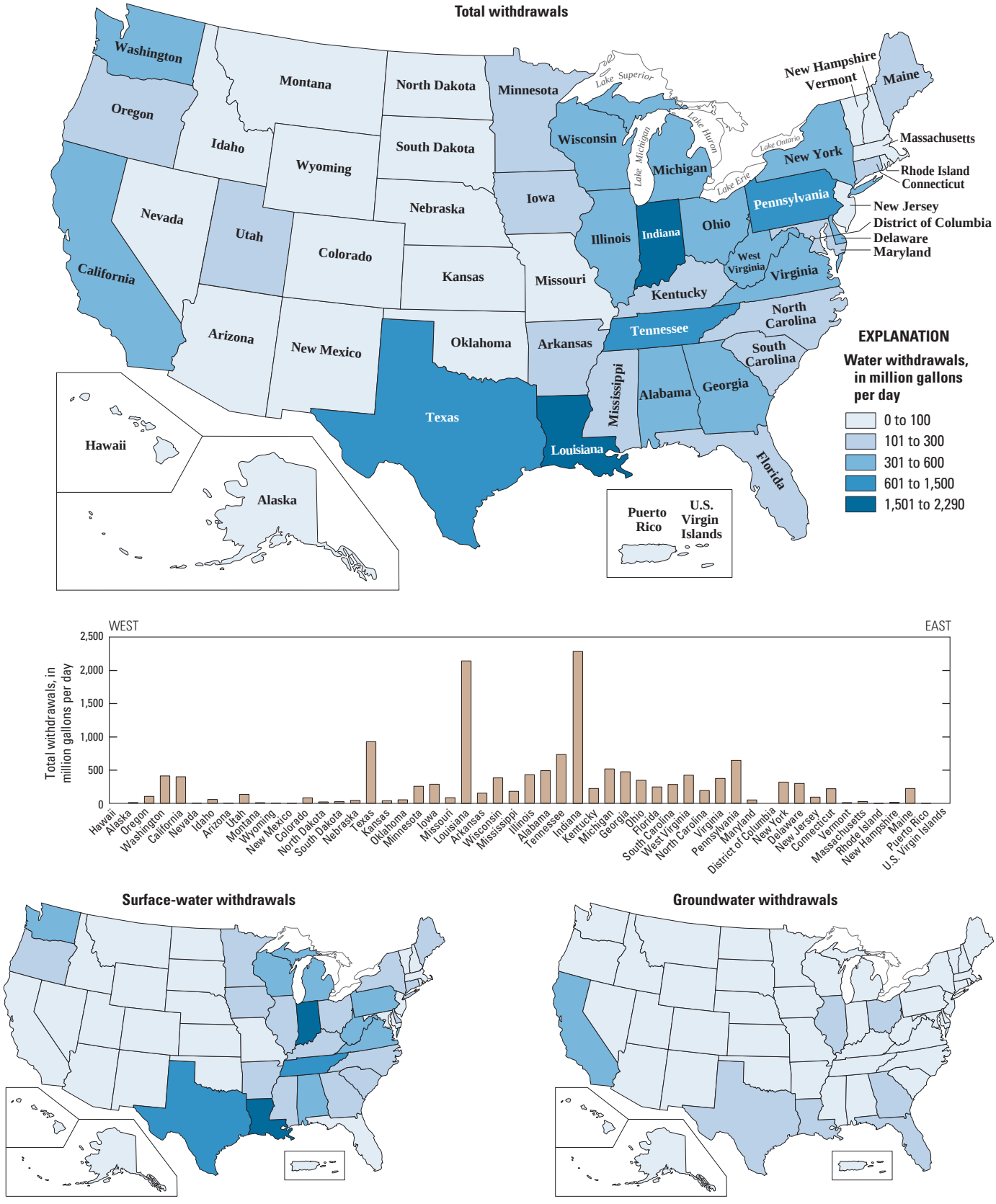


Figure 11. Industrial withdrawals by source and State, 2015.

Mining

4,000 million gallons per day

Mining water use is water used for the extraction of minerals and rocks that may be in the form of solids, such as coal, iron, sand, and gravel; liquids, such as crude petroleum; and gases, such as natural gas. The category includes quarrying, milling of mined materials, injection of water for secondary oil recovery or for unconventional oil and gas recovery (such as hydraulic fracturing), and other operations associated with mining activities. All mining withdrawals were considered to be self-supplied. Water withdrawals were reported as freshwater or saline water. Dewatering was not reported as a mining withdrawal unless the water was used beneficially, such as dampening roads for dust control.

Sources of data used to estimate water use for mining include surveys of mining operations and State and Federal agencies that collect water withdrawal, discharge, or mineral production data for mining operations. Many of the 2015 withdrawals for mining were estimated according to methods described by Lovelace (2009c), using mineral production data and water-use coefficients, in gallons per weight or volume of minerals produced. Production data for nonfuel minerals, including metals and nonmetallic minerals, were provided by the USGS National Minerals Information Center. Production or water-injection data for fuel minerals, including coal, petroleum, and natural gas, were obtained from the USDOE EIA, the FracFocus Chemical Disclosure Registry (FracFocus, 2016), and various State agencies.

Mining withdrawals during 2015 are listed by State in table 11. During 2015, an estimated 4,000 Mgal/d, or 4,480 thousand acre-ft/yr (table 2*B*), were withdrawn. Mining withdrawals were about 1 percent of total withdrawals and about 2 percent of total withdrawals for all categories, excluding thermoelectric power. Groundwater was the source for 72 percent of total withdrawals for mining (table 11).

Wash pond. Photograph by Wendy McPherson, USGS

Sixty-five percent of the groundwater withdrawn for mining was saline. Seventy-seven percent of the surface-water withdrawn was freshwater. Saline groundwater withdrawals and fresh surface-water withdrawals together represented 68 percent of the total withdrawals for mining (table 11). Total mining withdrawals in 2015 were about 1 percent more than in 2010. Groundwater withdrawals were 1 percent more, and surface-water withdrawals were less than 1 percent less. Freshwater withdrawals in 2015 were 4 percent less than in 2010, and saline-water withdrawals were 5 percent more than in 2010.

The geographic distribution of total, total freshwater, and total saline-water withdrawals is shown in figure 12. Total mining withdrawals in Texas, including 1,000 Mgal/d of saline groundwater, were 1,140 Mgal/d and accounted for 28 percent of the total withdrawals for mining (table 11). The next largest users, California, Utah, and Nevada each used greater than 200 Mgal/d of water for mining and accounted for another 20 percent of total withdrawals (fig. 12; table 11). Nevada, Texas, Ohio, Florida, and Arizona each used more than 50 Mgal/d of fresh groundwater for mining and together accounted for 55 percent of total fresh groundwater withdrawals for this use. Indiana, Iowa, Michigan, and New Jersey each used more than 50 Mgal/d of fresh surface water for mining and together accounted for 37 percent of total fresh surface-water withdrawals for this use (table 11). Saline groundwater withdrawals were greater than 150 Mgal/d in Texas, California, and Oklahoma and together accounted for 77 percent of total saline groundwater withdrawals for mining. Saline surface-water withdrawals were greater than 40 Mgal/d for Utah and Alaska and together accounted for almost 100 percent of total saline surface-water withdrawals for mining (table 11).

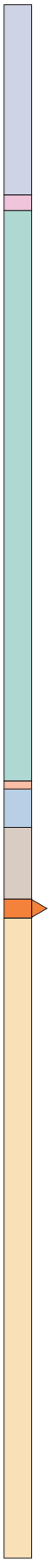


Table 11. Mining water withdrawals, 2015.

[Values may not sum to totals because of independent rounding]

State	Withdrawals (million gallons per day)								
	By source and type						Total		
	Groundwater			Surface water					
	Fresh	Saline	Total	Fresh	Saline	Total	Fresh	Saline	Total
Alabama	21.8	0	21.8	8.45	0	8.45	30.2	0	30.2
Alaska	0	89.2	89.2	36.4	41.4	77.8	36.4	131	167
Arizona	68.3	0	68.3	0	0	0	68.3	0	68.3
Arkansas	0.14	0	0.14	2.93	0	2.93	3.07	0	3.07
California	30.2	272	302	15.6	0.01	15.6	45.8	272	318
Colorado	5.24	24.2	29.4	2.46	0	2.46	7.70	24.2	31.9
Connecticut	0.82	0	0.82	3.43	0	3.43	4.25	0	4.25
Delaware	0.34	0	0.34	0.31	0	0.31	0.65	0	0.65
District of Columbia	0	0	0	0	0	0	0	0	0
Florida	89.1	0	89.1	40.7	0	40.7	130	0	130
Georgia	15.9	0	15.9	3.89	0	3.89	19.8	0	19.8
Hawaii	0.89	0	0.89	0.03	0	0.03	0.92	0	0.92
Idaho	1.35	0	1.35	21.8	0	21.8	23.1	0	23.1
Illinois	14.6	21.0	35.6	40.4	0	40.4	55.0	21.0	76.0
Indiana	5.52	0	5.52	121	0	121	126	0	126
Iowa	1.08	0	1.08	74.4	0	74.4	75.5	0	75.5
Kansas	5.44	0	5.44	0.55	0	0.55	5.99	0	5.99
Kentucky	17.6	0	17.6	22.9	0	22.9	40.6	0	40.6
Louisiana	1.65	0	1.65	4.59	0	4.59	6.24	0	6.24
Maine	1.45	0	1.45	4.88	0	4.88	6.33	0	6.33
Maryland	13.7	0	13.7	3.09	0	3.09	16.8	0	16.8
Massachusetts	5.51	0	5.51	4.09	0	4.09	9.60	0	9.60
Michigan	16.0	0.58	16.6	69.7	0	69.7	85.7	0.58	86.2
Minnesota	3.63	0	3.63	5.57	0	5.57	9.20	0	9.20
Mississippi	8.21	6.58	14.8	1.24	0	1.24	9.45	6.58	16.0
Missouri	21.1	0	21.1	8.47	0	8.47	29.6	0	29.6
Montana	1.06	16.3	17.4	20.5	0	20.5	21.6	16.3	37.9
Nebraska	0.06	6.41	6.47	9.54	0	9.54	9.60	6.41	16.0
Nevada	187	11.3	199	8.13	0	8.13	195	11.3	207
New Hampshire	1.76	0	1.76	4.37	0	4.37	6.13	0	6.13
New Jersey	1.48	0	1.48	56.8	0	56.8	58.3	0	58.3
New Mexico	39.4	89.4	129	17.4	0	17.4	56.8	89.4	146
New York	5.64	0.95	6.59	34.6	0	34.6	40.2	0.95	41.2
North Carolina	30.0	0	30.0	8.26	0	8.26	38.3	0	38.3
North Dakota	26.2	15.1	41.3	4.50	0	4.50	30.7	15.1	45.8
Ohio	91.3	0	91.3	37.6	0	37.6	129	0	129
Oklahoma	4.22	155	159	33.2	0	33.2	37.4	155	192
Oregon	8.45	0	8.45	2.85	0	2.85	11.3	0	11.3
Pennsylvania	32.9	5.60	38.5	5.21	0	5.21	38.1	5.60	43.7
Rhode Island	1.18	0	1.18	1.74	0	1.74	2.92	0	2.92
South Carolina	8.28	0	8.28	1.79	0	1.79	10.1	0	10.1
South Dakota	3.59	0	3.59	5.06	0	5.06	8.65	0	8.65
Tennessee	17.1	0	17.1	14.2	0	14.2	31.4	0	31.4
Texas	116	1,000	1,120	15.9	0.01	15.9	131	1,000	1,140
Utah	1.67	43.7	45.4	1.80	214	216	3.47	258	262
Vermont	0.23	0	0.23	4.33	0	4.33	4.56	0	4.56
Virginia	6.20	0	6.20	18.7	0	18.7	24.9	0	24.9
Washington	13.4	0	13.4	3.61	0	3.61	17.0	0	17.0
West Virginia	23.8	1.52	25.3	29.5	0	29.5	53.3	1.52	54.9
Wisconsin	0.42	0	0.42	28.8	0	28.8	29.3	0	29.3
Wyoming	33.1	96.8	130	11.4	0	11.4	44.5	96.8	141
Puerto Rico	1.84	0	1.84	0.18	0	0.18	2.02	0	2.02
U.S. Virgin Islands	0	0	0	0	0.02	0.02	0	0.02	0.02
TOTAL	1,010	1,860	2,870	877	256	1,130	1,880	2,120	4,000

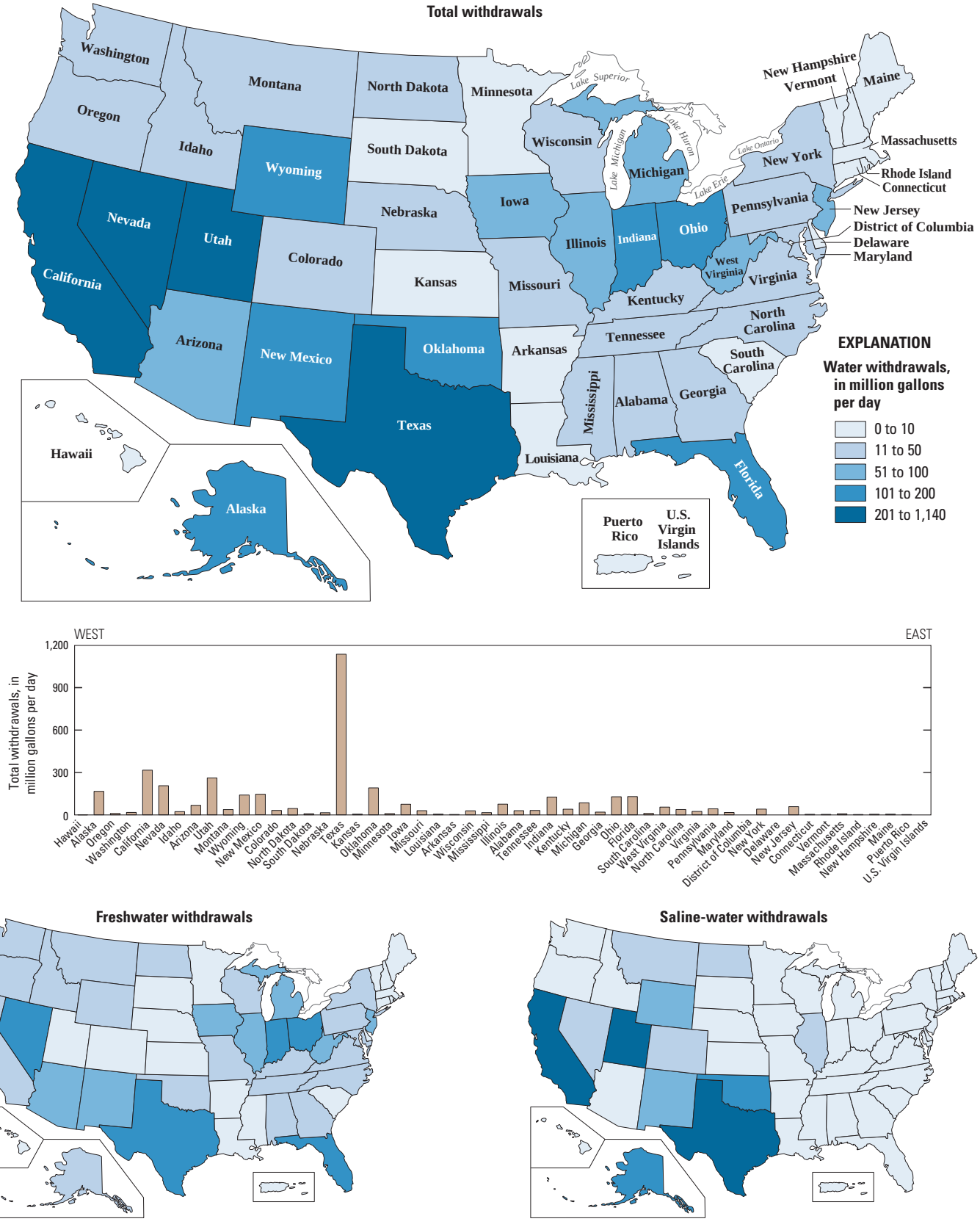


Figure 12. Mining withdrawals by water quality and State, 2015.

Thermoelectric Power

133,000 million gallons per day

Water withdrawn for thermoelectric-power generation is primarily used to condense, or cool, the steam used to drive thermoelectric generators. In general, there are two types of cooling systems used for thermoelectric power: once-through and recirculating. Once-through (also known as open-loop) cooling systems withdraw relatively large volumes of water, route the water through condensers to cool the steam used to generate electricity, and then return the water at a higher temperature. The heated discharge results in evaporative losses of the water, which for a once-through cooling system is the consumptive use of water. Consumptive use is relatively small compared to the total amount of water withdrawn for a once-through cooling system. Recirculating (also known as closed-loop or recirculation) cooling systems withdraw relatively smaller volumes of water (compared to once-through cooling systems) and circulate the water between the condensers and the cooling system, either recirculating towers or cooling ponds. Subsequent water withdrawals are used to replace, or make up, water lost to evaporation, blowdown, drift, and leakage. Consumptive use for a recirculating cooling system is the water lost to evaporation in cooling towers or from the surface of recirculating ponds and is relatively large (compared to the total amount of water withdrawn).

Sources of information used to compile the thermoelectric-power category data include State water agencies, powerplant facilities, USDOE EIA, USGS thermoelectric water-use project, and coefficients derived from previous USGS compilations. The USGS thermoelectric water-use project estimated monthly and annual water withdrawals, and consumptive use for 2015, on the basis of linked heat-and-water budget models that are constrained by power-generation technologies, cooling-system technologies, and environmental variables, such as air and water temperatures, wind speeds, and elevation (Diehl and others, 2013; Diehl and Harris, 2014). The USGS estimates include minimum to maximum ranges of withdrawals and consumptive use, as well as plant-level "best" estimates. These plausible, thermodynamically based model estimates provided a quality-assurance check for reported data. The monthly and annual model estimates were provided to NWUSP compilers as supplemental and supportive datasets for the compilation and included cooling-system-type categories and water sources. USDOE EIA-reported water-use data and net power generation data also were provided (U.S. Department of Energy, 2016a, b). These data were used either in whole or in part for this compilation. Compilers in some States obtained data reported directly from thermoelectric powerplants.

Thermoelectric-power withdrawals and consumptive-use data were compiled according to once-through and recirculating cooling-system types, and reported as freshwater or saline water from surface water or groundwater sources. Net power generation was compiled by cooling-system type. Consumptive use for thermoelectric water use was reported for the first time since 1995. Public-supply deliveries to thermoelectric powerplants and the use of reclaimed wastewater for cooling purposes were not required to be reported, although some States did report these data.

Thermoelectric-power withdrawals, consumptive use, and net power generation are listed by State in table 12. Total withdrawals for thermoelectric power for 2015 were 133,000 Mgal/d, or 149,000 thousand acre-ft/yr (table 2*B*). Surface water was the source for nearly 100 percent of total thermoelectric-power withdrawals, and 72 percent of those surface-water withdrawals were from freshwater sources. Saline surface-water withdrawals for thermoelectric power accounted for 97 percent of total saline surface-water withdrawals for all uses. Total withdrawals for thermoelectric power accounted for 41 percent of total water withdrawals, 34 percent of total freshwater withdrawals, and 48 percent of fresh surface-water withdrawals for all uses. Total thermoelectric-power consumptive use for 2015 was 4,310 Mgal/d, about 3 percent of total thermoelectric-power withdrawals. Freshwater accounted for 87 percent of total consumptive use. Net power generation associated with thermoelectric-power water use was 3,230,000 gigawatt-hours (gWh), or 83 percent of the total reported utility power (public utilities and independent power producers) in the United States for 2015 (U.S. Department of Energy, 2016b). On average, 15 gallons (gal) of water was used to produce 1 kilowatt-hour (kWh) of electricity in 2015, compared to almost 19 gallons per kilowatt-hour in 2010.

The geographic distribution of total, total freshwater, and total saline-water withdrawals for thermoelectric power is shown in figure 13. The largest total withdrawals for thermoelectric power were in Texas, where 93 percent of the withdrawals were from freshwater sources. Texas, Illinois, Michigan, Alabama, and North Carolina each withdrew more than 6,000 Mgal/d of freshwater for electricity generation, which combined accounted for more than 40 percent of freshwater withdrawals for thermoelectric power. Florida, New York, and Maryland accounted for about 53 percent of total saline withdrawals for thermoelectric power, nearly all from surface water. Nevada, California, Florida, and Hawaii accounted for 90 percent of the total saline groundwater withdrawals.

Estimated 2015 thermoelectric withdrawals were 18 percent less than estimates for 2010. Reasons for this large difference include plant closures (U.S. Department of Energy, 2016a), decrease of coal use and increase of natural gas use (U.S. Department of Energy, 2016c), and new powerplants using more water-efficient power generation and cooling-system technologies (U.S. Department of Energy, 2016a, b).

The conterminous Eastern States (fig. 13) accounted for 84 percent of total thermoelectric-power withdrawals and 70 percent of the related net power generation in the

Table 12. Thermoelectric-power water use, 2015.

[Values may not sum to totals because of independent rounding. All withdrawal, reclaimed wastewater, delivery, and use data are in million gallons per day. Abbreviation: —, not estimated]

State	Withdrawals							Reclaimed wastewater	Public-supply deliveries to thermoelectric-power generation use	Total use				Net power generated (gigawatt-hours)
	By source and type				Total					Water use (withdrawals, deliveries, and reclaimed wastewater)	Consumptive use			
	Groundwater		Surface water											
	Fresh	Saline	Fresh	Saline	Fresh	Saline	Total		Fresh	Total	Fresh	Saline	Total	
Alabama	0	0	6,630	0	6,630	0	6,630	—	—	6,630	107	0	107	128,000
Alaska	0.63	0	66.1	0	66.7	0	66.7	—	0.60	67.3	1.38	0	1.38	1,870
Arizona	57.7	0	25.8	0	83.5	0	83.5	67.7	0.50	152	147	0	147	102,000
Arkansas	3.13	0	1,440	0	1,440	0	1,440	—	—	1,440	61.3	0	61.3	49,500
California	19.6	35.1	16.7	2,800	36.4	2,840	2,880	15.6	38.9	2,930	64.4	25.3	89.7	111,000
Colorado	3.03	0	34.1	0	37.2	0	37.2	4.11	13.7	55.0	46.7	0	46.7	42,300
Connecticut	0	0	126	2,470	126	2,470	2,590	—	4.65	2,600	7.05	23.2	30.2	31,000
Delaware	0.13	0	14.3	256	14.4	256	271	—	—	271	10.3	4.02	14.3	5,660
District of Columbia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Florida	27.8	28.5	406	9,400	434	9,420	9,860	34.5	8.88	9,900	71.6	122	194	231,000
Georgia	3.43	0	738	102	741	102	843	—	—	843	161	0.02	161	110,000
Hawaii	1.48	20.2	0	357	1.48	377	379	—	—	379	0.51	3.10	3.61	7,820
Idaho	1.79	0	0	0	1.79	0	1.79	—	—	1.79	1.79	0	1.79	2,210
Illinois	4.21	0	8,130	0	8,140	0	8,140	—	—	8,140	572	0	572	177,000
Indiana	20.8	0	3,800	0	3,820	0	3,820	—	—	3,820	161	0	161	87,000
Iowa	27.0	0	1,660	0	1,680	0	1,680	0.42	0.16	1,680	40.0	0	40.0	35,500
Kansas	7.81	0	809	0	817	0	817	—	0.25	817	54.1	0	54.1	33,800
Kentucky	4.96	0	1,860	0	1,860	0	1,860	—	—	1,860	77.1	0	77.1	74,700
Louisiana	37.0	0	4,000	261	4,040	261	4,300	—	—	4,300	82.3	2.61	84.9	69,700
Maine	0.92	0	4.38	80.7	5.30	80.7	86.0	—	2.05	88.0	4.94	1.00	5.94	4,960
Maryland	2.30	0	218	5,300	220	5,300	5,520	—	—	5,520	2.29	61.2	63.4	30,700
Massachusetts	1.10	0	49.0	487	50.1	487	537	1.07	47.0	585	4.86	14.2	19.1	16,800
Michigan	5.61	0	7,800	0	7,800	0	7,800	—	—	7,800	117	0	117	102,000
Minnesota	1.77	0	2,010	0	2,010	0	2,010	0.35	—	2,010	130	0	130	50,600
Mississippi	33.7	6.35	84.0	2.07	118	8.42	126	5.41	0.01	132	36.1	6.01	42.1	57,500
Missouri	13.8	0	5,840	0	5,860	0	5,860	—	1.64	5,860	90.6	0	90.6	79,700
Montana	0.80	0	74.9	0	75.7	0	75.7	—	—	75.7	19.1	0	19.1	16,500
Nebraska	16.8	0	2,900	0	2,920	0	2,920	0.04	—	2,920	30.7	0	30.7	34,300
Nevada	7.04	70.9	1.69	0	8.73	70.9	79.7	0.56	0.49	80.7	4.63	27.5	32.1	11,400
New Hampshire	1.10	0	73.7	693	74.8	693	768	2.82	0.53	772	4.56	8.27	12.8	18,200
New Jersey	2.08	0	358	3,430	361	3,430	3,790	10.7	0.71	3,800	20.5	76.0	96.5	63,700
New Mexico	6.13	0	27.3	0	33.5	0	33.5	0	0.26	33.7	27.7	0	27.7	25,000
New York	7.30	0	2,200	5,470	2,210	5,470	7,680	2.76	17.1	7,700	67.0	54.8	122	89,400
North Carolina	0.18	0	6,180	1,360	6,180	1,360	7,540	—	8.33	7,550	113	13.6	127	113,000
North Dakota	0.42	0	983	0	983	0	983	1.13	0.05	984	28.6	0	28.6	34,300
Ohio	11.0	0	4,470	0	4,480	0	4,480	—	4.19	4,490	230	0	230	117,000
Oklahoma	1.59	0	70.2	0	71.7	0	71.7	8.94	6.96	87.6	53.5	0	53.5	60,600
Oregon	1.57	0	9.79	0	11.4	0	11.4	0	4.53	15.9	14.4	0	14.4	7,080
Pennsylvania	5.38	0	3,570	0	3,580	0	3,580	2.18	—	3,580	240	0	240	189,000
Rhode Island	0	0	1.33	222	1.33	222	223	—	1.44	224	1.98	2.22	4.20	5,240
South Carolina	4.52	0	4,980	0	4,980	0	4,980	0	3.93	4,990	159	0	159	89,200
South Dakota	0	0	2.39	0	2.39	0	2.39	—	—	2.39	2.39	0	2.39	1,470
Tennessee	2.18	0	4,620	0	4,620	0	4,620	—	—	4,620	62.8	0	62.8	62,600
Texas	37.7	0	9,600	757	9,640	757	10,400	38.2	48.3	10,500	294	4.71	299	351,000
Utah	22.7	8.46	38.3	0	61.0	8.46	69.5	0.45	1.33	71.2	43.6	2.46	46.0	40,500
Vermont	0.54	0	0.26	0	0.80	0	0.80	—	—	0.80	0.63	0	0.63	445
Virginia	1.08	2.72	2,910	2,400	2,910	2,400	5,320	1.24	0.29	5,320	36.8	13.8	50.6	61,100
Washington	7.77	0	44.4	0	52.2	0	52.2	—	1.63	53.8	47.7	0	47.7	25,900
West Virginia	1.19	0	1,570	0	1,570	0	1,570	—	0.62	1,570	89.9	0	89.9	67,700
Wisconsin	3.21	0	4,200	0	4,210	0	4,210	2.27	0.23	4,210	74.7	0	74.7	58,100
Wyoming	1.31	0	50.5	0	51.8	0	51.8	—	—	51.8	37.0	0	37.0	35,600
Puerto Rico	1.82	0	2.83	1,700	4.65	1,700	1,710	2.69	0.97	1,710	2.34	77.1	79.5	14,300
U.S. Virgin Islands	0	0	0.14	96.5	0.14	96.5	96.7	—	—	96.7	0	3.88	3.88	693
TOTAL	425	172	94,700	37,600	95,100	37,800	133,000	203	220	133,000	3,760	547	4,310	3,230,000

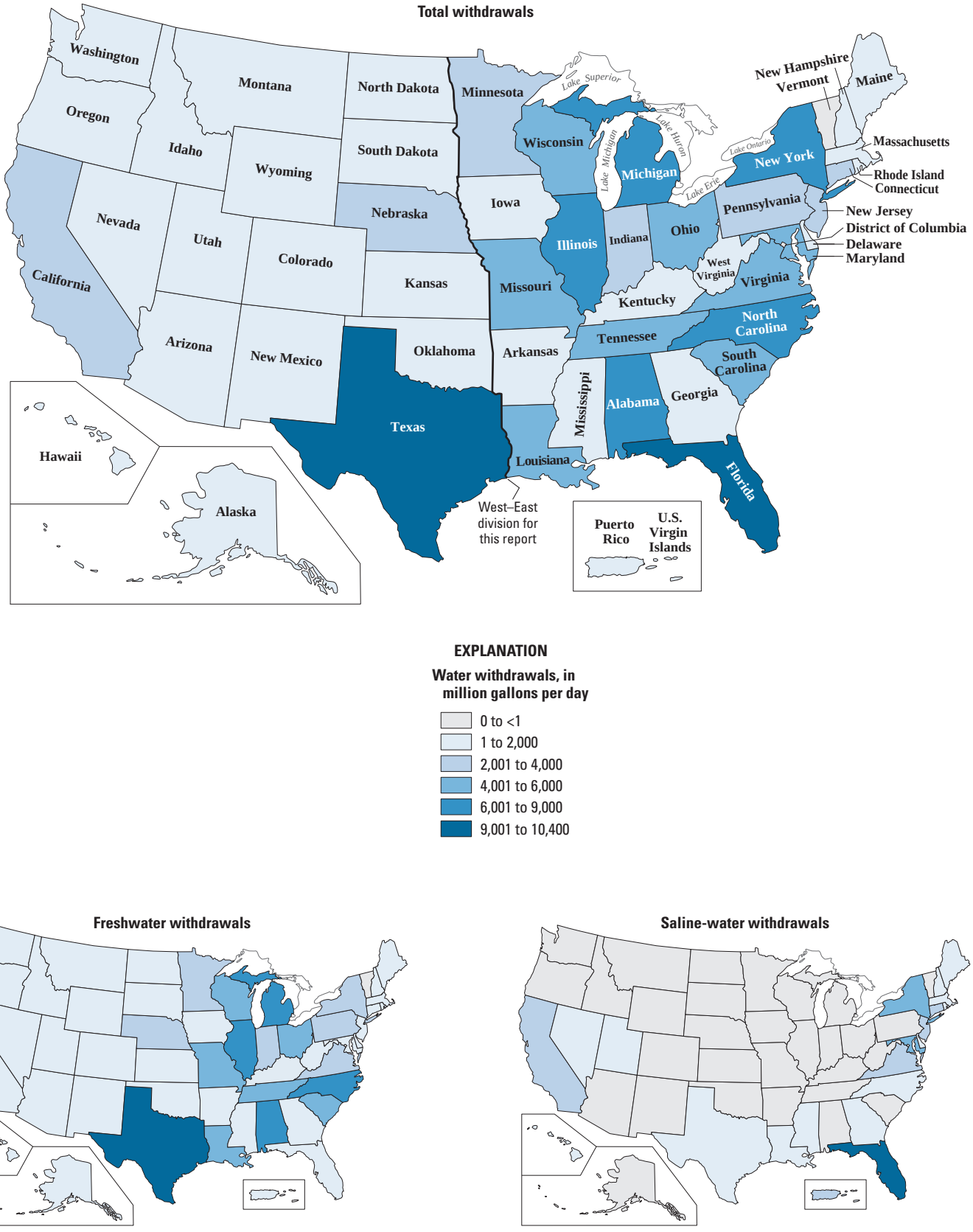


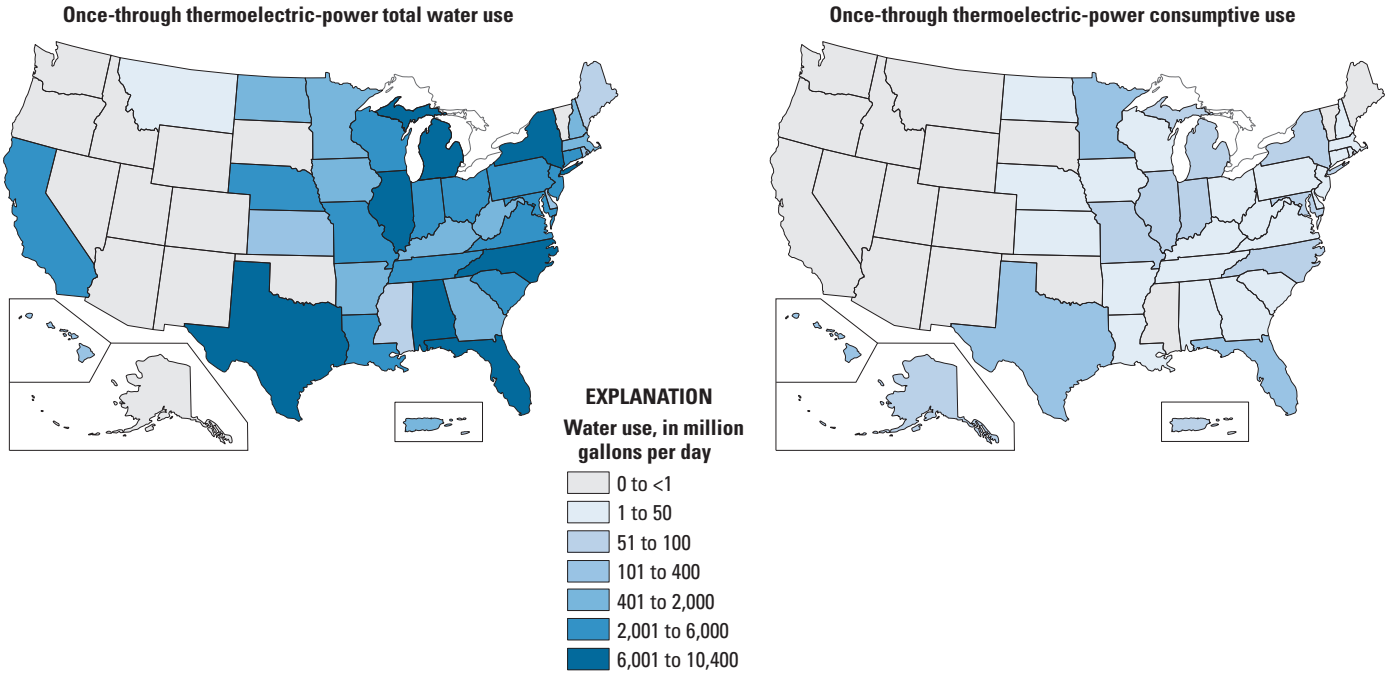
Figure 13. Thermoelectric-power withdrawals by water quality and State, 2015.

United States in 2015. Hydroelectric-power generation is not included in this report, but accounts for about 6 percent of the United States total energy needs and is an important energy source in the Western United States (U.S. Department of Energy, 2016b). In 2015, 58 percent of the total 248,000 gWh from hydroelectric powerplants was produced by utilities in Washington, California, Oregon, and New York (U.S. Department of Energy, 2016b).

The geographic distribution of total water use and total consumptive use is shown in figure 14*A* for once-through cooling systems and figure 14*B* for recirculating cooling systems. Powerplants equipped with once-through cooling systems accounted for 96 percent of total thermoelectric-power withdrawals and 37 percent of net power generated (table 13*A*), whereas plants with recirculating cooling systems withdrew much less water (4 percent of total withdrawals) and produced most (63 percent) of the power (table 13*B*). Plants with recirculating cooling systems accounted for 67 percent of total consumptive use. Consumptive use for recirculating cooling systems was 57 percent of total recirculating withdrawals, whereas consumptive use for once-through systems was just 1 percent of total once-through withdrawals (tables 13*A* and 13*B*). Powerplants with recirculating cooling systems are found in every State except the District of Columbia and the U.S. Virgin Islands. Powerplants with once-through cooling systems are found in every State except Arizona, Colorado, District of Columbia, Idaho, Nevada, New Mexico, Oklahoma, Oregon, South Dakota, Utah, Vermont, Washington, and Wyoming.

Reporting of public-supply deliveries and the use of reclaimed wastewater for cooling purposes was not required for 2015, although values were estimated for some States (table 12; fig. 14*A* and *B*). Public-supply deliveries were reported for 32 States and totaled 220 Mgal/d, less than 1 percent of total thermoelectric withdrawals. Texas (48.3 Mgal/d), Massachusetts (47.0 Mgal/d), and California (38.9 Mgal/d) accounted for 61 percent of total public-supply deliveries to thermoelectric plants. Reclaimed wastewater was reported for 25 States and totaled 203 Mgal/d. Arizona reported the largest use of reclaimed wastewater at 67.7 Mgal/d, almost all of which was used at the Palo Verde nuclear powerplant in Maricopa County, Arizona. Texas (38.2 Mgal/d) and Florida (34.5 Mgal/d) reported substantial amounts of reclaimed wastewater use as well. Plants with recirculating cooling systems accounted for 77 percent of public-supply deliveries and 95 percent of reclaimed wastewater uses (fig. 14*B*). Note that the reported public-supply deliveries and reclaimed wastewater data, because the reporting of data was not a requirement for this compilation, may not include all instances of these types of water use and, therefore, may be underestimated.

Thermoelectric powerplant in Montana. Photograph by Rodney Caldwell, USGS.



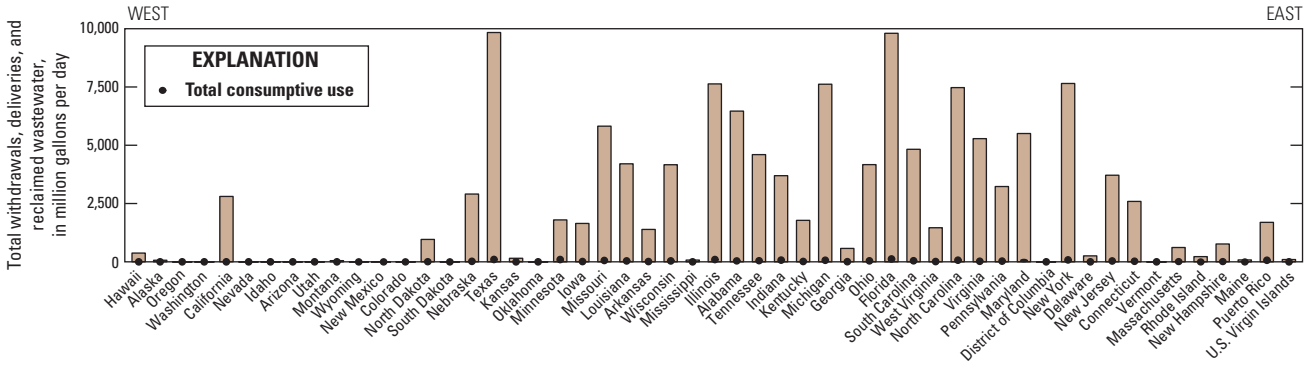


Figure 14*A*. Thermoelectric-power water use and consumptive use by State for once-through cooling types, 2015.

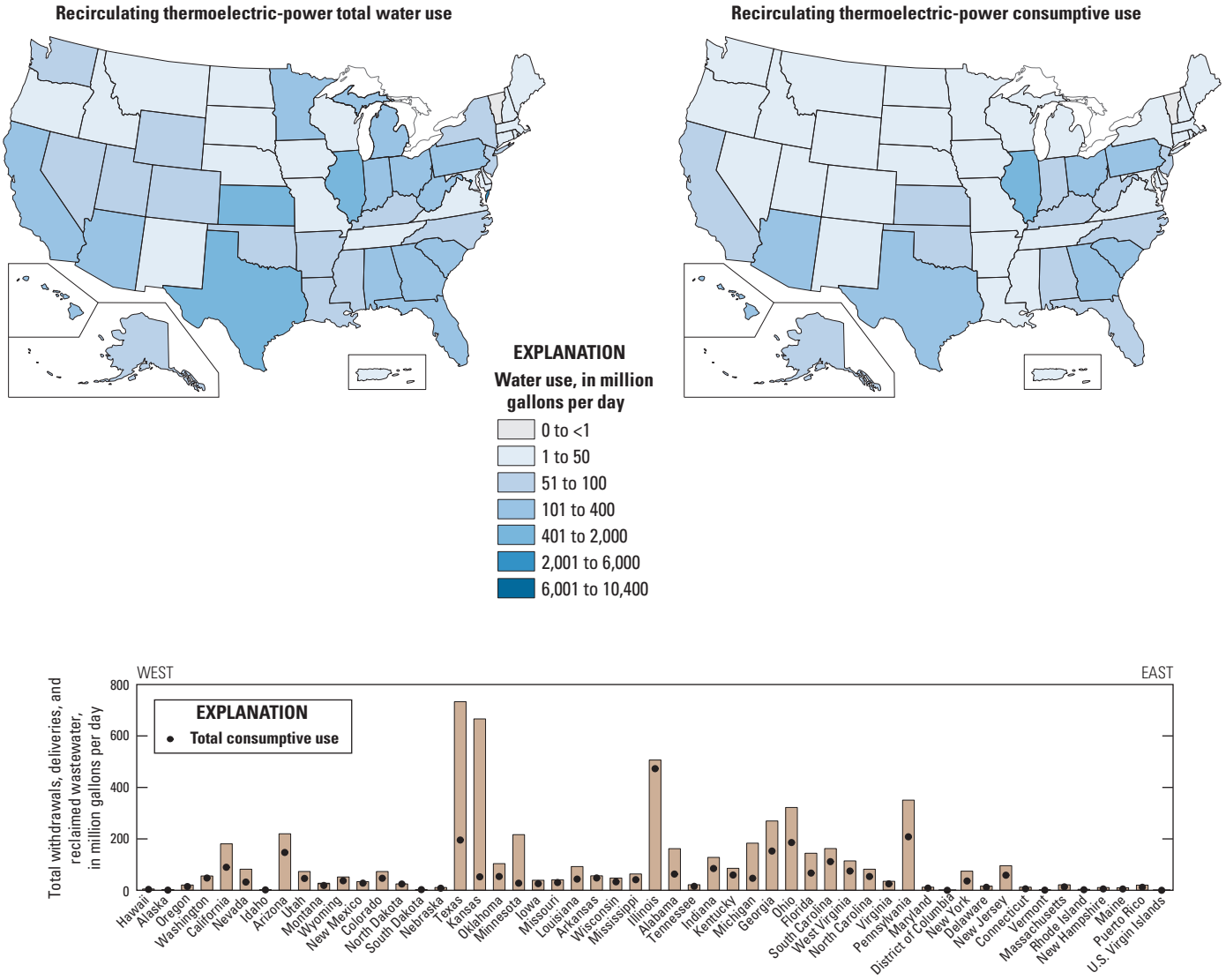


Figure 14*B*. Thermoelectric-power water use and consumptive use by State for recirculating cooling types, 2015.

Table 13*A*. Once-through cooling thermoelectric-power water use, 2015.

[Values may not sum to totals because of independent rounding. All withdrawal, reclaimed wastewater, delivery, and use data are in million gallons per day. Abbreviation: —, not estimated]

State	Withdrawals for once-through cooling							Reclaimed wastewater	Public-supply deliveries to once-through cooling thermoelectric-power generation use	Total use				Net power generated (gigawatt-hours)
	By source and type				Total					Water use (withdrawals, deliveries, and reclaimed wastewater)	Consumptive use			
	Groundwater		Surface water											
	Fresh	Saline	Fresh	Saline	Fresh	Saline	Total		Fresh	Total	Fresh	Saline	Total	
Alabama	0	0	6,460	0	6,460	0	6,460	—	—	6,460	44.1	0	44.1	44,900
Alaska	0	0	66.1	0	66.1	0	66.1	—	—	66.1	0.50	0	0.50	446
Arizona	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Arkansas	0	0	1,390	0	1,390	0	1,390	—	—	1,390	13.3	0	13.3	9,910
California	0	0	0	2,800	0	2,800	2,800	0	0	2,800	0	0.19	0.19	30,300
Colorado	0	0	0	0	0	0	0	—	—	0	0	0	0	0
Connecticut	0	0	123	2,470	123	2,470	2,590	—	—	2,590	1.16	23.2	24.4	21,900
Delaware	0	0	0	254	0	254	254	—	—	254	0	2.54	2.54	586
District of Columbia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Florida	2.17	27.5	354	9,400	356	9,420	9,780	7.10	3.81	9,790	5.26	121	127	93,900
Georgia	0.91	0	471	102	472	102	574	—	—	574	8.16	0.02	8.18	2,540
Hawaii	0.78	15.9	0	357	0.78	373	374	—	—	374	0.01	0	0.01	4,120
Idaho	0	0	0	0	0	0	0	—	—	0	0	0	0	0
Illinois	1.98	0	7,630	0	7,630	0	7,630	—	—	7,630	99.3	0	99.3	79,900
Indiana	13.9	0	3,680	0	3,690	0	3,690	—	—	3,690	76.3	0	76.3	30,000
Iowa	5.49	0	1,640	0	1,650	0	1,650	—	—	1,650	14.2	0	14.2	20,000
Kansas	0.06	0	150	0	151	0	151	—	—	151	1.69	0	1.69	1,520
Kentucky	0	0	1,780	0	1,780	0	1,780	—	—	1,780	17.7	0	17.7	28,900
Louisiana	24.6	0	3,920	261	3,940	261	4,200	—	—	4,200	38.9	2.61	41.5	39,700
Maine	0	0	0	80.4	0	80.4	80.4	—	—	80.4	0	0.81	0.81	573
Maryland	2.21	0	218	5,280	220	5,280	5,500	—	—	5,500	2.19	52.8	55.0	22,800
Massachusetts	0	0	46.9	473	46.9	473	520	0	45.7	566	0.94	4.74	5.68	9,060
Michigan	1.33	0	7,620	0	7,620	0	7,620	—	—	7,620	70.2	0	70.2	72,600
Minnesota	0.43	0	1,800	0	1,800	0	1,800	0	—	1,800	103	0	103	42,200
Mississippi	0	0	73.7	0	73.7	0	73.7	0	0	73.7	0.87	0	0.87	601
Missouri	0	0	5,820	0	5,820	0	5,820	—	—	5,820	60.5	0	60.5	62,900
Montana	0	0	49.2	0	49.2	0	49.2	—	—	49.2	0.49	0	0.49	375
Nebraska	11.1	0	2,900	0	2,910	0	2,910	—	—	2,910	22.7	0	22.7	27,000
Nevada	0	0	0	0	0	0	0	—	—	0	0	0	0	0
New Hampshire	0.20	0	72.0	692	72.2	692	764	0.14	0.18	764	0.54	6.92	7.46	10,900
New Jersey	0	0	348	3,370	348	3,370	3,710	0	0	3,710	3.54	34.2	37.8	24,700
New Mexico	0	0	0	0	0	0	0	0	0	0	0	0	0	0
New York	0	0	2,180	5,470	2,180	5,470	7,650	0	0	7,650	30.7	54.8	85.5	58,800
North Carolina	0	0	6,120	1,360	6,120	1,360	7,470	0	0	7,470	59.6	13.6	73.1	66,600
North Dakota	0	0	959	0	959	0	959	1.00	0.05	960	4.10	0	4.10	15,300
Ohio	4.36	0	4,160	0	4,170	0	4,170	—	0.75	4,170	43.9	0	43.9	32,400
Oklahoma	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Oregon	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Pennsylvania	0.60	0	3,230	0	3,230	0	3,230	1.12	—	3,230	32.5	0	32.5	35,000
Rhode Island	0	0	0	222	0	222	222	—	—	222	0	2.22	2.22	1,910
South Carolina	0	0	4,830	0	4,830	0	4,830	0	0	4,830	48.0	0	48.0	43,400
South Dakota	0	0	0	0	0	0	0	—	—	0	0	0	0	0
Tennessee	0	0	4,600	0	4,600	0	4,600	—	—	4,600	47.3	0	47.3	46,200
Texas	9.82	0	9,450	379	9,460	379	9,840	—	0.04	9,840	104	0	104	111,000
Utah	0	0	0	0	0	0	0	—	—	0	0	0	0	0
Vermont	0	0	0	0	0	0	0	—	—	0	0	0	0	0
Virginia	0.35	0	2,890	2,400	2,890	2,400	5,280	—	—	5,280	14.4	11.2	25.6	38,900
Washington	0	0	0	0	0	0	0	—	0	0	0	0	0	0
West Virginia	0.03	0	1,460	0	1,460	0	1,460	—	0.03	1,460	14.9	0	14.9	11,700
Wisconsin	0.49	0	4,160	0	4,160	0	4,160	0	0	4,160	41.6	0	41.6	36,600
Wyoming	0	0	0	0	0	0	0	—	—	0	0	0	0	0
Puerto Rico	1.63	0	0.24	1,690	1.87	1,690	1,690	0	0.97	1,690	0.11	67.6	67.7	8,100
U.S. Virgin Islands	0	0	0.14	96.5	0.14	96.5	96.7	—	—	96.7	0	3.88	3.88	693
TOTAL	82.4	43.4	90,600	37,200	90,700	37,200	128,000	9.36	51.5	128,000	1,030	403	1,430	1,190,000

Table 13*B*. Recirculating cooling thermoelectric-power water use, 2015.

[Values may not sum to totals because of independent rounding. All withdrawal, reclaimed wastewater, delivery, and use data are in million gallons per day. Abbreviation: —, not estimated]

State	Withdrawals for recirculating cooling							Reclaimed wastewater	Public-supply deliveries to recirculating cooling thermoelectric-power generation use	Total use				Net power generated (gigawatt-hours)
	By source and type				Total					Water use (withdrawals, deliveries, and reclaimed wastewater)	Consumptive use			
	Groundwater		Surface water											
	Fresh	Saline	Fresh	Saline	Fresh	Saline	Total		Fresh	Total	Fresh	Saline	Total	
Alabama	0	0	162	0	162	0	162	—	—	162	63.1	0	63.1	82,700
Alaska	0.63	0	0	0	0.63	0	0.63	—	0.60	1.23	0.88	0	0.88	1,430
Arizona	57.7	0	25.8	0	83.5	0	83.5	67.7	0.50	152	147	0	147	102,000
Arkansas	3.13	0	53.2	0	56.3	0	56.3	—	—	56.3	47.9	0	47.9	39,600
California	19.6	35.1	16.7	0.05	36.4	35.2	71.5	15.6	38.9	126	64.4	25.1	89.5	80,600
Colorado	3.03	0	34.1	0	37.2	0	37.2	4.11	13.7	55.0	46.7	0	46.7	42,300
Connecticut	0	0	2.96	0	2.96	0	2.96	—	4.65	7.61	5.89	0	5.89	9,040
Delaware	0.13	0	14.3	2.12	14.4	2.12	16.5	—	—	16.5	10.3	1.48	11.8	5,080
District of Columbia	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Florida	25.7	1.06	52.2	0	77.8	1.06	78.9	27.4	5.07	111	66.3	0.74	67.0	137,000
Georgia	2.52	0	267	0	270	0	270	—	—	270	153	0	153	108,000
Hawaii	0.70	4.34	0	0	0.70	4.34	5.04	—	—	5.04	0.50	3.10	3.60	3,700
Idaho	1.79	0	0	0	1.79	0	1.79	—	—	1.79	1.79	0	1.79	2,210
Illinois	2.23	0	504	0	506	0	506	—	—	506	473	0	473	97,100
Indiana	6.93	0	121	0	128	0	128	—	—	128	84.7	0	84.7	57,000
Iowa	21.5	0	16.4	0	37.8	0	37.8	0.42	0.16	38.4	25.8	0	25.8	15,600
Kansas	7.75	0	658	0	666	0	666	—	0.25	666	52.4	0	52.4	32,200
Kentucky	4.96	0	80.5	0	85.5	0	85.5	—	—	85.5	59.4	0	59.4	45,800
Louisiana	12.4	0	79.8	0	92.3	0	92.3	—	—	92.3	43.4	0	43.4	30,000
Maine	0.92	0	4.38	0.27	5.30	0.27	5.57	—	2.05	7.62	4.94	0.19	5.13	4,390
Maryland	0.09	0	0.14	11.9	0.23	11.9	12.1	—	—	12.1	0.10	8.31	8.41	7,940
Massachusetts	1.10	0	2.13	13.5	3.23	13.5	16.7	1.07	1.30	19.1	3.92	9.46	13.4	7,760
Michigan	4.28	0	179	0	183	0	183	—	—	183	46.9	0	46.9	29,500
Minnesota	1.34	0	215	0	216	0	216	0.35	—	216	27.6	0	27.6	8,420
Mississippi	33.7	6.35	10.3	2.07	44.0	8.42	52.5	5.41	0.01	57.9	35.2	6.01	41.2	56,900
Missouri	13.8	0	23.7	0	37.4	0	37.4	—	1.64	39.1	30.1	0	30.1	16,900
Montana	0.80	0	25.7	0	26.5	0	26.5	—	—	26.5	18.6	0	18.6	16,100
Nebraska	5.71	0	5.16	0	10.9	0	10.9	0.04	—	10.9	7.99	0	7.99	7,320
Nevada	7.04	70.9	1.69	0	8.73	70.9	79.7	0.56	0.49	80.7	4.63	27.5	32.1	11,400
New Hampshire	0.90	0	1.67	1.83	2.57	1.83	4.40	2.68	0.35	7.43	4.02	1.35	5.37	7,330
New Jersey	2.08	0	10.8	59.8	12.9	59.8	72.6	10.7	0.71	84.1	16.9	41.8	58.7	39,000
New Mexico	6.13	0	27.3	0	33.5	0	33.5	0	0.26	33.7	27.7	0	27.7	25,000
New York	7.30	0	27.2	0	34.6	0	34.6	2.76	17.1	54.4	36.3	0	36.3	30,600
North Carolina	0.18	0	65.2	0	65.4	0	65.4	—	8.33	73.8	53.5	0	53.5	46,000
North Dakota	0.42	0	24.3	0	24.7	0	24.7	0.13	0	24.8	24.5	0	24.5	19,000
Ohio	6.63	0	308	0	315	0	315	—	3.44	319	186	0	186	84,600
Oklahoma	1.59	0	70.2	0	71.7	0	71.7	8.94	6.96	87.6	53.5	0	53.5	60,600
Oregon	1.57	0	9.79	0	11.4	0	11.4	0	4.53	15.9	14.4	0	14.4	7,080
Pennsylvania	4.78	0	345	0	349	0	349	1.06	—	351	208	0	208	154,000
Rhode Island	0	0	1.33	0	1.33	0	1.33	0	1.44	2.77	1.98	0	1.98	3,330
South Carolina	4.52	0	150	0	155	0	155	0	3.93	158	111	0	111	45,800
South Dakota	0	0	2.39	0	2.39	0	2.39	—	—	2.39	2.39	0	2.39	1,470
Tennessee	2.18	0	19.4	0	21.6	0	21.6	—	—	21.6	15.4	0	15.4	16,400
Texas	27.9	0	155	378	182	378	561	38.2	48.2	647	191	4.71	195	239,000
Utah	22.7	8.46	38.3	0	61.0	8.46	69.5	0.45	1.33	71.2	43.6	2.46	46.0	40,500
Vermont	0.54	0	0.26	0	0.80	0	0.80	—	—	0.80	0.63	0	0.63	445
Virginia	0.73	2.72	27.5	0.80	28.3	3.52	31.8	1.24	0.29	33.3	22.4	2.70	25.1	22,300
Washington	7.77	0	44.4	0	52.2	0	52.2	—	1.63	53.8	47.7	0	47.7	25,900
West Virginia	1.16	0	112	0	113	0	113	—	0.59	114	75.0	0	75.0	56,100
Wisconsin	2.72	0	39.3	0	42.0	0	42.0	2.27	0.23	44.5	33.1	0	33.1	21,500
Wyoming	1.31	0	50.5	0	51.8	0	51.8	—	—	51.8	37.0	0	37.0	35,600
Puerto Rico	0.19	0	2.59	12.0	2.78	12.0	14.8	2.69	—	17.4	2.23	9.58	11.8	6,200
U.S. Virgin Islands	0	0	0	0	0	0	0	—	—	0	0	0	0	0
TOTAL	343	129	4,090	482	4,430	611	5,040	194	169	5,400	2,730	144	2,880	2,050,000

Trends in Water Use, 1950–2015

The USGS has conducted water-use compilations every 5 years since 1950 (https://water.usgs.gov/watuse/50years.html). A summary of population growth and withdrawal estimates by category of use and source of water is discussed in this section and shown in table 14 for each 5-year period from 1950 through 2015. These trends are shown graphically for freshwater uses in figure 15 and total uses in figure 16.

Some categories have been compiled and presented differently since compilations were begun. For example, self-supplied domestic and livestock withdrawals are shown separately in table 14; however, they were combined as "rural" in the 1950 and 1955 reports. Prior to 1985, the industrial water-use category included withdrawals for commercial, mining, and aquaculture; after 1985 these categories were estimated separately. Water use at fish hatcheries was reported as commercial use in 1990 and 1995 but has been included in the aquaculture category since 2000. Estimates of commercial withdrawals have not been compiled nationally since 2000. Totals in table 14 represent the most current data and incorporate revisions to previously published data; therefore, percentage differences and national totals may be slightly different from those in previous reports (Solley and others, 1988, 1993, 1998; Hutson and others, 2004; Kenny and others, 2009; Maupin and others, 2014).

Some revisions at the county or State levels have been made to previously published data since Maupin and others (2014) was published. The revisions have resulted in changes in total withdrawals by category as noted in table 14. For example, mining withdrawals published in Maupin and others (2014; table 14) were 5.32 Bgal/d, which is 1.35 Bgal/d more than the revised estimate of 3.97 Bgal/d shown in table 14 of this report. The 1.35 Bgal/d decrease in the 2010 estimate for total withdrawals for mining was almost entirely accounted for in Oklahoma (86 percent) from revisions to estimates that resulted in reduced saline groundwater withdrawals. An increase of 1 Bgal/d for thermoelectric-power withdrawals

Table 14. Trends in estimated water use in the United States, 1950–2015.

[Data for 1980 and earlier are from Kenny and others (2009). Water-use data are in billion gallons per day (thousand million gallons per day) and are rounded to two significant figures for 1950–80, and to three significant figures for 1985–2015; percent change is calculated from unrounded numbers. Values may not sum to totals because of independent rounding. Geographic extent: 1950, 48 States, District of Columbia, and Hawaii; 1955, 48 States and District of Columbia; 1960 and 1975–2015, 50 States, District of Columbia, Puerto Rico, and U.S. Virgin Islands; 1965–70, 50 States, District of Columbia, and Puerto Rico]

	Year														Percent change, 2010–15
	1950	1955	1960	1965	1970	1975	1980	1985	1990	1995	2000	2005	2010	2015	
Population, in millions	150.7	164.0	179.3	193.8	205.9	216.4	229.6	242.4	252.3	267.1	285.3	300.7	312.6	325.0	4
Total withdrawals	180	240	270	310	370	420	430	397	404	398	413	410[a]	354[a]	322	–9
Public supply	14	17	21	24	27	29	33	36.6	38.7	40.2	43.3	44.4[a]	42.0	39.0	–7
Rural domestic and livestock															
Self-supplied domestic	2.1	2.1	2.0	2.3	2.6	2.8	3.4	3.32	3.39	3.39	3.58	3.73[a]	3.53[a]	3.26	–8
Livestock	1.5	1.5	1.6	1.7	1.9	2.1	2.2	2.23	2.25	2.28	2.37[a]	2.15	2.00	2.00	0
Irrigation	89	110	110	120	130	140	150	135	134	130	139	127	116[a]	118	2
Thermoelectric power	40	72	100	130	170	200	210	187	194	190	195	201	162[a]	133	–18
Other															
Self-supplied industrial	37	39	38	46	47	45	45	25.8	22.4[a]	21.6	19.5[a]	18.1	16.2[a]	14.8	–9
Mining	(b)	(b)	(b)	(b)	(b)	(b)	(b)	3.44	4.93	3.59	4.13[a]	3.83	3.97[a]	4.00	1
Commercial	(b)	(b)	(b)	(b)	(b)	(b)	(b)	1.23	2.39	2.89	(c)	(c)	(c)	(c)	
Aquaculture	(b)	(b)	(b)	(b)	(b)	(b)	(b)	2.24	2.24	3.27[a]	5.79[a]	8.83[a]	8.96[a]	7.55	–16
Source of water															
Groundwater															
Fresh	34	47	50	60	68	82	83	73.4	79.4	76.4[a]	84.3[a]	78.9	75.9[a]	82.3	8
Saline	(c)	0.6	0.4	0.5	1.0	1.0	0.93	0.66	1.30[a]	1.11	2.47[a]	1.51	2.22[a]	2.34	5
Surface water															
Fresh	140	180	190	210	250	260	280	263	255[a]	261	265	270	231[a]	198	–14
Saline	10	18	31	43	53	69	71	59.6	68.7[a]	59.7	61.0	59.8[a]	45.0	38.6	–14

[a]Data revised from Maupin and others (2014) because of revisions to individual State data during interim years.

[b]Included in self-supplied industrial.

[c]Data not available.

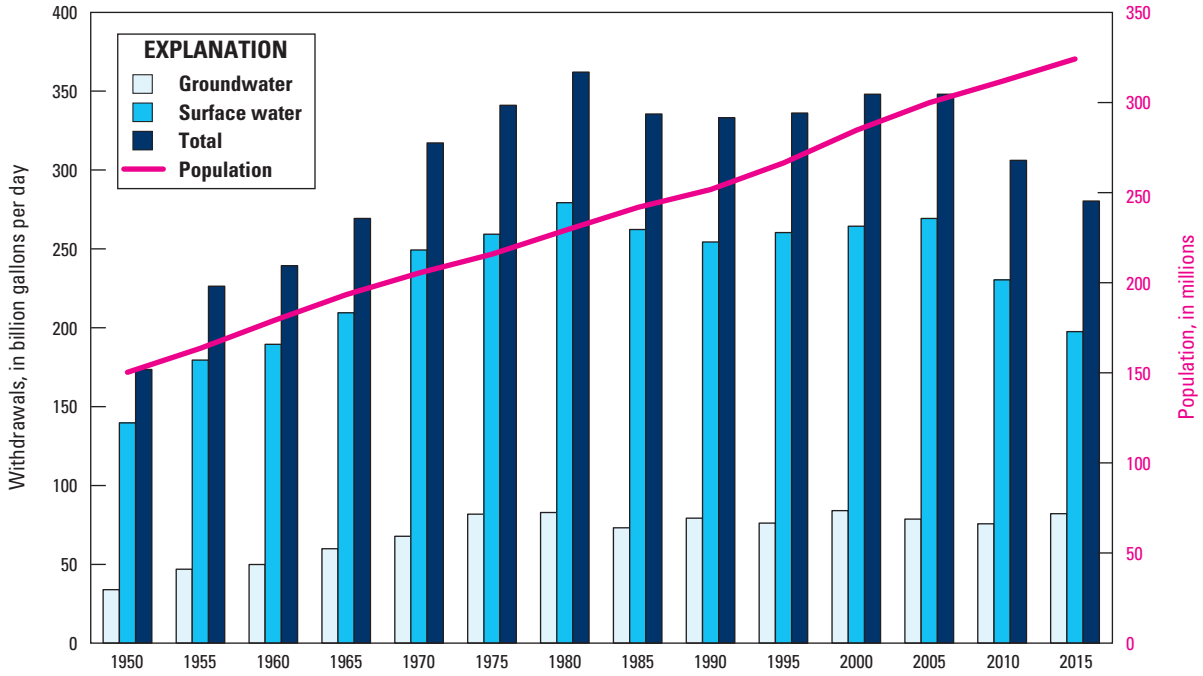


Figure 15. Trends in population and freshwater withdrawals by source, 1950–2015.

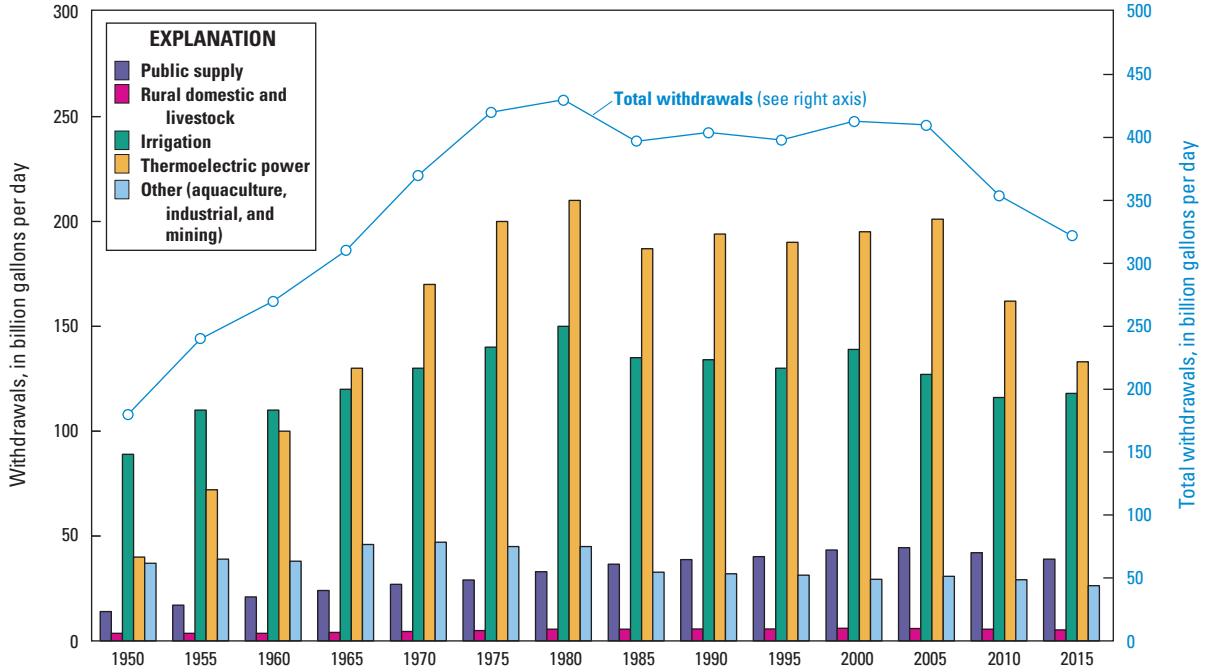


Figure 16. Trends in total water withdrawals by water-use category, 1950–2015.

for 2010 published in Maupin and others (2014; table 14) versus the value in table 14 (this report) was entirely related to revisions in estimates for South Carolina. A small decrease (0.46 Bgal/d) for aquaculture withdrawals published in Maupin and others (2014; table 14) versus the value in table 14 (this report) was mostly accounted for by revisions to estimates, resulting in a decrease in Idaho and an increase in Colorado. The increase of 1 Bgal/d between published values for irrigation in Maupin and others (2014, table 14) versus the value in table 14 (this report) is caused by rounding; the actual difference amounted to only 0.182 Bgal/d, mostly resulting from revisions to withdrawals in Montana. Table 14 notes additional total withdrawals by category for the United States from 1990 to 2015 that have changed since values were last published in Maupin and others (2014). These fluctuations in total withdrawals by category over time represent the level of flux that is inherent in maintaining large national datasets over time; datasets are constantly updated by USGS work or are based on new information from State, Federal, and local entities that are contributors to this national water-use compilation effort.

Comparisons between years stated hereafter are based on updated historical data and current 2015 data (table 14). Total withdrawals for all categories of use in 2015 were estimated to be 322 Bgal/d, a level not reported since before 1970 and 9 percent less than in 2010, continuing a sharp but steady downward trend since 2005. The drop in total withdrawals in 2015 was primarily caused by significant decreases in withdrawals for thermoelectric power (28.8 Bgal/d), which accounted for 89 percent of the decrease in total withdrawals. The decrease in public-supply withdrawals accounted for another 9 percent of the decline in total withdrawals. Categories of use with larger withdrawals in 2015 than in 2010 were irrigation and mining. The increase in irrigation withdrawals was only about 2 percent greater than 2010 levels, partly resulting from updated 2010 data, and mining withdrawals were corrected downward for 2010.

States with the largest decreases in total withdrawals for all categories between 2010 and 2015 were California, Texas, Ohio, Illinois, Pennsylvania, and North Carolina, and cumulatively these six States accounted for more than two-thirds of the total decrease in withdrawals for all categories. States that showed the largest increases between 2010 and 2015 withdrawals were Wyoming, Arkansas, Montana, Nebraska and Idaho. Total groundwater withdrawals (mostly freshwater) increased about 6.52 Bgal/d between 2010 and 2015. States with the largest increases in groundwater withdrawals were California, Arkansas, Idaho, and Nebraska, mostly for irrigation uses. Total surface-water withdrawals decreased about 38.9 Bgal/d, and the States that contributed to most of those decreased withdrawals were California, Texas, Ohio, Illinois, Pennsylvania, and North Carolina. These States, cumulatively, accounted for more than two-thirds of the total surface-water withdrawal decrease between 2010 and 2015, either through larger reductions in irrigation or thermoelectric-power withdrawals. California and Texas were experiencing record-setting droughts during 2015, which also likely contributed to lower surface-water withdrawals because of the decrease in available water.

The total population in the United States increased 4 percent between 2010 and 2015, or 12.4 million people, almost exactly mirroring the increase between 2005 and 2010 (table 14; fig. 16). This continues the steady upward trend in total population growth exhibited since 1950. Texas, California, and Florida all had population increases ranging from about 1.5 million (Florida) to 2.3 million (Texas). These three States accounted for 46 percent of the total population increase in the Nation.

Public-supply withdrawals in 2015 were 7 percent less than in 2010, decreasing from 42.0 Bgal/d to 39.0 Bgal/d and continuing the decline in public-supply withdrawals that was first observed in 2010 (table 14), which marked the first decline since being initially reported in 1950 (fig. 17*A*). Public-supply withdrawals increased between 2010 and 2015 in 17 States, with Florida showing the largest increase of about 0.12 Bgal/d. States with the largest decreases in public-supply withdrawals were California and Texas (1.15 Bgal/d and 1.11 Bgal/d, respectively), and they accounted for 76 percent of the national decrease of 2.99 Bgal/d between 2010 and 2015. The percentage of the population that is served from public-supply withdrawals has increased from 62 percent in 1950 to 87 percent in 2015. Texas, California, and Florida had the largest increases in the population that is served from public-supply withdrawals, accounting for 55 percent of the total national increase. Although California and Texas reported increased population served by public supply, withdrawals decreased. In 2015, California experienced a severe drought, and Governor Jerry Brown ordered a 25-percent statewide reduction in urban water use (which included water for landscaping) from water withdrawals in 2013 (Boxall and Xia, 2015). Selected water districts were ordered to reduce water usage by 36 percent, including water districts in the Sacramento region (Reese and Kasler, 2015). Reports from California water districts recorded a statewide reduction in water use of 27 and 31 percent in the summer months of June and July 2015, respectively, from the same months in 2013 (Boxall and Xia, 2015), exceeding the Governor's ordered limit. Although Texas was experiencing a drought in 2015 that had officially started in 2010 (National Oceanic and Atmospheric Administration, 2018), no mandatory water restrictions from the Governor were ordered in the State; however, municipal utilities in cities in Texas have been working with the populations they serve to promote water conservation. The San Antonio Water System that serves 1.6 million people, for example, reduced per capita water usage by 42 percent, simply by focusing on education, outreach, and regulations, through tools promoting water-smart landscaping, seminars on maintaining soils, and year-round time restrictions on the use of irrigation and sprinkler systems (U.S. Environmental Protection Agency, 2016).

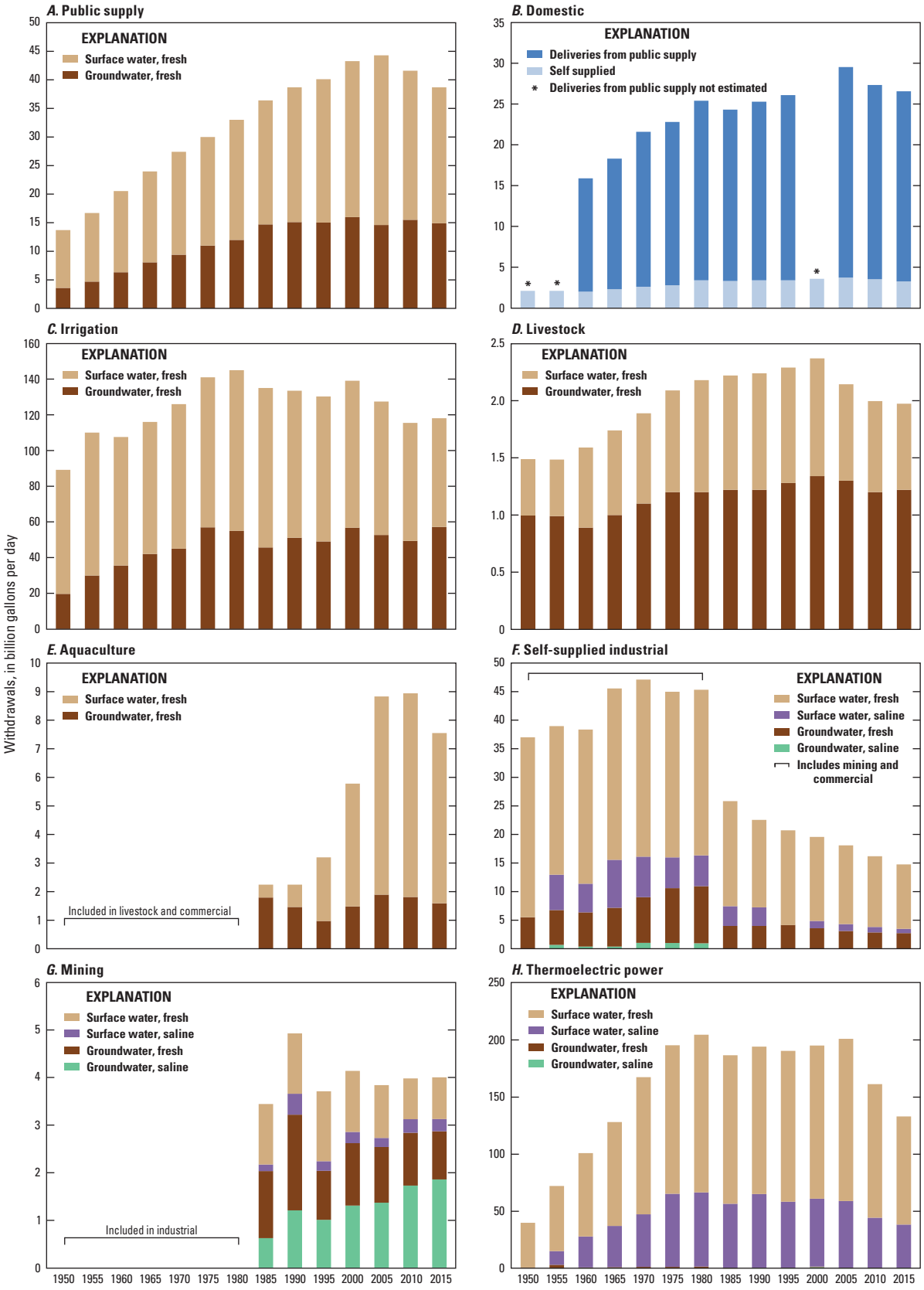


Figure 17. Trends in water withdrawals, 1950–2015.

The self-supplied domestic withdrawals decreased by 8 percent from 3.53 Bgal/d in 2010 to 3.26 Bgal/d in 2015. This represents a continued decline since 2005 and marks the lowest levels since prior to 1980 (table 14; fig. 17*B*). Between 1985 and 2015, the percentage of total population that was self-supplied has continuously declined, from about 18 percent to 13 percent.

The national average per capita use rate for self-supplied domestic withdrawals decreased from 81 GPCD in 2010 to 77 GPCD in 2015. This represents the rate of use for people with their own water supply. The rate of use for water that is delivered to people from public-supply systems (public-supply delivery GPCD) also decreased from 88 GPCD in 2010 to 82 GPCD in 2015.

Total domestic use is the combined water from public-supply deliveries to domestic users and self-supplied domestic withdrawals. Nationally, these withdrawals decreased about 0.75 Bgal/d between 2010 and 2015, from 27.3 Bgal/d in 2010 to 26.6 Bgal/d in 2015. Total domestic use in California alone decreased 0.68 Bgal/d between 2010 and 2015, accounting for 91 percent of the total national decrease and representing a 17-percent decrease in California's total domestic use between 2010 and 2015. In 2015, California endured one of the worst drought years on record (Khokha, 2014; Richtel, 2015; Stephens, 2015; California Department of Water Resources, 2016), with wide-scale water-use reductions and curtailments in effect statewide. Similarly, Texas was in a drought year in 2015 and reported about 0.05 Bgal/d, or 2 percent, less total domestic use between 2010 and 2015.

Reductions from 2005 to 2015 in water withdrawals for public supply and self-supplied domestic can be attributed to Federal, State, and local policies that have allowed for water and energy efficiency improvements. One policy is the National Energy Policy Act of 1992 (Donnelly and Cooley, 2015; Osann, 2017). This act established efficiency standards for all toilets, faucets, and showerheads. Additional and amendment legislation improved the efficiency of washing machines, dishwashers, and other water using appliances (Donnelly and Cooley, 2015; Osann, 2017). Another program to encourage water efficiency is the EPA WaterSense launched in 2006; it is a voluntary program that uses an easily identifiable label on consumer products. Many of these products are the water and energy efficient fixtures and appliances mandated through the National Energy Act of 1992 (U.S. Environmental Protection Agency, 2018a); however, the WaterSense label also currently (2018) extends to irrigation and landscaping, buildings, and certification of irrigation professionals. WaterSense-labeled products are certified to use at least 20 percent less water and save energy.

Total irrigation withdrawals were somewhat similar between 2010 and 2015 with about a 2-percent increase from 116 Bgal/d to 118 Bgal/d. Irrigation withdrawals for 2015 are at the fifth lowest level since 1950 and are 21 percent less than 1980, when withdrawals peaked at 150 Bgal/d (table 14; fig. 17*C*). However, 2015 marks the first 5-year period of increase in irrigation withdrawals since 2000, although it is possible that the increase is within the error of the estimated total withdrawal and that the withdrawals in 2015 are essentially the same as in 2010. California and Texas experienced the largest declines in irrigation withdrawals between 2010 and 2015, with a combined total reduction of 5.42 Bgal/d. However, States with increased irrigation withdrawals between 2010 and 2015 include Wyoming, Arkansas, Montana, and Idaho. These States had a combined total increase of 9.59 Bgal/d. Irrigation remains the second-largest category of use after thermoelectric, but the difference between irrigation withdrawals and thermoelectric is narrowing. Irrigation withdrawals in 2015 accounted for 64 percent of total freshwater withdrawals, excluding thermoelectric, the same percentage as in 1950. Surface water continues to be the primary source of irrigation water in the United States, but the relative proportion appears to be changing. Between 1985 and 2010, most of the irrigation water was supplied by surface-water sources, ranging from 66 percent in 1985 to 57 percent in 2010. Surface water accounted for only 52 percent of the total irrigation withdrawals in 2015. Although reclaimed wastewater is a minor overall source of irrigation water in the Nation, accounting for less than 1 percent of the total irrigation water, its use increased from 0.47 Bgal/d in 2010 to about 0.67 Bgal/d in 2015.

The use of more water-efficient irrigation systems continued to increase with 10 percent more irrigated acres using sprinkler systems in 2015 than in 2010. About 11 percent fewer irrigated acres were reported using surface (flood) irrigation systems in 2015 than in 2010. About 19 percent more irrigated acres were reported using microirrigation systems between 2010 and 2015. Total irrigated acres were about 2 percent more in 2015 than in 2010.

The compilation of irrigation water-use data conducted every 5 years since 1950 not only makes it possible to observe long-term changes in irrigation practices, including changing irrigation system types (for example, conversion of surface irrigation to sprinkler irrigation) and changes in total irrigated acres, but also allows for observations of shorter-term dynamic changes in irrigation practices and water use. For example, the 2015 dataset revealed the dynamic change in the Nation's largest user of water for irrigation, California. Estimated 2015 California irrigation withdrawals declined 4.07 Bgal/d (18 percent), and irrigated acres decreased by 10 percent in comparison to 2010, likely as a result of the intense drought conditions in 2015. Historically (1950–2010), surface water has been the primary source of irrigation water in California. However, groundwater was the primary source of irrigation water in California in 2015, likely as a result of limited available surface-water resources during the period of intense drought. In California in 2015, groundwater withdrawals for irrigation increased 60 percent from 2010, and surface-water withdrawals for irrigation decreased 64 percent.

Livestock initially was included with rural domestic but since 1960 has been estimated as a separate category and has consistently accounted for about 1–2 percent of total withdrawals, excluding thermoelectric. Total withdrawals

for livestock were 2.00 Bgal/d in 2015, the same as in 2010 (table 14; fig. 17*D*). Livestock withdrawals in 2015 were 16 percent less than the peak year of 2000, when 2.37 Bgal/d was reported. This may, in part, be a reflection of the decreasing number of cattle and calves raised in the United States; the USDA NASS reported that the number of cattle and calves in the United States decreased 23 percent from 1,188,659 in 1997 to 913,246 in 2012 (U.S. Department of Agriculture, 2014a). Withdrawals for livestock are heavily influenced by numbers of cattle, especially milk cows, which generally use much more water than other livestock because of their size and the sanitation needs of milking facilities.

Aquaculture withdrawals were 7.55 Bgal/d in 2015, or a 16 percent decrease from 2010 (8.95 Bgal/d). From 1985 to 2010, aquaculture quadrupled from 2.24 Bgal/d in 1985 to 8.96 Bgal/d in 2010. Much of the increase occurred between 1995 and 2005 and is attributed to increased accounting of aquaculture withdrawals. The decrease in aquaculture withdrawals after 2010 (table 14; fig. 17*E*) marks the first period of decline since 1985, but the reason for the decline is unclear. The decrease could be a reflection of a sharp decrease in the reported number of aquaculture farms in the United States from 4,309 to 3,093 and in freshwater acreage used for aquaculture from 365,566 to 249,274 between 2005 and 2013 (U.S. Department of Agriculture, 2014b). The reported number of flow-through raceways, however, increased by 77 percent from 9,160 to 16,253 during the same period (U.S. Department of Agriculture, 2014b). However, the decrease could simply be due to differences in changes in methodologies that were used to estimate withdrawals for many of the States. The 2005 and 2015 water withdrawals for many States were estimated on the basis of data from the USDA NASS 2005 and 2013 censuses of aquaculture. The USDA NASS did not conduct a comparable census for 2010; therefore, the 2010 withdrawal estimates for many States were based on changes in the numbers of aquaculture operations from the USDA NASS 2002 and 2007 censuses of agriculture.

Self-supplied industrial withdrawals in the Nation can be directly compared from 1985 through 2015. Since 1985, self-supplied industrial withdrawals have consistently declined and are about 43 percent less than 1985 (table 14; fig. 17*F*). Between 2010 and 2015, self-supplied industrial withdrawals decreased 1.4 Bgal/d. Texas (–0.37 Bgal/d), West Virginia (–0.34 Bgal/d), Pennsylvania (–0.22 Bgal/d), Maryland (–0.15 Bgal/d), Ohio (–0.14 Bgal/d), Arkansas (–0.12 Bgal/d), and Michigan (–0.10 Bgal/d) had the largest decreases. Delaware (0.21 Bgal/d) and Connecticut (0.12 Bgal/d) showed the largest increases from 2010 to 2015.

Declines in self-supplied industrial water withdrawals between 1985 and 2015 can likely be linked to a number of changes in factors in the United States economy, including technology, trade with foreign markets, operating costs, and a decline in manufacturing output (Bailey and Bosworth, 2014), as well as increases in the efficient use of water in industrial processes. One partial explanation for the decline in industry in the United States is a shift to a more service-based economy, where financial and health-care services have grown while the higher standard of living and higher labor costs in the United States have sent industries to countries with lower-paid labor (Amadeo, 2017). A decline in manufacturing (and a loss of jobs in this sector) in the decade 2000 to 2009 (this would impact the 2005 and 2010 water-use data) is linked to a decline in manufacturing's share of gross domestic product; the products from the United States could not compete globally (Atkinson, 2013; Bailey and Bosworth, 2014). Finally, it has been suggested that higher taxes for manufactured goods in the United States, as well as decreased prices for overseas supplies better negotiated by other nations through trade agreements, make industrial products from the United States more expensive and less able to compete in the global market (Amadeo, 2017), resulting in less need for these manufactured goods.

In addition to changes in the United States economy, declines in self-supplied industrial withdrawals reflect greater efficiencies in industrial processes and an emphasis on water reuse and recycling within industrial facilities, both driven by environmental regulations and limited availability of freshwater resources in some areas. The EPA EnergyStar program, begun in 1992, provides information and suggestions on reducing water and energy use to industries (U.S. Environmental Protection Agency, 2018b).

Mining withdrawals were 4.00 Bgal/d in 2015, about a 1-percent increase from 2010 (3.97 Bgal/d). Prior to 1985, mining was included in other industrial withdrawals but since 1985 has represented from about 2 to 3 percent of total withdrawals, excluding thermoelectric. Trends in mining withdrawals fluctuated between 1985 and 2015, ranging from an increase of 43 percent between 1985 and 1990 to a 27-percent decrease between 1990 and 1995 (table 14; fig. 17*G*). Since 2000, mining withdrawals have fluctuated only slightly, averaging about 4 Bgal/d over the period.

Thermoelectric-power withdrawals continued to account for the largest portion of total withdrawals for all categories of use, at 133 Bgal/d, or 41 percent of the total withdrawals. However, total thermoelectric-power withdrawals in 2015 were about 18 percent less than in 2010. On average, 15 gallons of water were used to produce 1 kWh of electricity in 2015, compared to almost 19 gallons in 2010. The decline in withdrawals between 2010 and 2015 continues the trend of declining withdrawals for thermoelectric power; withdrawals in 2010 were about 20 percent less than in 2005 (table 14; fig. 17*H*). Total withdrawals for thermoelectric power in 1985 were 11 percent less than in 1980, and fluctuations in total withdrawals during the 5-year intervals between 1985 and 2005 were never more than 5 percent. States with the largest increases in thermoelectric-power withdrawals between 2010 and 2015 were Nebraska (1.12 Bgal/d), Florida (0.67 Bgal/d), and North Dakota (0.15 Bgal/d). Many States (California, Ohio, Illinois, Pennsylvania, Alabama, Indiana, Massachusetts, Kentucky, North Carolina, Tennessee, and Georgia) had large decreases in withdrawals, ranging from 3.73 Bgal/d (California) to 1.17 Bgal/d (Georgia).

Several factors may have contributed to the 18 percent decline in total thermoelectric withdrawals between 2010 and 2015 (table 14). Since the 1970s, an increasing number of powerplants were built with or converted to recirculating cooling systems or dry cooling systems, which withdraw less water than powerplants with once-through cooling systems. Since 2010, 77 percent of the new cooling systems are recirculating cooling systems, and 18 percent are dry cooling systems (U.S. Department of Energy, 2016a). The increased use of natural gas to power energy- and water-efficient combined-cycle plants, almost all of which have recirculating or dry-cooling towers, has contributed to the decline in withdrawals (U.S. Department of Energy, 2016a, c). The decreased use of coal has also helped to reduce withdrawals because many coal-fired powerplants with once-through cooling systems have been retired. Of the 49 plants with once-through cooling systems that were generating electricity in 2010 and have since been decommissioned, 31 of them were conventional coal-fired powerplants (U.S. Department of Energy, 2016a). Withdrawals have declined in some States as a result of the implementation of new rules designed to minimize adverse effects to aquatic life from heated discharges and from entrainment/impingement at pump intakes at powerplants with once-through cooling systems (California Environmental Protection Agency, 2010).

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Glossary

The following terms are referenced in the text or are part of the water-use Circular series.

animal-specialties water use Water use associated with the production of fish in captivity, except for fish hatcheries, and the raising of horses and such fur-bearing animals as rabbits and pets. Animal-specialties water-use estimates were included in the 1990 and 1995 water-use Circulars but were combined with the livestock categories or aquaculture categories beginning in 2000. *See also* aquaculture water use, fish-farm water use, livestock water use, and rural water use.

aquaculture water use Water use associated with the farming of organisms that live in water (such as finfish and shellfish) and offstream water use associated with fish hatcheries. *See also* fish-farm water use, fish-hatchery water use, animal-specialties water use, and livestock water use.

closed-loop cooling system *See* recirculating cooling system.

commercial water use Water for motels, hotels, restaurants, office buildings, other commercial facilities, military and nonmilitary institutions, and (for 1990 and 1995) offstream fish hatcheries. Water may be obtained from a public-supply system or may be self-supplied. Commercial water-use estimates were included in some previous water-use Circulars but were omitted beginning in 2000. *See also* fish-hatchery water use, public-supply water use, public-supply deliveries, and self-supplied water use.

consumptive use The part of water withdrawn that is evaporated, transpired, incorporated into products or crops, consumed by humans or livestock, or otherwise removed from the immediate water environment. Also referred to as water consumed.

conveyance loss Water that is lost in transit from a pipe, canal, conduit, or ditch by leakage or evaporation. Generally, the water is not available for further use; however, leakage from an irrigation ditch, for example, may percolate to a groundwater source and be available for further use. Conveyance-loss estimates were included in some previous water-use Circulars but were omitted beginning in 2000. *See also* irrigation water use.

cooling system An equipment system that provides water for cooling purposes, such as to condensers at powerplants or at factories. May include water intakes, outlets, cooling towers, ponds, canals, pumps, and pipes. *See also* cooling-system type, industrial water use, and thermoelectric-power water use.

cooling-system type Defined as either once-through or recirculating cooling system. *See also* industrial water use, once-through cooling system, recirculating cooling system, and thermoelectric-power water use.

domestic water use Water used for indoor household purposes such as drinking, food preparation, bathing, washing clothes and dishes, flushing toilets, and outdoor purposes such as watering lawns and gardens. Domestic water use includes water provided to households by a public water supply (domestic deliveries from public suppliers) and self-supplied water. *See also* public-supply deliveries, public-supply water use, rural water use, and self-supplied water use.

fish-farm water use Water used for the production of finfish and shellfish under controlled feeding, sanitation, and harvesting procedures for commercial purposes. Water use by fish farms is classified in the aquaculture category. *See also* animal-specialties water use, aquaculture water use, and fish-hatchery water use.

fish-hatchery water use Water used for raising fish for later release and in association with the operation of fish hatcheries or fishing preserves. Fish-hatchery water use has been included in the aquaculture category since 2000. *See also* aquaculture water use, commercial water use, and fish-farm water use.

freshwater Water that contains less than 1,000 milligrams per liter (mg/L) of dissolved solids. Generally, water with more than 500 mg/L of dissolved solids is undesirable for drinking and many industrial uses. *See also* saline water.

industrial water use Water used for fabrication, processing, washing, and cooling. Includes industries such as chemical and allied products, food, mining, paper and allied products, petroleum refining, and steel. Term used in previous water-use Circulars to describe the combined public-supply deliveries to industrial users and self-supplied industrial withdrawals. Since 2000, industrial water use refers only to self-supplied industrial withdrawals. *See also* mining water use, public-supply deliveries, public-supply water use, and self-supplied water use.

instream use Water that is used, but not withdrawn, from a surface-water source for such purposes as hydroelectric-power generation, navigation, water-quality improvement, fish propagation, and recreation. Instream water-use estimates for hydroelectric power were included in some previous water-use Circulars but were omitted since 2000. *See also* offstream use.

irrigation district A cooperative, self-governing public corporation set up as a subdivision of the State government, with definite geographic boundaries, organized, and having taxing power to obtain and distribute water for irrigation of lands within the district. Created under the authority of a State legislature with the consent of a designated fraction of the landowners or citizens. *See also* irrigation water use.

irrigation water use Water that is applied by an irrigation system to assist crop and pasture growth, or to maintain vegetation on recreational lands such as parks and golf courses. Irrigation includes water that is applied for pre-irrigation, frost protection, chemical application, weed control, field preparation, crop cooling, harvesting, dust suppression, leaching of salts from the root zone, and conveyance losses. Irrigation water use includes self-supplied water and reclaimed wastewater. *See also* conveyance loss, microirrigation system, sprinkler irrigation system, and surface irrigation system.

livestock water use Water used for livestock watering, feedlots, dairy operations, and other on-farm needs. Types of livestock include dairy cows and heifers, beef cattle and calves, sheep and lambs, goats, hogs and pigs, horses, and poultry. *See also* animal-specialties water use, aquaculture water use, and rural water use.

microirrigation system An irrigation system that wets only a discrete portion of the soil surface in the vicinity of the plant by means of applicators (such as orifices, emitters, porous tubing, or perforated pipe) and operated under low pressure. The applicators may be placed on or below the surface of the ground or suspended from supports. *See also* irrigation water use, sprinkler irrigation system, and surface irrigation system.

mining water use Water used for the extraction of naturally occurring minerals including solids (such as coal, sand, gravel, and other ores), liquids (such as crude petroleum), and gases (such as natural gas). Also includes uses associated with quarrying, milling of mined materials, injection of water for secondary oil recovery or for unconventional oil and gas recovery (such as hydraulic fracturing), and other operations associated with mining activity. Does not include water associated with dewatering of the aquifer that is not put to beneficial use. Also does not include water used in processing, such as smelting, refining petroleum, or slurry pipeline operations. These processing uses are included in industrial water use. *See also* industrial water use and self-supplied water use.

offstream use Water withdrawn or diverted from a groundwater or surface-water source for aquaculture, commercial, self-supplied domestic, industrial, irrigation, livestock, mining, public supply, thermoelectric power, and other uses. *See also* entries for each of these categories of use, and instream use.

once-through cooling system Also known as open-loop cooling system. Cooling system in which the water is withdrawn from a source, circulated through the heat exchangers, and then returned to a body of water at a higher temperature. *See also* cooling system, cooling-system type, and thermoelectric-power water use.

public-supply deliveries Amount of water delivered from a public supplier to users for domestic, commercial, industrial, thermoelectric-power, or public-use purposes. Estimates of deliveries for each purpose were provided for 1995 and earlier years, but not for 2000. For 2005–2015, only domestic deliveries were estimated nationally. *See also* commercial water use, domestic water use, industrial water use, public-supply water use, public water use, and thermoelectric-power use.

public-supply water use Water withdrawn by public and private water suppliers that furnish water to at least 25 people or have a minimum of 15 connections. Public suppliers provide water for a variety of uses, such as domestic, commercial, industrial, thermoelectric-power, and public water use. *See also* commercial water use, domestic water use, industrial water use, public-supply deliveries, public water use, and thermoelectric-power water use.

public water use Water supplied from a public supplier and used for such purposes as firefighting, street washing, flushing of water lines, and maintaining municipal parks and swimming pools. Generally, public-use water is not billed by the public supplier. *See also* public-supply deliveries and public-supply water use.

recirculating cooling system Also known as closed-loop cooling system or recirculation cooling system. Water is withdrawn from a source, circulated through heat exchangers, cooled, and then re-used in the same process. Recirculating cooling systems may use induced draft cooling towers, forced draft cooling towers, cooling ponds, or canals. *See also* cooling system, cooling-system type, and thermoelectric-power water use.

reclaimed wastewater Wastewater-treatment plant effluent that has been diverted for beneficial uses such as irrigation, industrial use, or thermoelectric-power cooling instead of being released to a natural waterway or aquifer. *See also* water use.

return flow Water that reaches a groundwater or surface-water source after release from the point of use and thus becomes available for further use. *See also* water use.

rural water use Water used in suburban or farm areas for domestic and livestock needs. The water generally is self-supplied, and includes domestic use, drinking water for livestock, and other uses such as dairy sanitation, cleaning, and waste disposal. Term used in 1950 and 1955 water-use Circulars. *See also* animal-specialties water use, domestic water use, livestock water use, and self-supplied water use.

saline water Water that contains 1,000 mg/L or more of dissolved solids. *See also* freshwater.

self-supplied water use Water withdrawn from a groundwater or surface-water source by a user rather than being obtained from a public-supply source.

sprinkler irrigation system An irrigation system in which water is applied by means of perforated pipes or nozzles operated under pressure so as to form a spray pattern. *See also* irrigation water use, microirrigation system, and surface irrigation system.

surface irrigation system Irrigation by means of flood, furrow, or gravity methods. Flood irrigation is the application of irrigation water in which the entire soil surface is covered by ponded water. Furrow is a partial surface-flooding method of irrigation normally used with clean-tilled crops in which water is applied in furrows or rows of sufficient capacity to contain the design irrigation stream. Gravity is an irrigation method in which water is not pumped, but flows in ditches or pipes and is distributed by gravity. *See also* irrigation water use, microirrigation system, and sprinkler irrigation system.

thermoelectric-power water use Water used in the process of generating electricity with steam-driven turbine generators. Thermoelectric-power water use includes water provided by a public water supply (deliveries from public suppliers), self-supplied water, and reclaimed wastewater. *See also* cooling system, cooling-system type, public-supply water use, reclaimed wastewater, and self-supplied water use.

wastewater-treatment return flow Term used in previous water-use Circulars to describe water returned to the hydrologic system by wastewater-treatment facilities. *See also* water use.

water use In a restrictive sense, the term refers to water that is withdrawn for a specific purpose, such as for public supply, domestic use, irrigation, thermoelectric-power cooling, or industrial processing. In some previous water-use Circulars, water use for the domestic, commercial, industrial, and thermoelectric categories included both self-supplied withdrawals and deliveries from public supply, and some categories included reclaimed wastewater use. More broadly, water use pertains to the interaction of humans with and influence on the hydrologic cycle, and includes elements such as water withdrawal, delivery, consumptive use, wastewater release, reclaimed wastewater, return flow, and instream use. *See also* offstream use and instream use.

water withdrawal Water removed from a groundwater or surface-water source for use. *See also* offstream use and self-supplied water use.

watt-hour (Wh) An electrical energy unit of measure equal to 1 watt of power supplied to, or taken from, an electric circuit steadily for 1 hour.

Contributing Agencies and Organizations

The following State, regional, and local organizations provided assistance and data as part of the water-use compilation. In addition, State, regional, and national offices of the U.S. Army Corps of Engineers, U.S. Bureau of Reclamation, U.S. Census Bureau, U.S. Department of Energy, U.S. Environmental Protection Agency, U.S. Fish and Wildlife Service, National Agricultural Statistics Service, National Oceanic and Atmospheric Administration, National Weather Service, Natural Resources Conservation Service, and other Federal agencies provided assistance and data for various States.

Alabama

Alabama Department of Economic and Community Development, Office of Water Resources

Alaska

Alaska Department of Commerce, Community and Economic Development, Community and Regional Affairs
Alaska Department of Environmental Conservation, Division of Water
Alaska Department of Fish and Game
Alaska Department of Natural Resources, Division of Mining, Land and Water

Arizona

Arizona Corporation Commission
Arizona Department of Environmental Quality
Arizona Department of Water Resources
Arizona Public Service
Buckeye Water Conservation and Drainage District
Central Arizona Project
Gila Water Commissioner
Paloma Irrigation and Drainage District
Salt River Project
Wellton-Mohawk Irrigation and Drainage District

Arkansas

Arkansas Association of Conservation Districts
Arkansas Department of Health, Engineering Division
Arkansas Natural Resources Commission

California

California Department of Conservation, Division of Land Resource Protection
California Department of Corrections and Rehabilitation
California Department of Water Resources
California Environmental Protection Agency, State Water Resources Control Board
Golf Course Superintendents Association of America

Colorado

Colorado Division of Reclamation Mining and Safety
Colorado Division of Water Resources
Colorado Oil and Gas Conservation Commission
Colorado Water Conservation Board
Rocky Mountain Golf Course Superintendents Association

Connecticut

State of Connecticut Department of Environmental Protection

Delaware

Delaware Department of Natural Resources and Environmental Control
Delaware State University
University of Delaware

District of Columbia

DC Water

Florida

Florida Department of Agriculture and Consumer Services
Northwest Florida Water Management District
South Florida Water Management District
Southwest Florida Water Management District
St. Johns River Water Management District
Suwannee River Water Management District

Georgia

Georgia Environmental Protection Division, Watershed Protection Branch
Georgia Power Company
Georgia Water Planning and Policy Center

Hawaii

Hawaii Department of Water Supply
Hawaiian Electric Company
Honolulu Board of Water Supply
Kauai Department of Water
Maui Department of Water Supply

Idaho

Idaho Chapter Golf Course Superintendents Association of America
Idaho Department of Commerce
Idaho Department of Environmental Quality
Idaho Department of Fish and Game
Idaho Department of Water Resources

Illinois

Illinois State Water Survey—Illinois Water Inventory Program
Imperial Valley Water Authority

Indiana

Indiana Department of Natural Resources, Division of Water, Water Rights, and Use Section

Iowa

Iowa Department of Natural Resources—Water Allocation and Use Program

Kansas

Kansas Department of Agriculture—Division of Water Resources
Kansas Water Office

Kentucky

Kentucky Energy and Environment Cabinet, Department of Environmental Protection, Division of Water

Louisiana

Capitol Area Ground Water Conservation Committee
Louisiana Cooperative Extension Service
Louisiana Department of Health and Hospitals
Louisiana Department of Natural Resources
Louisiana Department of Transportation and Development
Louisiana State University Agricultural Center

Maine

Maine Department of Agriculture, Conservation and Forestry
Maine Department of Environmental Protection
Maine Department of Health and Human Services
Maine Geological Survey
Maine Public Utilities Commission

Maryland

Maryland Department of the Environment

Massachusetts

Massachusetts Department of Environmental Protection

Michigan

Michigan Department of Environmental Quality, Water Use Program
Michigan Department of Agriculture and Rural Development

Minnesota

Minnesota Department of Natural Resources

Mississippi

Mississippi Department of Environmental Quality, Office of Land and Water Resources
Mississippi State Department of Health
Mississippi State Oil and Gas Board
Mississippi State University Extension Service
Yazoo Mississippi Delta Joint Management District

Missouri

Missouri Department of Natural Resources

Montana

Montana Board of Oil and Gas Conservation
Montana Department of Natural Resources and Conservation

Nebraska

Central Platte Natural Resources District
Lewis and Clark Natural Resources District
Lower Elkhorn Natural Resources District
Lower Loup Natural Resources District
Lower Platte North Natural Resources District
Lower Platte South Natural Resources District
Lower Republican Natural Resources District
Middle Niobrara Natural Resources District
Middle Republican Natural Resources District
Nebraska Department of Natural Resources
North Platte Natural Resources District
South Platte Natural Resources District
Tri-Basin Natural Resources District
Twin Platte Natural Resources District
Upper Big Blue Natural Resources District
Upper Elkhorn Natural Resources District
Upper Loup Natural Resources District
Upper Niobrara–White Natural Resources District
Upper Republican Natural Resources District

Nevada

Colorado River Commission
Federal Water Master
Nevada Department of Business and Industry
Nevada Department of Conservation and Natural Resources, Division of Environmental Protection
Nevada Department of Wildlife
Nevada Division of Water Resources
Southern Nevada Water Authority

New Hampshire

New Hampshire Department of Environmental Services, Water Management Bureau

New Jersey

New Jersey Department of Environmental Protection

New Mexico

New Mexico Office of the State Engineer—Water Conservation Bureau
New Mexico Oil Conservation Division

New York

New York City Department of Environmental Protection
New York State Department of Environmental Conservation
New York State Department of Health

North Carolina

North Carolina Department of Agriculture and Consumer Services, Agribusiness and Aquaculture
North Carolina Department of Environmental Quality, Water Supply Planning Branch

North Dakota

North Dakota Department of Mineral Resources
North Dakota State Department of Commerce
North Dakota State Water Commission

Ohio

Ohio Department of Natural Resources

Oklahoma

Oklahoma Corporation Commission
Oklahoma Water Resources Board

Oregon

Oregon Health Authority Drinking Water Services
Oregon Water Resources Department

Pennsylvania

Delaware River Basin Commission
Pennsylvania Department of Environmental Protection

Puerto Rico

Puerto Rico Aqueduct and Sewer Authority
Puerto Rico Department of Health
Puerto Rico Department of Natural and Environmental Resources
Puerto Rico Electric and Power Authority

Rhode Island

Rhode Island Department of Environmental Management
Rhode Island Department of Health
Rhode Island Water Resources Board

South Carolina

South Carolina Department of Health and Environmental Control

South Dakota

South Dakota Department of Environment and Natural Resources

Tennessee

Tennessee Department of Environment and Conservation, Division of Water Resources

Texas

Texas Commission on Environmental Quality
Texas Railroad Commission
Texas Water Development Board—Water Use and Projections & Planning

U.S. Virgin Islands

U.S. Virgin Islands Department of Planning and Natural Resources

Utah

Golf Course Superintendents Association of America
State of Utah Automated Geographic Reference Center
Utah Department of Agriculture and Food
Utah Department of Natural Resources, Division of Oil, Gas, and Mining
Utah Department of Natural Resources, Division of Water Resources
Utah Department of Natural Resources, Division of Water Rights
Utah Department of Natural Resources, Division of Wildlife Resources
Ute Tribe Fish and Wildlife Department

Vermont

Vermont Agency of Natural Resources, Department of Environmental Conservation, Drinking Water and Groundwater Protection Division
Vermont Fish and Wildlife Department, Agency of Natural Resources

Virginia

Virginia Department of Environmental Quality, Water Supply Planning Program

Washington

Golf Course Superintendents Association of America
Washington State Department of Ecology
Washington State Department of Health

West Virginia

West Virginia Department of Environmental Protection, Water Use Section
West Virginia Public Service Division

Wisconsin

Public Service Commission of Wisconsin—Energy Division
Public Service Commission of Wisconsin—Water Division
Wisconsin Department of Administration (DOA) Demographic Services Center
Wisconsin Department of Natural Resources

Wyoming

Wyoming Oil and Gas Conservation Commission
Wyoming Water Development Commission

For additional information, contact:
U.S. Geological Survey
National Water Use Science Project Team
wu-info@usgs.gov

or visit our website at:
https://water.usgs.gov/watuse/

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