INTRODUCTION

Many existing sources of water are being stressed by withdrawals from aquifers and diversions from rivers and reservoirs to meet the needs of homes, cities, farms, and industries. Increasing requirements to leave water in the streams and rivers to meet environmental, human, and recreational needs further complicate the matter.

Traditionally, water management in the United States has focused on manipulating the country's supplies of freshwater to meet the needs of users. A number of large dams were built during the early 20th century to increase the supply of freshwater for any given time. This era of building large dams to meet water demand in the United States has passed. As we approach the 21st century, the finite water supply and established infrastructure require that demand be managed effectively within the available sustainable supply. Quantitative assessments derived from this type of national water-use compilation can be used to evaluate the impacts of population growth and the effectiveness of alternative water-management policies, regulations, and conservation activities. As the focus on water management is increasingly on the river basin or watershed, often spanning multiple States, this national compilation of data also can be used to develop and evaluate trends in water use, to plan for more effective uses of the Nation's water resources, and to make projections of future demands.

PURPOSE AND SCOPE

The purpose of this report is to present consistent and current water-use estimates by State and water-resources region for the United States, Puerto Rico, the U.S. Virgin Islands, and the District of Columbia. Estimates of water withdrawn from surface- and ground-water sources, estimates of consumptive use, and estimates of instream use and wastewater releases during 1995 are presented in this report. The U.S. Geological Survey (USGS) has compiled similar national estimates at 5-year intervals since 1950 (MacKichan, 1951, 1957; MacKichan and Kammerer, 1961; Murray, 1968; Murray and Reeves, 1972, 1977; and Solley and others, 1983, 1988, 1993). This series of water-use reports serves as one of the few sources of information about regional or naional trends in water use. This report discusses eight categories of offstream water use—public supply, domestic, commercial, irrigation, livestock, industrial, mining, and thermoelectric power—and one category of instream use: hydroelectric power. Detailed information for other instream uses, such as navigation, recreation, pollution abatement, and fish habitat is beyond the scope of this report. Information on wastewater-treatment facilities is given in the "Wastewater Release" section.

For each category of offstream water use, 1995 withdrawal and consumptive-use estimates are discussed and those estimates are compared with corresponding 1990 estimates. The text is supplemented with illustrations and tables showing data for each State, Puerto Rico, the U.S. Virgin Islands, and the District of Columbia and for each of the 21 water-resources regions. (Water-resources regions are shown on a map on the inside of the front cover.) Totals are highlighted in the tables for ease of reference. At the beginning of this report is a section on total water use by category and source of water, and at the end is a section on trends in water use for the period 1950-95.

TERMINOLOGY

The terms and units used in this report are similar to those used in previous water-use circulars in this series. In this report, the term "offstream use" refers to water diverted or withdrawn from a surface- or groundwater source and conveyed to a place of use. "Instream use" refers to uses taking place within the river channel itself. Hydroelectric power generation is discussed as an "instream use," although some hydroelectric power water use was reported as offstream use. The hydroelectric power offstream use is included in the instream totals for consistency with previous reports. The terms "freshwater," "saline water," and "reclaimed wastewater," as types of water, are defined in the glossary. The definition of saline water has been expanded in the glossary to include slightly saline, moderately saline, and highly saline. Slightly saline withdrawals, 1,000 to 3,000 parts per million (ppm) of dissolved solids, are reported as freshwater in this series. Saline water is tabulated only for the industrial, mining, and thermoelectric power categories. A few States reported saline withdrawals for the commercial, animal specialties, and public-supply categories. These withdrawals are small and are included under freshwater for the commercial and public-supply categories. The saline withdrawals reported for animal specialties are not listed in the tables or included in the totals. Some public supplies treat slightly saline water

before it is distributed, but all public-supply withdrawals are considered as freshwater in this report. Surface water and ground water, as sources of water, and the categories of water use also are defined in the glossary. In this report, withdrawals refer to self-supplied withdrawals, and deliveries refer to public-supply deliveries. "Consumptive use" refers to that part of the water withdrawn that is evaporated, transpired, incorporated into products and crops, consumed by humans or livestock, or otherwise removed from the immediate water supply.

Sources of Data and Methods of Analysis

In cooperation with State and local agencies, the water-use estimates for 1995 were compiled by the USGS's District offices for each county in the United States, Puerto Rico, and the U.S. Virgin Islands, and for the 2,149 water-resources cataloging units. [For an explanation of cataloging units, see Seaber and others (1987)]. These estimates were entered into a State aggregate water-use data base in each District office, reviewed by a regional water-use specialist, and submitted to the USGS's headquarters in Reston, Va. The information was aggregated by State (including Puerto Rico, the U.S. Virgin Islands, and the District of Columbia) and by the 21 water-resources regions for each category of water use. All the water-use information compiled for this report is stored in the USGS's Aggregate Water-Use Data System (AWUDS) and is available by both county and cataloging unit on the World Wide Web through URL:

http://water.usgs.gov/public/watuse/

Sources of information and accuracy of data vary and are discussed for each category in subsequent parts of this report. This compilation effort was coordinated by the USGS's National Water-Use Information Program which was implemented in 1977 to provide more uniform, current, and reliable information on water use. "Guidelines for Preparing U.S. Geological Survey Water-Use Estimates in the United States for 1995" were developed and distributed on the Web, and are available at the site identified above. USGS water-use project chiefs also are identified at the Web site mentioned above. Each project chief compiled and analyzed information from various State cooperators, made estimates of missing data elements, and prepared documentation that identifies the sources of water-use information for each State and describes how the water-use estimates were determined for this report. Many state agencies publish reports on water use as part of their participation in the National Water-Use Information Program, and a list of these publications is given at the end of this report.

The following national data files were made available to each USGS District office for reference: U.S. Environmental Protection Agency Permit Compliance files and Safe Drinking Water Information System (SDWIS) files, U.S. Bureau of Census population files, and the U.S. Department of Energy, Energy Information Administration reports. Each District is responsible for determining the most reliable source of information available for that State.

Water-use numerical data are the average daily quantities used. Irrigation water is applied during only a part of each year and at variable rates; therefore, the actual rate of application is much greater than the average daily rate given in tables in this report. In this report, numerical data generally are rounded to three significant figures for values greater than 100 and two significant figures for values less than 100. Most tables show these data in million gallons per day. Selected tables also show per-capita-use data in gallons per day, rounded to three significant figures, and irrigation and hydroelectric power data in thousand-acre feet per year. A conversion table is given before the glossary to assist those readers who may wish to convert the data to other units of measurement. All numbers were rounded independently; thus, the sums of individual rounded numbers may not equal the totals. The percentage changes discussed in the text were calculated from the unrounded data.

Population data, which are from the U.S. Bureau of the Census population estimates and projections (U.S. Bureau of the Census, 1996), are shown to the nearest thousand. Data on population served by public supply were compiled in cooperation with State and local agencies and are rounded to three significant figures.

Acknowledgments

The authors acknowledge the assistance provided by the many State and local agencies that cooperated with the U.S. Geological Survey, and the many USGS State water-use project chiefs that participated in the collection and compilation of data for this report. USGS water-use project chiefs responsible for the 1995 compilation for each state are identified on the Web through the URL:

http://water.usgs.gov/public/watuse/

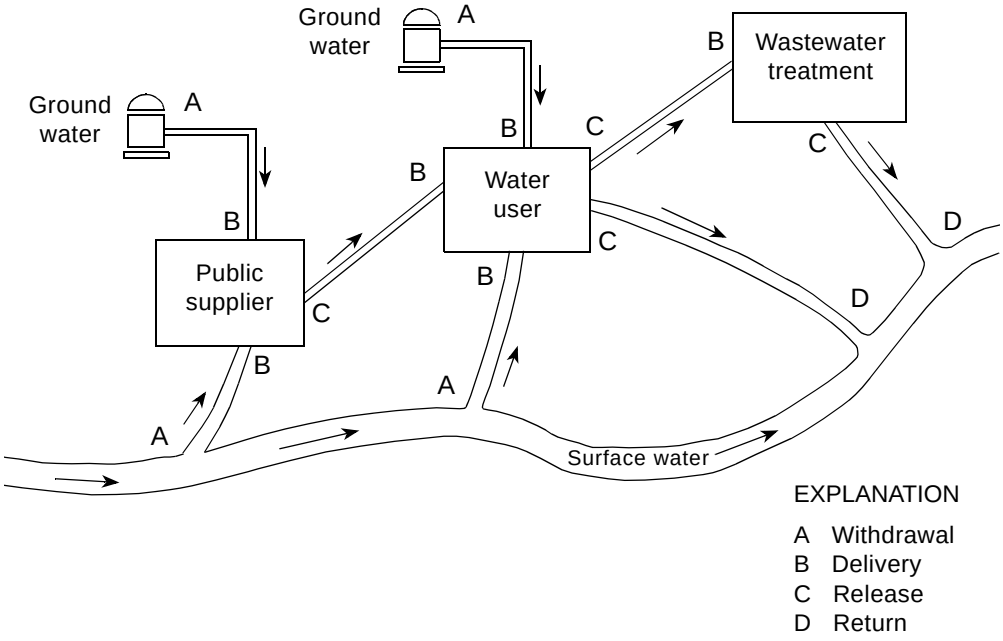
In many States, such as West Virginia and New Mexico, cooperator personnel worked as full partners with the USGS in this compilation and analysis effort.

WATER USE

Water use in this report is subdivided into offstream use, instream use, and wastewater release. The difference among these types of use is explained below.

Offstream use is a water use that refers to water being diverted or withdrawn from a surface- or ground-water source and conveyed to the place of use. To determine the total quantity of offstream water use (self-supplied withdrawals and public-supply deliveries), five subtypes of use are evaluated, as explained below and shown in the following sketch.

1. Withdrawal—The quantity of water diverted or withdrawn from a surface- or ground-water source. (A in sketch).
2. Delivery/release—The quantity of water delivered at the point of use (B) and the quantity released after use (C).
3. Conveyance loss—The quantity of water that is lost in transit, for example, from point of withdrawal to point of delivery (A-B), or from point of release to point of return (C-D).
4. Consumptive use—That part of water withdrawn that is evaporated, transpired, or incorporated into products or crops. In some instances, consumptive use will be the difference between the volume of water delivered and the volume released (B-C).
5. Return flow—The quantity of water that is discharged to a surface- or ground-water source (D) after release from the point of use and thus becomes available for further use.



In this report, self-supplied withdrawals by source, deliveries from public suppliers (where applicable), and consumptive-use estimates are given for the following categories of offstream use: domestic, commercial, irrigation, livestock, industrial, mining, and thermoelectric power. For the public-supply category, in addition to withdrawals, the report also gives water delivered to domestic, commercial, industrial, and thermoelectric power users.

Each category of offstream use typically effects the reuse potential of return flows differently. Reuse potential reflects the quality and the quantity of water available for subsequent uses; for example, irrigation return flow may be contaminated by pesticides and fertilizers, and, because of the high consumptive use of water during irrigation, the mineral content of the return flow often is substantially greater than that of the water applied. Consequently, irrigation return flow frequently may have little reuse potential. This is a significant contrast to the reuse potential of most water discharged from thermoelectric plants, where the principal change is an increase in water temperature.

Instream use is a water use that takes place without the water being diverted or withdrawn from surface- or ground-water sources. Examples of instream uses are hydroelectric power generation, navigation, freshwater dilution of saline estuaries, maintenance of minimum streamflows to support fish and wildlife habitat, and wastewater assimilation.

Quantitative estimates for most instream uses are difficult to compile on a national scale. However, because such uses compete with offstream uses and affect the quality and quantity of water resources for all uses, effective water-resources management requires that methods and procedures be devised to enable instream uses to be assessed quantitatively. California is one of the first States to quantify various types of instream uses.

The only instream-use estimates compiled for this report are for hydroelectric power generation. Unlike other instream uses, the water used for hydroelectric power generation is a measurable quantity because the amount of water passed through the plant can be documented. Consumptive use in actual hydroelectric power generation (as opposed to evaporation from impoundments created by hydroelectric dams) generally is negligible.

In this report, wastewater release refers to water released from private and public wastewater-treatment facilities. Information is provided on the number of publicly and privately owned wastewater-treatment facilities and on releases from only the public wastewater-treatment facilities. The releases can be either returned to the natural environment or reclaimed for beneficial uses, such as irrigation of golf courses and parks.