

Prepared in cooperation with the South Dakota Department of Agriculture and the South Dakota Department of Environment and Natural Resources

# Estimated Use of Water in South Dakota, 2005



Scientific Investigations Report 2008–5216

**Cover photographs left to right:**

Livestock water use. Photograph by Kathleen M. Neitzert.

Aquaculture water use. Photograph by Michael T. Carter.

Industrial water use. Photograph by Kathleen M. Neitzert.

Domestic water use. Photograph by Janet M. Carter.

Instream water use. Photograph courtesy of the U.S. Army Corps of Engineers.

Irrigation water use. Photograph by Kathleen M. Neitzert.

Public-supply water use. Photograph by Janet M. Carter.

Livestock water use. Photograph by Hopa Yellow Horse.

# **Estimated Use of Water in South Dakota, 2005**

By Janet M. Carter and Kathleen M. Neizert

Prepared in cooperation with the South Dakota Department of Agriculture and  
the South Dakota Department of Environment and Natural Resources

Scientific Investigations Report 2008–5216

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

**U.S. Department of the Interior**  
DIRK KEMPTHORNE, Secretary

**U.S. Geological Survey**  
Mark D. Myers, Director

U.S. Geological Survey, Reston, Virginia: 2008

This and other USGS information products are available at <http://store.usgs.gov/>  
U.S. Geological Survey  
Box 25286, Denver Federal Center  
Denver, CO 80225

To learn about the USGS and its information products visit <http://www.usgs.gov/>  
1-888-ASK-USGS

Any use of trade, product, or firm names is for descriptive purposes only and does not imply endorsement by the U.S. Government.

Although this report is in the public domain, permission must be secured from the individual copyright owners to reproduce any copyrighted materials contained within this report.

*Suggested citation:*

Carter, J.M., and Neitzert, K.M., 2008, Estimated use of water in South Dakota, 2005: U.S. Geological Survey Scientific Investigations Report 2008–5216, 30 p.

## Contents

Abstract.....	1
Introduction.....	1
Data-Collection Methods.....	2
Estimated Use of Water .....	2
Offstream Use.....	2
Public Supply.....	10
Domestic.....	15
Industrial.....	17
Thermoelectric Power .....	18
Mining .....	19
Livestock.....	20
Aquaculture .....	22
Irrigation.....	23
Instream Use.....	26
Changes in Water Use, 1985–2005 .....	27
Summary.....	29
References Cited.....	30

## Figures

1. Map showing total water withdrawals in South Dakota by county, 2005 .....	3
2. Graph showing total water withdrawals from ground water and surface water in South Dakota by water-use category, 2005 .....	4
3. Map showing total ground-water withdrawals in South Dakota by county, 2005.....	5
4. Graph showing ground-water withdrawals in South Dakota by water-use category, 2005.....	6
5. Map showing total surface-water withdrawals in South Dakota by county, 2005.....	7
6–10. Graphs showing:	
6. Surface-water withdrawals in South Dakota by water-use category, 2005.....	8
7. Changes in water use and total State population in South Dakota, 1985–2005 .....	27
8. Changes in irrigation water use and acres irrigated in South Dakota, 1985–2005 .....	28

9. Changes in water use for public supply and population served in South Dakota, 1985–2005 .....	28
10. Changes in self-supplied domestic water use and self-supplied population in South Dakota, 1985–2005.....	29

## Tables

1. Total population and water withdrawals by county in South Dakota, 2005 .....	9
2. Estimated population served and withdrawals for public supply by county in South Dakota, 2005 .....	11
3. Estimated public-supply domestic water deliveries and percentage of county population served by public supplies, by county in South Dakota, 2005.....	13
4. Estimated self-supplied domestic water withdrawals for counties with this use in South Dakota, 2005.....	16
5. Estimated self-supplied industrial water withdrawals for counties with this use in South Dakota, 2005.....	17
6. Estimated total thermoelectric power water use for counties with this use in South Dakota, 2005 .....	18
7. Estimated fossil-fuel thermoelectric power water use for counties with this use in South Dakota, 2005.....	18
8. Estimated geothermal thermoelectric power water use for counties with this use in South Dakota, 2005.....	18
9. Estimated self-supplied mining water withdrawals for counties with this use in South Dakota, 2005 .....	19
10. Estimated livestock water use by county in South Dakota, 2005 .....	21
11. Estimated aquaculture water use for counties with this use in South Dakota, 2005 .....	22
12. Estimated irrigation withdrawals and acreage irrigated by county in South Dakota, 2005.....	24
13. Estimated hydroelectric power water use for counties with this use in South Dakota, 2005.....	26

## Conversion Factors

<b>Multiply</b>	<b>By</b>	<b>To obtain</b>
Area		
acre	4,047	square meter (m <sup>2</sup> )
Volume		
gallon (gal)	3.785	liter (L)
million gallons (Mgal)	3,785	cubic meter (m <sup>3</sup> )
Flow rate		
acre-foot per year (acre-ft/yr)	1,233	cubic meter per year (m <sup>3</sup> /yr)
gallon per day (gal/d)	0.003785	cubic meter per day (m <sup>3</sup> /d)
million gallons per day (Mgal/d)	0.04381	cubic meter per second (m <sup>3</sup> /s)

Horizontal coordinate information is referenced to the North American Datum of 1927 (NAD 27).

## Acronyms

AWUDS	Aggregated Water-Use Data System
SDDENR	South Dakota Department of Environment and Natural Resources
SWUDS	Site-Specific Water-Use Data System
USGS	U.S. Geological Survey





# Estimated Use of Water in South Dakota, 2005

By Janet M. Carter and Kathleen M. Neitzert

## Abstract

During 2005, withdrawals from ground-water and surface-water sources in South Dakota for the eight categories of offstream use totaled about 500 million gallons per day (Mgal/d). Of total withdrawals, about 271 Mgal/d was withdrawn from ground water and about 230 Mgal/d was withdrawn from surface water. The largest use of water in South Dakota during 2005 was irrigation, which accounted for about 58 percent of the total water withdrawn, followed by public supply, which accounted for about 20 percent of withdrawals.

Public-supply systems served about 666,210 people, or about 86 percent of South Dakota's population in 2005. Public-supply systems withdrew about 100 Mgal/d in 2005. Ground-water withdrawals accounted for about 66 percent of the total withdrawals (66 Mgal/d), and surface-water withdrawals accounted for about 34 percent of total withdrawals (35 Mgal/d). Total public-supply withdrawals averaged about 151 gallons per day (gal/d) per capita. About 65 percent of the public-supply water was used for domestic purposes, and the average per capita domestic use was 99 gal/d.

Self-supplied domestic withdrawals were about 8 Mgal/d, all of which was from ground water. About 109,750 people obtained household water from private wells in 2005, and per capita use was about 70 gal/d.

Industrial self-supplied water use during 2005 was about 4 Mgal/d, of which about 98 percent was from ground water and about 2 percent was from surface water. Total withdrawals for thermoelectric use were about 5 Mgal/d, of which about 1 Mgal/d was from ground water and about 4 Mgal/d was from surface water. Total mining water use was about 10 Mgal/d, of which about 5 Mgal/d came from ground water and about 6 Mgal/d came from surface water. Total livestock water use was about 48 Mgal/d, of which about 19 Mgal/d came from ground water and about 28 Mgal/d came from surface water. Total aquaculture use was about 33 Mgal/d, of which about 19 Mgal/d came from ground water and about 14 Mgal/d came from surface water.

Irrigation withdrawals during 2005 totaled about 292 Mgal/d, of which about 149 Mgal/d was from ground-water sources and about 143 Mgal/d was from surface-water sources. An estimated 421,830 acres was irrigated during 2005. Of the total acres irrigated, 298,160 acres was irrigated

by sprinkler application and 123,670 acres was irrigated by surface (or flood) application.

The only instream use reported for South Dakota was for hydroelectric power generation. During 2005, about 68,400 Mgal/d was used by the hydroelectric powerplants to generate about 3,688 gigawatt-hours of electricity.

Total water use in South Dakota decreased by about 25 percent (175 Mgal/d) between 1985 and 2005 despite an increase in the State's population of about 70,000 people. Total ground-water use increased slightly (about 21 Mgal/d) between 1985 and 2005, whereas surface-water use decreased by about 195 Mgal/d. The decreases in both total use and surface-water use are mostly attributable to decreases in irrigation water use. Total irrigation water use decreased by about 168 Mgal/d between 1985 and 2005, and surface-water irrigation use decreased by about 204 Mgal/d. Ground-water irrigation use increased by about 36 Mgal/d between 1985 and 2005.

Water use for public supply increased about 20 Mgal/d between 1985 and 2005, and the population served by public suppliers increased by about 118,000 people. In contrast, the number of people relying on private wells for domestic use decreased by about 48,000 between 1985 and 2005. All self-supplied domestic water use in 2005 was supplied by ground water. Total domestic use decreased about 8 Mgal/d between 1985 and 2005.

## Introduction

Social and economic development in the United States depend on the availability of usable water. In 1950, the U.S. Geological Survey (USGS) began publishing water-use data on a national level every 5 years to assist in the management of our Nation's water resources. In 2000, about 408 billion gallons per day was withdrawn in the United States for all uses (Hutson and others, 2004).

In 1977, Congress authorized the National Water-Use Information Program. The program encourages the USGS and a State-level agency in each of the 50 States to cooperate in the collection and dissemination of water-use data. The USGS and the South Dakota Department of Environment and Natural Resources (SDDENR), Water Rights Program cooperated in

## 2 Estimated Use of Water in South Dakota, 2005

the collection and compilation of South Dakota water-use data for 2005.

In South Dakota, agriculture and industry depend to a large extent on an adequate supply of good quality water. Water-use data compiled for South Dakota as part of the National Water-Use Information Program provide important information on withdrawals and trends to water-resources users, managers, and researchers. In addition to national water-use summaries since 1950 (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), the USGS has published reports on water use in South Dakota for 1985, 1995, and 2000 (Benson and Winterton, 1988; Amundson, 1998, 2002). This 2005 water-use report for South Dakota was prepared in cooperation with the South Dakota Department of Agriculture and the South Dakota Department of Environment and Natural Resources.

This report describes estimated water use in South Dakota that is based on the total withdrawals from ground- and surface-water resources by county for 2005. Eight categories of offstream water use—public supply, domestic, industrial, thermoelectric power, mining, livestock, aquaculture, and irrigation—and one instream use (hydroelectric power generation) are described in this report. Offstream use represents all water diverted or withdrawn from a ground- or surface-water source and conveyed to a place of use. Instream use refers to water that is used but not withdrawn from a surface-water source. Changes in water use in South Dakota from 1985 to 2005 also are described. The water-use estimates presented in this report are not equivalent to water consumed (consumptive use), which refers to that part of water withdrawn that is no longer available because it has been incorporated into products and crops, consumed by man or livestock, or otherwise removed from the water environment; for example, some water withdrawn for irrigation purposes is not consumed but rather is returned to its source after being used for crop irrigation.

## Data-Collection Methods

Water-use data for 2005 were collected and compiled by the SDDENR in cooperation with the USGS. SDDENR mailed out a water-use questionnaire to each entity that has a SDDENR permit to withdraw water requesting total withdrawals, acres (for irrigation sites), and the sources of withdrawals. The reported irrigation data were compiled by SDDENR and provided to the USGS as a database file; these data then were entered by the USGS into a Site-Specific Water-Use Data System (SWUDS). For other water uses, SDDENR sent the completed questionnaires to the USGS where they were

compiled and entered into SWUDS. Telephone follow-ups were used, if needed, for additional information or clarification of data. All SWUDS data then were aggregated by water-use category and county and stored in the USGS Aggregated Water-Use Data System (AWUDS; <http://water.usgs.gov/watuse/wuawuds.html>).

## Estimated Use of Water

This section of the report describes estimated water use in South Dakota for 2005. Estimated water use is presented for eight categories of offstream water use—public supply, domestic, industrial, thermoelectric power, mining, livestock, aquaculture, and irrigation—and one instream use (hydroelectric power generation).

### Offstream Use

Water-use information was compiled for eight categories of offstream use during 2005. The eight categories of offstream use are public supply, domestic, industrial, thermoelectric, mining, livestock, aquaculture, and irrigation. During 2005, withdrawals from ground-water and surface-water sources in South Dakota for the eight categories of offstream use totaled 500.35 million gallons per day (Mgal/d; table 1). Total withdrawals by county are shown in figure 1. The largest withdrawals (greater than 20 Mgal/d) occurred in Butte, Pennington, Minnehaha, Fall River, Hughes, Spink, and Turner Counties. Total withdrawals by category of use are shown in figure 2. The largest use of water in South Dakota during 2005 was irrigation, which accounted for about 58 percent of the total water withdrawn, followed by public supply, which accounted for about 20 percent of withdrawals.

Of total withdrawals, 270.59 Mgal/d, or about 54 percent of the total, was withdrawn from ground water (table 1). The largest ground-water withdrawals were in Pennington and Minnehaha Counties (fig. 3). Ground-water withdrawals by category are shown in figure 4. Similar to the total water withdrawn, the categories with the largest ground-water withdrawals were irrigation (about 55 percent of total ground-water withdrawals) and public supply (about 24 percent of total ground-water withdrawals).

Of total withdrawals, 229.76 Mgal/d, or about 46 percent of the total, was withdrawn from surface water (table 1). The largest surface-water withdrawals were in Butte, Fall River, and Hughes Counties (fig. 5). Surface-water withdrawals by category are shown in figure 6. Irrigation and public supply had the largest withdrawals from surface water, accounting for about 62 and 15 percent, respectively, of total surface-water withdrawals.

**Table 1.** Total population and water withdrawals by county in South Dakota, 2005.

County	Population, in thousands	Water withdrawals, in million gallons per day			County	Population, in thousands	Water withdrawals, in million gallons per day		
		Ground water	Surface water	Total			Ground water	Surface water	Total
Aurora	2.90	0.37	0.45	0.82	Jackson	2.86	0.61	2.55	3.16
Beadle	15.90	10.69	1.35	12.04	Jerauld	2.14	1.51	.60	2.11
Bennett	3.59	9.49	.29	9.78	Jones	1.03	.17	.58	.75
Bon Homme	7.09	2.79	3.57	6.36	Kingsbury	5.53	3.31	1.19	4.50
Brookings	28.12	13.65	1.40	15.05	Lake	11.04	1.31	.46	1.77
Brown	34.71	3.53	4.36	7.89	Lawrence	22.40	5.87	7.00	12.87
Brule	5.19	.41	2.32	2.73	Lincoln	33.38	3.76	.53	4.29
Buffalo	2.10	.42	4.89	5.31	Lyman	3.92	.35	2.12	2.47
Butte	9.33	5.27	46.03	51.30	McCook	5.93	1.04	.48	1.52
Campbell	1.57	2.28	.24	2.52	McPherson	2.62	1.84	1.32	3.16
Charles Mix	9.19	3.49	10.70	14.19	Marshall	4.42	1.38	.91	2.29
Clark	3.80	5.55	.71	6.26	Meade	24.62	3.23	6.11	9.34
Clay	13.00	6.68	.29	6.97	Mellette	2.09	.50	1.99	2.49
Codington	26.01	7.22	1.30	8.52	Miner	2.58	.30	.38	.68
Corson	4.37	.70	.85	1.55	Minnehaha	160.09	24.45	7.72	32.17
Custer	7.90	1.03	6.78	7.81	Moody	6.64	2.28	.82	3.10
Davison	18.78	.90	.68	1.58	Pennington	93.58	25.84	9.49	35.33
Day	5.76	3.00	.99	3.99	Perkins	3.02	.62	.86	1.48
Deuel	4.30	1.31	.46	1.77	Potter	2.35	1.16	.27	1.43
Dewey	6.16	.47	.71	1.18	Roberts	10.04	2.96	.27	3.23
Douglas	3.31	2.64	.54	3.18	Sanborn	2.54	.35	.41	.76
Edmunds	4.11	.72	.61	1.33	Shannon	13.66	1.14	.28	1.42
Fall River	7.36	1.89	24.65	26.54	Spink	6.90	19.24	2.65	21.89
Faulk	2.39	.32	.49	.81	Stanley	2.83	.63	.29	.92
Grant	7.38	4.04	4.94	8.98	Sully	1.43	1.57	8.44	10.01
Gregory	4.29	.93	1.54	2.47	Todd	9.88	10.55	.89	11.44
Haakon	1.91	.50	1.42	1.92	Tripp	6.07	3.32	2.74	6.06
Hamlin	5.71	5.88	.31	6.19	Turner	8.52	19.99	.75	20.74
Hand	3.31	1.45	.75	2.20	Union	13.46	18.09	.53	18.62
Hanson	3.75	.56	.87	1.43	Walworth	5.49	.90	6.36	7.26
Harding	1.22	.42	1.27	1.69	Yankton	21.72	7.35	12.01	19.36
Hughes	16.88	4.06	21.24	25.30	Ziebach	2.63	.21	.27	.48
Hutchinson	7.58	1.61	1.19	2.80					
Hyde	1.61	.49	.30	.79					
					<b>Total</b>	<b>775.93</b>	<b>270.59</b>	<b>229.76</b>	<b>500.35</b>

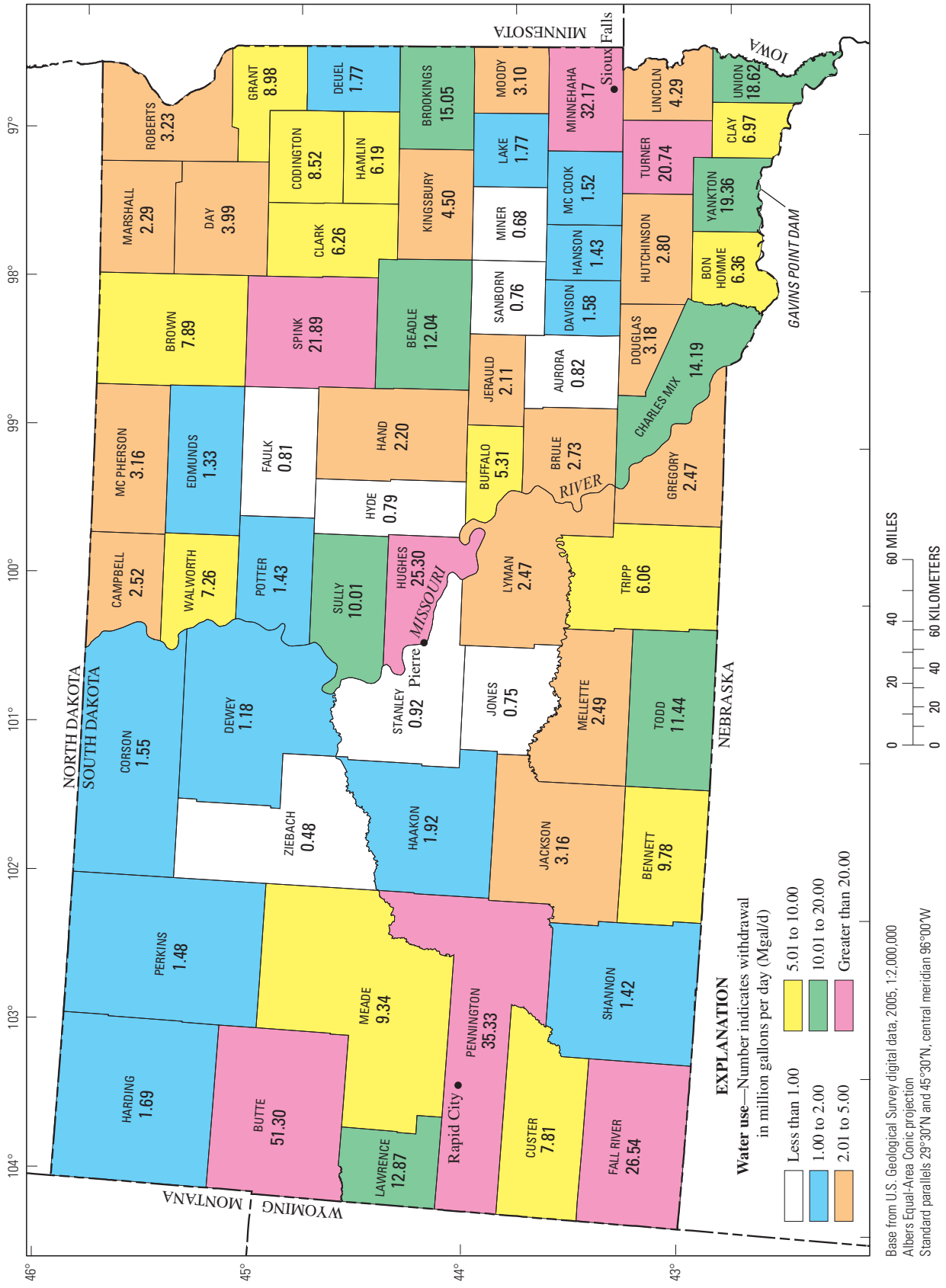


Figure 1. Total water withdrawals in South Dakota by county, 2005.

Base from U.S. Geological Survey digital data, 2005, 1:2,000,000  
 Albers Equal-Area Conic projection  
 Standard parallels 29°30'N and 45°30'N, central meridian 96°00'W

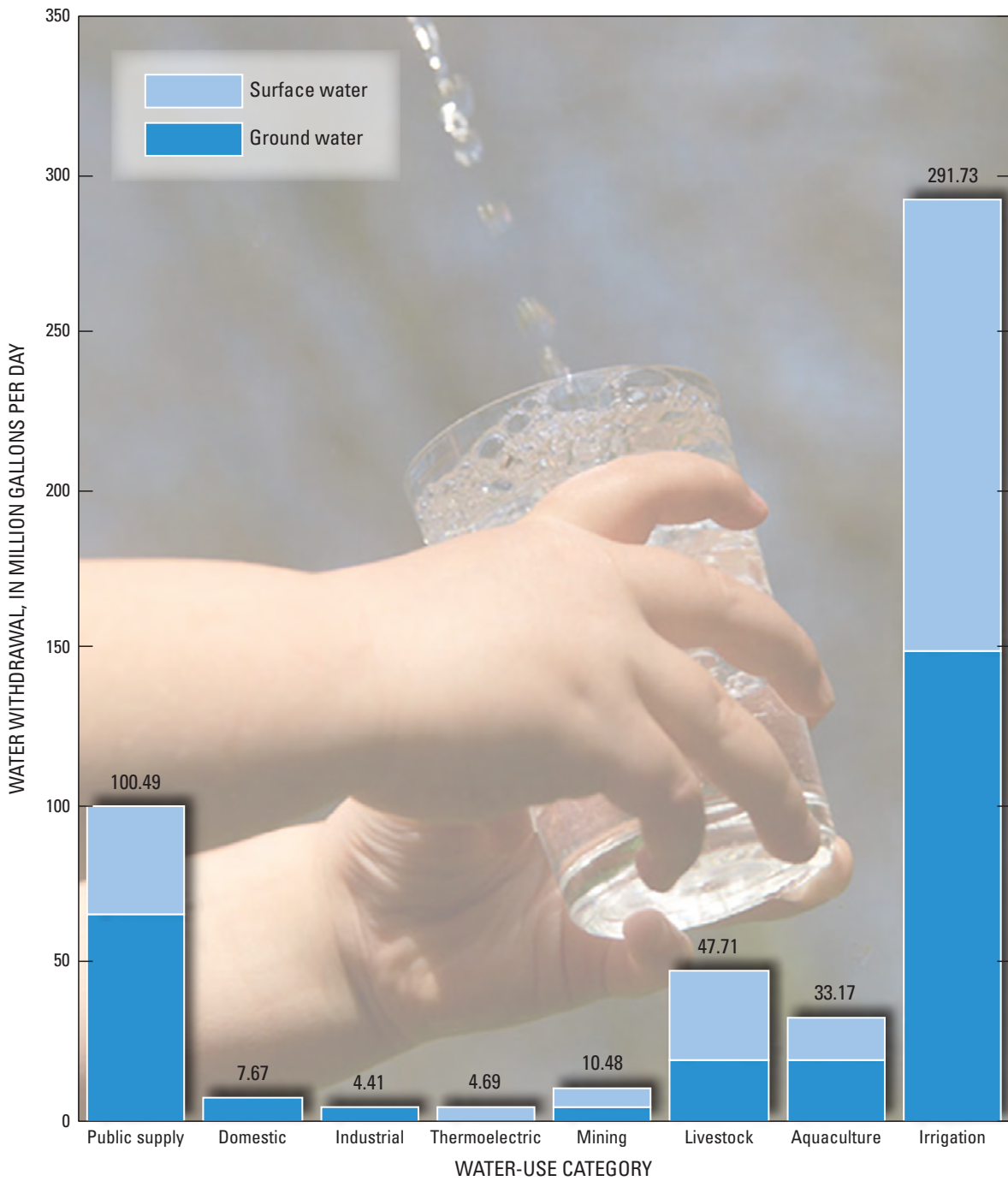


Figure 2. Total water withdrawals from ground water and surface water in South Dakota by water-use category, 2005.

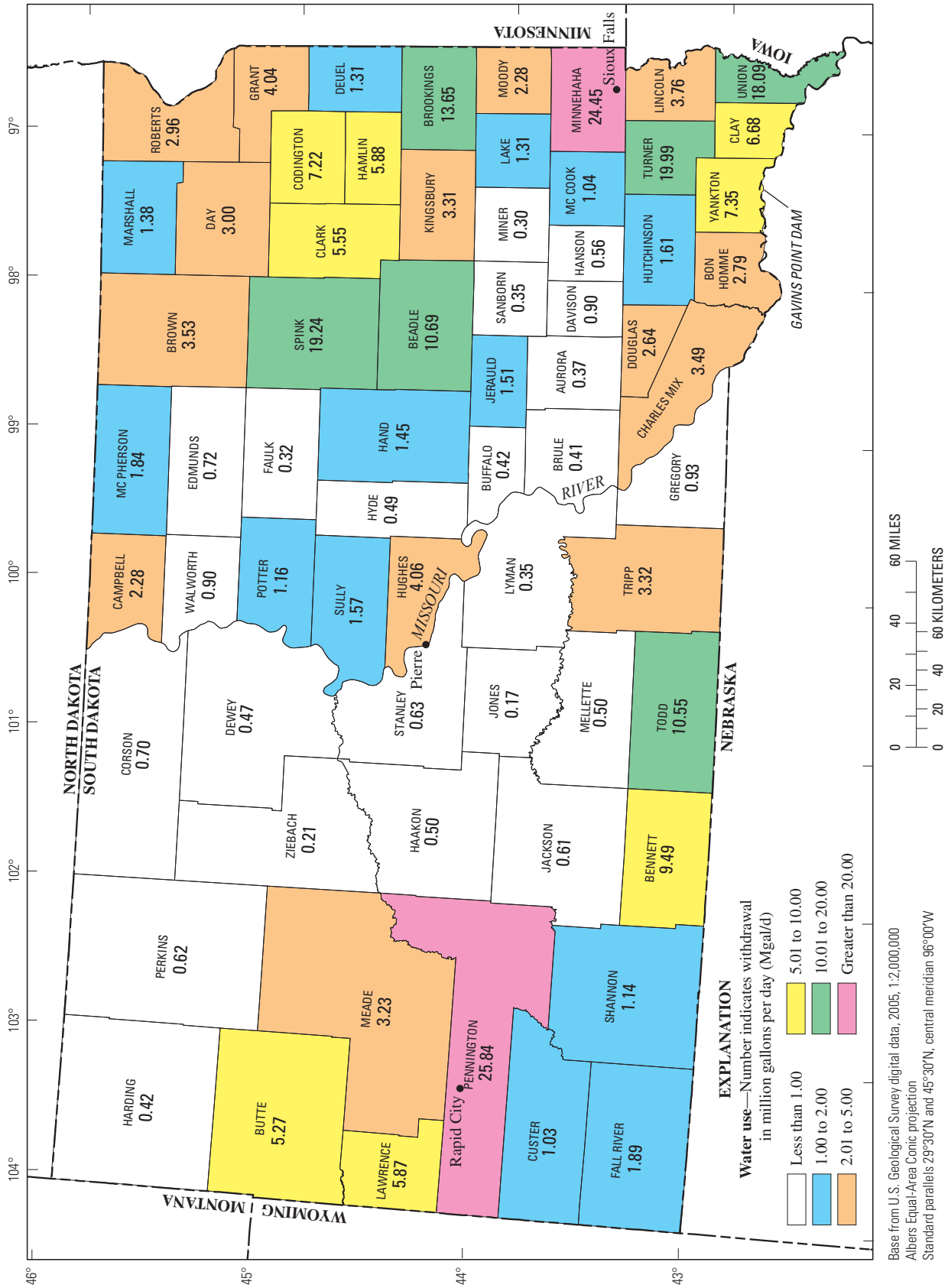
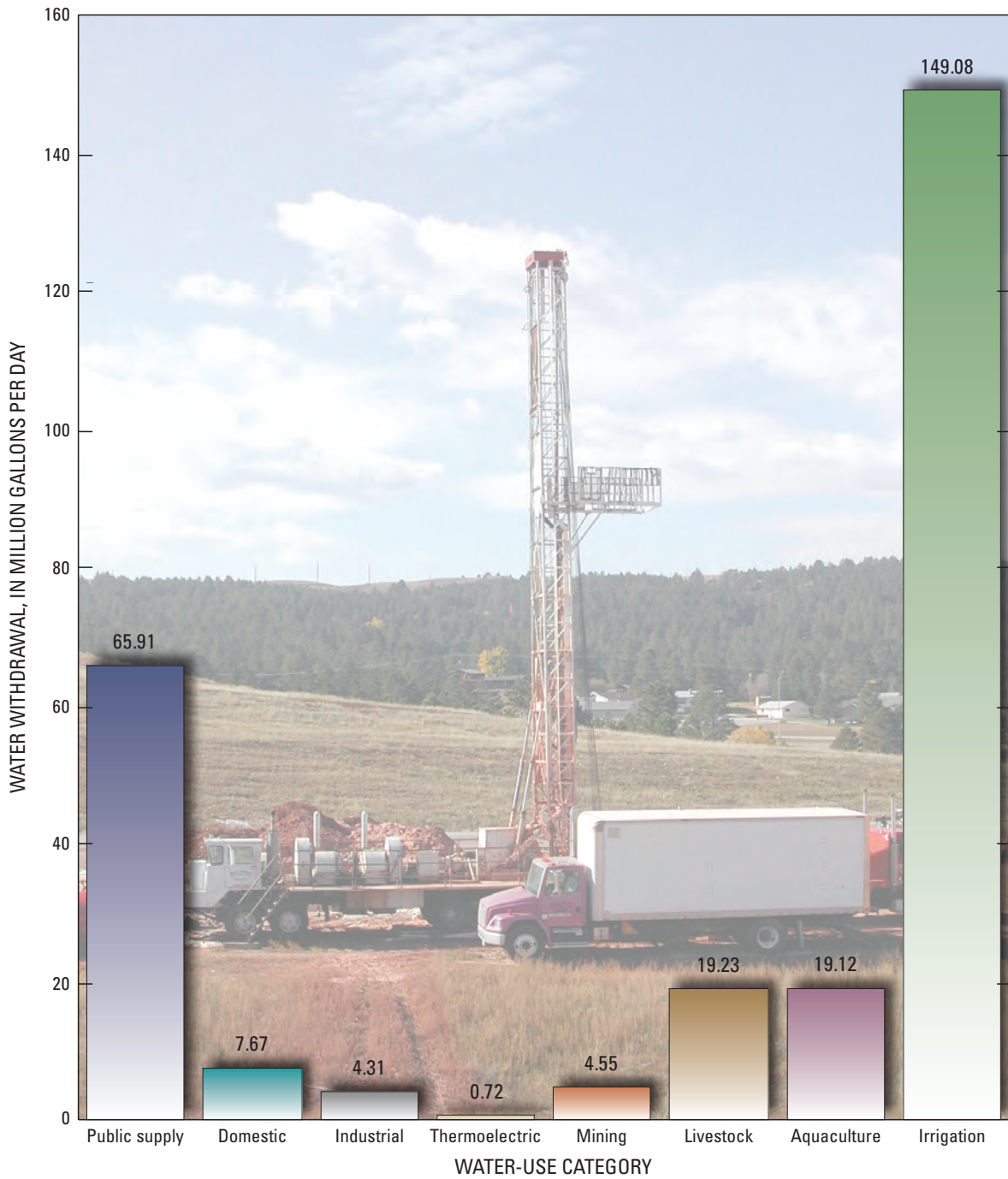


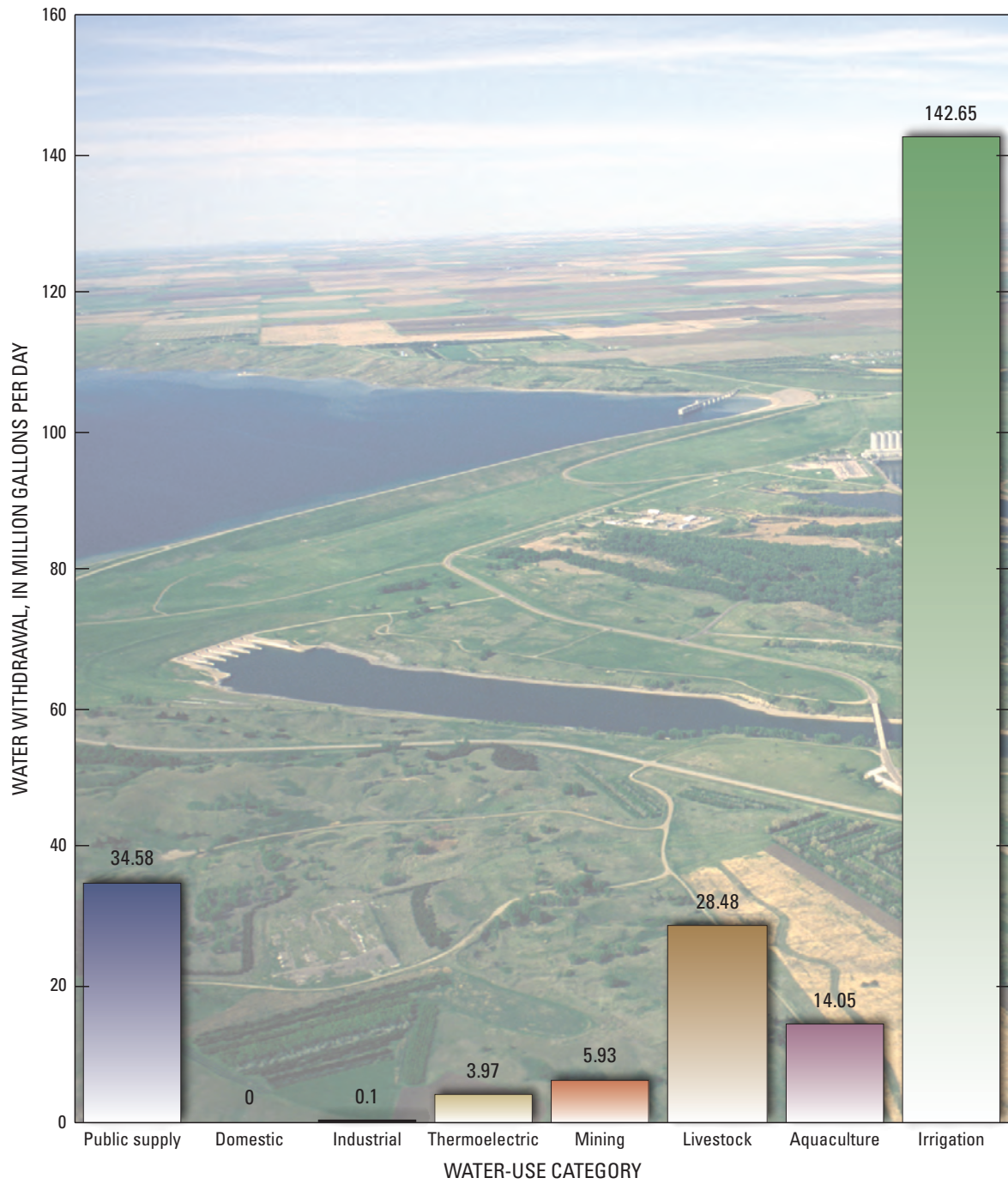
Figure 3. Total ground-water withdrawals in South Dakota by county, 2005.



**Figure 4.** Ground-water withdrawals in South Dakota by water-use category, 2005. Photograph of drilling operations for a public-supply well in Rapid City by Larry D. Putnam.







**Figure 6.** Surface-water withdrawals in South Dakota by water-use category, 2005. Photograph of Oahe Dam courtesy of U.S. Army Corps of Engineers.

## Public Supply

Public supply refers to water withdrawn by public and private water suppliers and delivered to multiple users primarily for domestic, commercial, and industrial uses. Public uses and losses are other components of total public water-supply withdrawals. Public supply includes public and private systems that furnish water to at least 25 people or have a minimum of 15 service connections.

Public-supply systems served about 666,210 people (table 2), or about 86 percent of South Dakota's population in 2005. Public-supply systems withdrew 100.49 Mgal/d in 2005. Ground-water withdrawals accounted for 65.91 Mgal/d, or 66 percent, of the total withdrawals. Surface-water withdrawals accounted for 34.58 Mgal/d, or 34 percent of the total. Total public-supply withdrawals averaged about 151 gallons per day (gal/d) per capita. Individual county per-capita uses may not represent actual use of water in counties where water withdrawals are transferred to adjacent counties. For example, Walworth County had the largest per capita use, but this is because of large withdrawals from the Missouri River within

Walworth County that are exported to other counties. Very small or no per-capita uses occur for counties where most or all water for public supply is imported from other counties.

About 30 regional rural water systems are operating in South Dakota. Many of these regional rural water systems make withdrawals from one location and deliver the water over a large geographic area that may include several counties. Deliveries by public suppliers for domestic use totaled 65.65 Mgal/d (table 3). This represents about 65 percent of total public supply withdrawals. No estimates were made for 2005 of public-supply deliveries to commercial and industrial users.

The percentage of the population served by public supplies varied from less than 1 percent in Shannon County to 100 percent in more than one-half of the South Dakota counties (table 3). Many of the counties that are served mostly by public supplies have large population centers, such as Sioux Falls in Minnehaha County, or areas with extensive rural water systems.



▲ Photograph by Kathleen M. Neitzert.

Photograph by Janet M. Carter. ▼



Public supply systems served about 666,210 people or about 86 percent of South Dakota's population in 2005.

**Table 2.** Estimated population served and withdrawals for public supply by county in South Dakota, 2005.

County	Population served, in thousands			Water withdrawals <sup>1</sup> , in million gallons per day			Per capita use <sup>1</sup> , in gallons per day
	Source		Total	Source		Total	
	Ground water	Surface water		Ground water	Surface water		
Aurora	0.00	2.90	2.90	0.00	0.00	0.00	0
Beadle	.56	15.34	15.90	.06	.00	.06	4
Bennett	1.05	.00	1.05	.23	.00	.23	219
Bon Homme	.00	7.09	7.09	.00	.15	.15	21
Brookings	26.55	.00	26.55	3.93	.00	3.93	148
Brown	1.67	33.03	34.71	.73	3.44	4.17	120
Brule	.00	5.19	5.19	.00	1.16	1.16	224
Buffalo	.00	2.10	2.10	.00	.00	.00	0
Butte	7.83	.00	7.83	3.93	.00	3.93	502
Campbell	.09	1.48	1.56	.09	.00	.09	58
Charles Mix	.00	9.19	9.19	.00	3.40	3.40	370
Clark	3.80	.00	3.80	.84	.00	.84	221
Clay	12.80	.19	13.00	1.63	.00	1.63	125
Codington	16.78	8.11	24.88	4.12	.00	4.12	166
Corson	1.20	.00	1.20	.17	.00	.17	142
Custer	2.99	.00	2.99	.48	.00	.48	161
Davison	.00	18.78	18.78	.00	.02	.02	1
Day	4.24	1.52	5.76	.24	.00	.24	42
Deuel	4.30	.00	4.30	.13	.00	.13	30
Dewey	.44	3.92	4.36	.13	.00	.13	30
Douglas	.00	2.60	2.60	.00	.00	.00	0
Edmunds	.00	4.11	4.11	.01	.00	.01	2
Fall River	5.07	.00	5.07	1.32	.00	1.32	260
Faulk	.05	2.34	2.39	.01	.00	.01	4
Grant	3.38	3.36	6.74	.05	.38	.43	64
Gregory	4.29	.00	4.29	.42	.00	.42	98
Haakon	.36	1.55	1.91	.04	.02	.06	31
Hamlin	4.46	.00	4.46	.26	.00	.26	58
Hand	.01	3.29	3.31	.00	.00	.00	0
Hanson	.12	3.62	3.75	.00	.00	.00	0
Harding	.39	.00	.39	.02	.00	.02	51
Hughes	14.05	1.65	15.70	2.97	4.08	7.05	449
Hutchinson	.87	6.71	7.58	.05	.00	.05	7
Hyde	.00	1.61	1.61	.00	.00	.00	0
Jackson	.81	.95	1.76	.29	.00	.29	165

**Table 2.** Estimated population served and withdrawals for public supply by county in South Dakota, 2005.—Continued

County	Population served, in thousands			Water withdrawals <sup>1</sup> , in million gallons per day			Per capita use <sup>1</sup> , in gallons per day
	Source		Total	Source		Total	
	Ground water	Surface water		Ground water	Surface water		
Jerauld	0.06	2.08	2.14	0.00	0.16	0.16	75
Jones	.08	.95	1.03	.01	.01	.02	19
Kingsbury	5.53	.00	5.53	1.64	.00	1.64	296
Lake	11.04	.00	11.04	.32	.00	.32	29
Lawrence	9.36	5.55	14.90	1.79	.54	2.33	156
Lincoln	28.27	.00	28.27	2.06	.00	2.06	73
Lyman	.64	3.28	3.92	.06	.13	.19	48
McCook	2.89	3.04	5.93	.77	.00	.77	130
McPherson	1.04	1.57	2.62	.02	.00	.02	8
Marshall	4.33	.09	4.42	.97	.07	1.04	235
Meade	6.26	1.09	7.35	1.25	.00	1.25	170
Mellette	.70	1.30	2.00	.04	.00	.04	20
Miner	2.54	.04	2.58	.02	.00	.02	8
Minnehaha	39.91	120.18	160.09	19.88	6.39	26.27	164
Moody	6.45	.00	6.45	1.28	.00	1.28	198
Pennington	67.10	1.70	68.80	8.11	.00	8.11	118
Perkins	1.57	.00	1.57	.12	.00	.12	76
Potter	.08	2.28	2.35	.00	.00	.00	0
Roberts	7.76	.00	7.76	.56	.00	.56	72
Sanborn	.82	1.53	2.36	.08	.00	.08	34
Shannon	.10	.00	.10	.00	.00	.00	0
Spink	.20	6.70	6.90	.23	.00	.23	33
Stanley	2.07	.00	2.07	.44	.00	.44	213
Sully	.08	1.36	1.43	.00	.00	.00	0
Todd	1.68	.00	1.68	.11	.00	.11	65
Tripp	6.06	.00	6.06	1.64	.00	1.64	270
Turner	4.31	4.21	8.52	1.49	.00	1.49	175
Union	10.15	.00	10.15	.86	.00	.86	85
Walworth	.22	5.27	5.49	.01	5.87	5.88	1,070
Yankton	.39	21.32	21.72	.00	8.76	8.76	403
Ziebach	.00	2.17	2.17	.00	.00	.00	0
<b>Total</b>	<b>339.85</b>	<b>326.34</b>	<b>666.21</b>	<b>65.91</b>	<b>34.58</b>	<b>100.49</b>	<b>151</b>

<sup>1</sup>May include withdrawals by rural water systems that make deliveries to other counties.

**Table 3.** Estimated public-supply domestic water deliveries and percentage of county population served by public supplies, by county in South Dakota, 2005.

<b>County</b>	<b>Public-supplied population, in thousands</b>	<b>Total deliveries, in million gallons per day</b>	<b>Per capita use, in gallons per day</b>	<b>Percentage of population served by public supplies</b>
Aurora	2.90	0.36	124	100.0
Beadle	15.90	1.12	70	100.0
Bennett	1.05	.15	143	29.2
Bon Homme	7.09	1.49	210	100.0
Brookings	26.55	1.45	55	94.4
Brown	34.71	3.77	109	100.0
Brule	5.19	.60	116	100.0
Buffalo	2.10	.12	57	100.0
Butte	7.83	.89	114	83.9
Campbell	1.57	.36	230	100.0
Charles Mix	9.19	.97	106	100.0
Clark	3.80	.29	76	100.0
Clay	13.00	1.03	79	100.0
Codington	24.88	2.45	98	95.7
Corson	1.20	.13	109	27.5
Custer	2.99	.20	67	37.8
Davison	18.78	1.65	88	100.0
Day	5.76	1.42	247	100.0
Deuel	4.30	.46	107	100.0
Dewey	4.36	.39	89	70.8
Douglas	2.60	.22	85	78.5
Edmunds	4.11	.48	117	100.0
Fall River	5.07	1.22	241	68.9
Faulk	2.39	.33	138	100.0
Grant	6.74	.47	70	91.3
Gregory	4.29	.65	152	100.0
Haakon	1.91	.48	251	100.0
Hamlin	4.46	.44	99	78.1
Hand	3.31	.54	163	100.0
Hanson	3.75	.45	120	100.0
Harding	.39	.02	51	32.0
Hughes	15.70	1.87	119	93.0
Hutchinson	7.58	1.32	174	100.0

**Table 3.** Estimated public-supply domestic water deliveries and percentage of county population served by public supplies, by county in South Dakota, 2005.—Continued

County	Public-supplied population, in thousands	Total deliveries, in million gallons per day	Per capita use, in gallons per day	Percentage of population served by public supplies
Hyde	1.61	0.24	149	100.0
Jackson	1.76	.22	125	61.5
Jerauld	2.14	.30	140	100.0
Jones	1.03	.11	106	100.0
Kingsbury	5.53	.71	128	100.0
Lake	11.04	1.08	98	100.0
Lawrence	14.90	1.58	106	66.5
Lincoln	28.27	1.55	55	84.7
Lyman	3.92	.40	102	100.0
McCook	5.93	.48	81	100.0
McPherson	2.62	.45	172	100.0
Marshall	4.42	.16	36	100.0
Meade	7.35	.86	117	29.9
Mellette	2.00	.14	70	95.7
Miner	2.58	.22	85	100.0
Minnehaha	160.09	14.38	90	100.0
Moody	6.45	.50	78	97.1
Pennington	68.80	6.84	99	73.5
Perkins	1.57	.09	57	52.0
Potter	2.35	.41	174	100.0
Roberts	7.76	.72	93	77.3
Sanborn	2.36	.19	81	92.9
Shannon	.10	.00	0	.7
Spink	6.90	.95	138	100.0
Stanley	2.07	.16	77	73.1
Sully	1.43	.18	126	100.0
Todd	1.68	.12	71	17.0
Tripp	6.07	.41	68	100.0
Turner	8.52	1.17	137	100.0
Union	10.15	.53	52	75.4
Walworth	5.49	.64	116	100.0
Yankton	21.72	1.91	88	100.0
Ziebach	2.17	.16	74	82.5
<b>Total</b>	<b>666.21</b>	<b>65.65</b>	<b>199</b>	<b>85.9</b>

<sup>1</sup>Average computed by dividing total deliveries by total population.

## Domestic

Domestic water use includes water for household purposes, such as drinking, food preparation, bathing, washing clothes and dishes, flushing toilets, car washing, and watering lawns and gardens. Domestic water users obtain water either from public suppliers or private wells (self-supplied).

Domestic water use in South Dakota during 2005 was 73.32 Mgal/d. Of this total, 65.65 Mgal/d was delivered from public-supply systems and served about 666,210 people (table 3). Per-capita domestic use was 99 gal/d for public-supplied users. Self-supplied withdrawals were 7.67 Mgal/d, all of which was from ground water (table 4). The self-supplied domestic population during 2005 was about 109,750,

and per capita use was 70 gal/d. Pennington County had the largest self-supplied population (nearly 25,000 people), followed by Meade County (about 17,000 people). Together, these two counties accounted for about 38 percent of the total self-supplied domestic withdrawals in South Dakota.

Less than one-half of the counties in South Dakota (28 out of 66 counties) have a self-supplied population for domestic water use (table 4). Counties where more than 70 percent of the population is self-supplied for domestic use (Bennett, Corson, Meade, Shannon, and Todd Counties) are in rural areas that do not have extensive rural water systems.



Domestic water use includes water for household purposes, such as washing clothes (photograph by Janet M. Carter). About 109,750 people in South Dakota obtained household water from private wells in 2005, and per capita use was about 70 gallons per day.

**Table 4.** Estimated self-supplied domestic water withdrawals for counties with this use in South Dakota, 2005.

County	Self-supplied population, in thousands	Self-supplied water withdrawals, in million gallons per day			Per capita use, in gallons per day	Percentage of population that is self-supplied
		Source		Total		
		Ground water	Surface water			
Bennett	2.54	0.18	0.00	0.18	71	70.8
Brookings	1.57	.11	.00	.11	70	5.6
Butte	1.50	.10	.00	.10	67	16.1
Codington	1.13	.08	.00	.08	71	4.3
Corson	3.17	.22	.00	.22	69	72.5
Custer	4.91	.34	.00	.34	69	62.2
Dewey	1.80	.13	.00	.13	72	29.2
Douglas	.71	.05	.00	.05	70	21.5
Fall River	2.28	.16	.00	.16	70	31.0
Grant	.64	.04	.00	.04	62	8.7
Hamlin	1.24	.09	.00	.09	72	21.7
Harding	.83	.06	.00	.06	73	68.0
Hughes	1.17	.08	.00	.08	68	6.9
Jackson	1.10	.08	.00	.08	73	38.5
Lawrence	7.49	.52	.00	.52	69	33.4
Lincoln	5.11	.36	.00	.36	70	15.3
Meade	17.27	1.21	.00	1.21	70	70.1
Mellette	.09	.01	.00	.01	116	4.3
Moody	.19	.01	.00	.01	53	2.9
Pennington	24.78	1.74	.00	1.74	70	26.5
Perkins	1.45	.10	.00	.10	69	48.0
Roberts	2.29	.16	.00	.16	70	22.8
Sanborn	.19	.01	.00	.01	54	7.5
Shannon	13.56	.95	.00	.95	70	99.3
Stanley	.76	.05	.00	.05	66	26.9
Todd	8.20	.57	.00	.57	70	83.0
Union	3.32	.23	.00	.23	69	24.7
Ziebach	.46	.03	.00	.03	65	17.5
<b>Total</b>	<b>109.75</b>	<b>7.67</b>	<b>0.00</b>	<b>7.67</b>	<b>70</b>	<b>14.1</b>



## Industrial

Industrial water use includes water used for such purposes as fabrication, processing, washing, and cooling in facilities that manufacture products. Self-supplied industrial water use during 2005 was 4.41 Mgal/d (table 5), of which about 98 percent was from ground water (4.31 Mgal/d) and about 2 percent (0.10 Mgal/d) was from surface water. Self-supplied industrial withdrawals occurred in only 12 of the 66 counties in South Dakota in 2005. The largest industrial water use was in Minnehaha County. The only surface-water use was in Lawrence County. Public-supply deliveries to industrial users were not tracked in 2005.

**Industrial water use includes water used in the production of ethanol, and many ethanol plants recently have been built in South Dakota (photograph by Kathleen M. Neitzert). Almost all of the self-supplied industrial water use during 2005 was from ground water.**

**Table 5.** Estimated self-supplied industrial water withdrawals for counties with this use in South Dakota, 2005.

County	Self-supplied water withdrawals, in million gallons per day		
	Source		Total
	Ground water	Surface water	
Beadle	0.02	0.00	0.02
Brookings	.92	.00	.92
Brown	.38	.00	.38
Codington	.06	.00	.06
Grant	.02	.00	.02
Harding	.03	.00	.03
Lake	.01	.00	.01
Lawrence	.80	.10	.90
Lincoln	.32	.00	.32
Minnehaha	1.60	.00	1.60
Pennington	.13	.00	.13
Yankton	.02	.00	.02
<b>Total</b>	<b>4.31</b>	<b>0.10</b>	<b>4.41</b>



## Thermoelectric Power

Thermoelectric power water use includes water used in the production of electric power generated with fossil-fuel, geothermal, or nuclear energy. Thermoelectric withdrawals occurred in only 6 of 66 counties in South Dakota in 2005. Withdrawals for thermoelectric use during 2005 totaled 4.69 Mgal/d, of which 0.72 Mgal/d was from ground water and 3.97 Mgal/d was from surface water (table 6). The largest use for thermoelectric power was in Grant County. Total water withdrawn for thermoelectric power generation by powerplants using fossil fuel was 4.35 Mgal/d, of which about 0.38 Mgal/d was from ground water and 3.89 Mgal/d was from surface water (table 7). All fossil fuel thermoelectric plants in South Dakota use recirculating, or closed-loop, cooling systems. The withdrawal of geothermal water totaled 0.34 Mgal/d during 2005 (table 8). Most of the geothermal water was from wells that are used for heating and are completed in the Madison aquifer (Amundson, 2000). South Dakota does not have any operating nuclear powerplants.



Total water withdrawn in South Dakota for thermoelectric power generation by powerplants using fossil fuel was about 4 million gallons per day in 2005 (photograph by Janet M. Carter).

**Table 6.** Estimated total thermoelectric power water use for counties with this use in South Dakota, 2005.

County	Self-supplied water withdrawals, in million gallons per day		
	Source		Total
	Ground water	Surface water	
Edmunds	0.11	0.00	0.11
Grant	.00	3.89	3.89
Haakon	.16	.00	.16
Minnehaha	.05	.08	.13
Pennington	.38	.00	.38
Stanley	.02	.00	.02
<b>Total</b>	<b>0.72</b>	<b>3.97</b>	<b>4.69</b>

**Table 7.** Estimated fossil-fuel thermoelectric power water use for counties with this use in South Dakota, 2005.

County	Self-supplied water withdrawals, in million gallons per day		
	Source		Total
	Ground water	Surface water	
Grant	0.00	3.89	3.89
Minnehaha	.00	.08	.08
Pennington	.38	.00	.38
<b>Total</b>	<b>0.38</b>	<b>3.89</b>	<b>4.35</b>

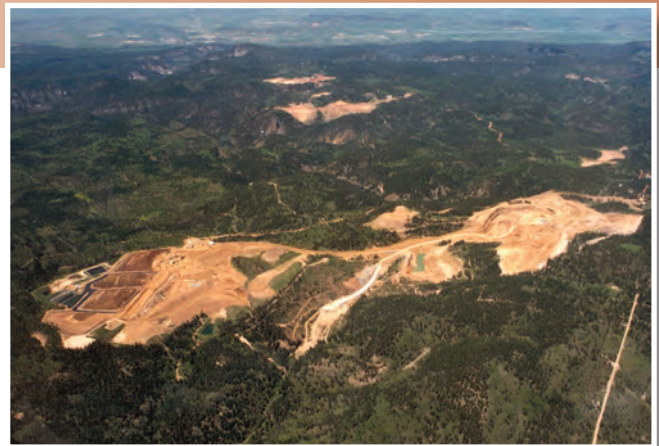
**Table 8.** Estimated geothermal thermoelectric power water use for counties with this use in South Dakota, 2005.

County	Self-supplied water withdrawals, in million gallons per day		
	Source		Total
	Ground water	Surface water	
Edmunds	0.11	0.00	0.11
Haakon	.16	.00	.16
Minnehaha	.05	.00	.05
Stanley	.02	.00	.02
<b>Total</b>	<b>0.34</b>	<b>0.00</b>	<b>0.34</b>

## Mining

Mining water use is water used for the extraction of naturally occurring minerals, including solids (such as coal, clay, and ores), liquids (such as crude petroleum), and gases (such as natural gas). This category also includes water uses associated with sand, gravel, and quarrying for rock aggregates, well operations (dewatering), milling (crushing, screening, washing, flotation, and others), and other preparations customarily done at the mine site or as part of a mining activity.

Total mining water use during 2005 was 10.48 Mgal/d (table 9). Of this total, 4.55 Mgal/d was from ground water (about 43 percent) and 5.93 Mgal/d was from surface water (about 57 percent). Mining withdrawals occurred in 39 counties in South Dakota in 2005. The largest mining use occurred in Lawrence, Minnehaha, Pennington, and Brookings Counties.



**Water withdrawals for mining occurred in 39 counties in South Dakota in 2005. The largest mining use occurred in Lawrence, Minnehaha, Pennington, and Brookings Counties (photograph by Mark A. Keenihan, South Dakota Department of Environment and Natural Resources).**

**Table 9.** Estimated self-supplied mining water withdrawals for counties with this use in South Dakota, 2005.

County	Self-supplied water withdrawals, in million gallons per day			County	Self-supplied water withdrawals, in million gallons per day		
	Source		Total		Source		Total
	Ground water	Surface water			Ground water	Surface water	
Bon Homme	0.02	0.03	0.05	Jerauld	.09	.11	.20
Brookings	.58	.77	1.35	Kingsbury	.03	.00	.03
Brown	.08	.00	.08	Lake	.00	.07	.07
Brule	.07	.10	.17	Lawrence	.39	1.29	1.68
Butte	.15	.20	.35	Marshall	.00	.19	.19
Campbell	.05	.00	.05	McPherson	.02	.54	.56
Charles Mix	.04	.06	.10	Meade	.00	.01	.01
Clark	.02	.03	.05	Miner	.04	.06	.10
Codington	.15	.38	.53	Minnehaha	1.50	.00	1.50
Custer	.00	.07	.07	Moody	.02	.00	.02
Davison	.16	.00	.16	Pennington	.15	1.24	1.39
Day	.10	.00	.10	Potter	.03	.05	.08
Douglas	.01	.01	.02	Roberts	.02	.02	.04
Fall River	.03	.05	.08	Shannon	.03	.05	.08
Grant	.07	.10	.17	Stanley	.02	.03	.05
Gregory	.00	.01	.01	Sully	.07	.00	.07
Hamlin	.01	.01	.02	Turner	.05	.06	.11
Hanson	.17	.00	.17	Union	.18	.23	.41
Harding	.02	.03	.05	Yankton	.08	.00	.08
Hughes	.10	.13	.23	<b>Total</b>	<b>4.55</b>	<b>5.93</b>	<b>10.48</b>

## Livestock

Livestock water use includes water used in the production of meat, poultry, eggs, milk, and wool. It does not include rural-domestic water use, irrigation water use, or other farm needs such as lawn and garden watering. Livestock data from the South Dakota Agricultural Statistics Service and U.S. Census of Agriculture for 2002 and water-use coefficients for various animals were used to estimate the livestock water use during 2005. The following coefficients (in gallons per day) from U.S. Department of Agriculture (2004) were used: 10 for beef cows, 20 for milk cows, 8 for calves, 6 for breed

hogs and pigs, 4 for feed hogs and pigs, 2 for sheep, 12 for horses, 0.09 for lay hens, 0.07 for other chicks, and 0.15 for turkeys. Livestock water use occurred in every county in South Dakota in 2005 and totaled 47.71 Mgal/d (table 10). Of this total, 19.23 Mgal/d was from ground water (about 40 percent) and 28.48 Mgal/d was from surface water (about 60 percent). Total livestock during 2002 included 3,710,629 cattle, 1,375,506 hogs and pigs, 2,226,368 poultry, 69,568 horses, and 376,468 sheep (U.S. Department of Agriculture, 2004).



▲ Photograph by Kathleen M. Neitzert.

▼ Photograph by Hopa Yellow Horse.

Livestock water use in South Dakota occurred in every county in 2005. Cattle are the predominant livestock raised in South Dakota, and windmills that supply power to stock wells are common features on the landscape.



**Table 10.** Estimated livestock water use by county in South Dakota, 2005.

County	Water withdrawals, in million gallons per day			County	Water withdrawals, in million gallons per day		
	Source		Total		Source		Total
	Ground water	Surface water			Ground water	Surface water	
Aurora	0.35	0.45	0.80	Jackson	0.24	0.35	0.59
Beadle	.56	.83	1.39	Jerauld	.22	.33	.55
Bennett	.19	.28	.47	Jones	.16	.25	.41
Bon Homme	.29	.42	.71	Kingsbury	.33	.48	.81
Brookings	.39	.59	.98	Lake	.24	.37	.61
Brown	.49	.74	1.23	Lawrence	.06	.09	.15
Brule	.34	.61	.95	Lincoln	.21	.31	.52
Buffalo	.09	.14	.23	Lyman	.26	.40	.66
Butte	.32	.49	.81	McCook	.27	.41	.68
Campbell	.16	.24	.40	McPherson	.40	.61	1.01
Charles Mix	.56	.84	1.40	Marshall	.40	.62	1.02
Clark	.41	.60	1.01	Meade	.52	.77	1.29
Clay	.10	.15	.25	Mellette	.39	.60	.99
Codington	.30	.44	.74	Miner	.22	.32	.54
Corson	.31	.46	.77	Minnehaha	.40	.60	1.00
Custer	.12	.19	.31	Moody	.27	.35	.62
Davison	.23	.34	.57	Pennington	.26	.39	.65
Day	.20	.31	.51	Perkins	.40	.50	.90
Deuel	.31	.46	.77	Potter	.14	.22	.36
Dewey	.21	.51	.72	Roberts	.49	.24	.73
Douglas	.35	.53	.88	Sanborn	.26	.40	.66
Edmunds	.39	.61	1.00	Shannon	.16	.23	.39
Fall River	.25	.38	.63	Spink	.42	.61	1.03
Faulk	.31	.47	.78	Stanley	.10	.15	.25
Grant	.28	.43	.71	Sully	.10	.16	.26
Gregory	.38	.57	.95	Todd	.26	.40	.66
Haakon	.30	.45	.75	Tripp	.67	.99	1.66
Hamlin	.19	.30	.49	Turner	.37	.54	.91
Hand	.47	.71	1.18	Union	.17	.25	.42
Hanson	.26	.40	.66	Walworth	.18	.27	.45
Harding	.29	.43	.72	Yankton	.25	.37	.62
Hughes	.12	.18	.30	Ziebach	.18	.27	.45
Hutchinson	.51	.78	1.29				
Hyde	.20	.30	.50	<b>Total</b>	<b>19.23</b>	<b>28.48</b>	<b>47.71</b>

## Aquaculture

Aquaculture water use includes water used for fish farming and fish hatcheries. Aquaculture withdrawals occurred in nine counties in South Dakota in 2005 and totaled 33.17 Mgal/d (table 11). Of this total, 19.12 Mgal/d (or about 58 percent) was from ground water and 14.05 Mgal/d (or about 42 percent) was from surface water. The largest aquaculture use was in Pennington County, which accounted for 53 percent of the statewide aquaculture use.

Aquaculture water use includes water used for fish farming and fish hatcheries, such as for fish raised at the McNenny State Fish Hatchery near Spearfish, South Dakota (photograph by Michael T. Carter).



**Table 11.** Estimated aquaculture water use for counties with this use in South Dakota, 2005.

County	Water withdrawals, in million gallons per day		Total
	Source		
	Ground water	Surface water	
Brookings	0.01	0.01	0.02
Clark	.63	.00	.63
Custer	.00	2.88	2.88
Day	2.12	.63	2.75
Kingsbury	.00	.71	.71
Lawrence	.00	4.64	4.64
Marshall	.00	.03	.03
Pennington	14.74	2.92	17.66
Yankton	1.62	2.23	3.85
<b>Total</b>	<b>19.12</b>	<b>14.05</b>	<b>33.17</b>

## Irrigation

Irrigation water use includes all water artificially applied to farms, orchards, pastures, and golf courses to grow crops or maintain vegetative growth. Because irrigation is the largest offstream use of water in South Dakota, the quantity of water used by the holder of an irrigation permit is reported annually to the SDDENR (<http://www.state.sd.us/denr/des/waterrights/waterprg.htm>). The irrigation data provided in this report are based on the 2005 SDDENR irrigation questionnaires.

Irrigation withdrawals during 2005 totaled 291.73 Mgal/d (table 12). Of the total withdrawals for irrigation, 149.08 Mgal/d (51 percent) was from ground-water sources and 142.65 Mgal/d (49 percent) was from surface-water sources. An estimated 421,830 acres was irrigated during 2005. Of the total acres irrigated, 298,160 acres (about 71 percent) was irrigated by sprinkler application and 123,670 acres (29 percent) was irrigated by surface (or flood) application.



**Irrigation is the largest offstream use of water in South Dakota. Irrigation withdrawals during 2005 totaled about 292 million gallons per day (photograph by Kathleen M. Neitzert).**

**Table 12.** Estimated irrigation withdrawals and acreage irrigated by county in South Dakota, 2005.

County	Water withdrawals, in million gallons per day			Irrigated land, in thousand acres		
	Source		Total	Application method		Total
	Ground water	Surface water		Sprinkler	Surface	
Aurora	0.02	0.00	0.02	0.03	0.00	0.03
Beadle	10.05	.52	10.57	16.28	.63	16.91
Bennett	8.89	.01	8.90	6.62	.99	7.61
Bon Homme	2.48	2.97	5.45	7.16	.45	7.61
Brookings	7.71	.03	7.74	14.82	1.18	16.00
Brown	1.85	.18	2.03	4.50	.15	4.65
Brule	.00	.45	.45	1.59	.17	1.76
Buffalo	.33	4.75	5.08	3.27	.49	3.76
Butte	.77	45.34	46.11	22.03	91.64	113.67
Campbell	1.98	.00	1.98	2.68	.26	2.94
Charles Mix	2.89	6.40	9.29	9.23	.78	10.01
Clark	3.65	.08	3.73	6.94	.18	7.12
Clay	4.95	.14	5.09	11.48	.38	11.86
Codington	2.51	.48	2.99	4.80	.39	5.19
Corson	.00	.39	.39	.72	.05	.77
Custer	.09	3.64	3.73	1.39	.80	2.19
Davison	.51	.32	.83	1.01	.01	1.02
Day	.34	.05	.39	1.54	.02	1.56
Deuel	.87	.00	.87	1.62	.03	1.65
Dewey	.00	.20	.20	.21	.04	.25
Douglas	2.23	.00	2.23	1.79	.08	1.87
Edmunds	.21	.00	.21	.69	.00	.69
Fall River	.13	24.22	24.35	5.03	9.04	14.07
Faulk	.00	.02	.02	.02	.00	.02
Grant	3.58	.14	3.72	4.95	.20	5.15
Gregory	.13	.96	1.09	1.31	.10	1.41
Haakon	.00	.95	.95	.74	.30	1.04
Hamlin	5.33	.00	5.33	8.60	.55	9.15
Hand	.98	.04	1.02	1.69	.06	1.75
Hanson	.13	.47	.60	.92	.00	.92
Harding	.00	.81	.81	.57	.28	.85
Hughes	.79	16.85	17.64	10.80	.82	11.62
Hutchinson	1.05	.41	1.46	3.11	.05	3.16
Hyde	.29	.00	.29	.27	.00	.27



**Table 12.** Estimated irrigation withdrawals and acreage irrigated by county in South Dakota, 2005.—Continued

County	Water withdrawals, in million gallons per day			Irrigated land, in thousand acres		
	Source		Total	Application method		Total
	Ground water	Surface water		Sprinkler	Surface	
Jackson	0.00	2.20	2.20	0.57	0.57	1.14
Jerauld	1.20	.00	1.20	1.32	.07	1.39
Jones	.00	.32	.32	.14	.11	.25
Kingsbury	1.31	.00	1.31	1.69	.03	1.72
Lake	.74	.02	.76	1.65	.06	1.71
Lawrence	2.31	.34	2.65	.85	.83	1.68
Lincoln	.81	.22	1.03	1.60	.06	1.66
Lyman	.03	1.59	1.62	1.93	.17	2.10
McCook	.00	.07	.07	.03	.00	.03
McPherson	1.40	.17	1.57	1.65	.05	1.70
Marshall	.01	.00	.01	.00	.00	.00
Meade	.25	5.33	5.58	1.54	1.29	2.83
Mellette	.06	1.39	1.45	.37	.23	.60
Miner	.02	.00	.02	.07	.00	.07
Minnehaha	1.02	.65	1.67	2.12	.12	2.24
Moody	.70	.47	1.17	2.76	.19	2.95
Pennington	.33	4.94	5.27	2.45	2.35	4.80
Perkins	.00	.36	.36	.28	.07	.35
Potter	.99	.00	.99	1.19	.09	1.28
Roberts	1.73	.01	1.74	2.36	.07	2.43
Sanborn	.00	.01	.01	.01	.00	.01
Shannon	.00	.00	.00	.00	.00	.00
Spink	18.59	2.04	20.63	29.09	.66	29.75
Stanley	.00	.11	.11	.08	.00	.08
Sully	1.40	8.28	9.68	13.02	2.67	15.69
Todd	9.61	.49	10.10	10.11	1.13	11.24
Tripp	1.01	1.75	2.76	2.59	.41	3.00
Turner	18.08	.15	18.23	18.50	.52	19.02
Union	16.65	.05	16.70	30.25	1.33	31.58
Walworth	.71	.22	.93	1.14	.10	1.24
Yankton	5.38	.65	6.03	10.39	.37	10.76
Ziebach	.00	.00	.00	.00	.00	.00
<b>Total</b>	<b>149.08</b>	<b>142.65</b>	<b>291.73</b>	<b>298.16</b>	<b>123.67</b>	<b>421.83</b>

## Instream Use

The only instream use reported for South Dakota is for hydroelectric power generation. Instream use occurred in four counties in South Dakota during 2005—Buffalo, Charles Mix, Hughes, and Yankton (table 13).

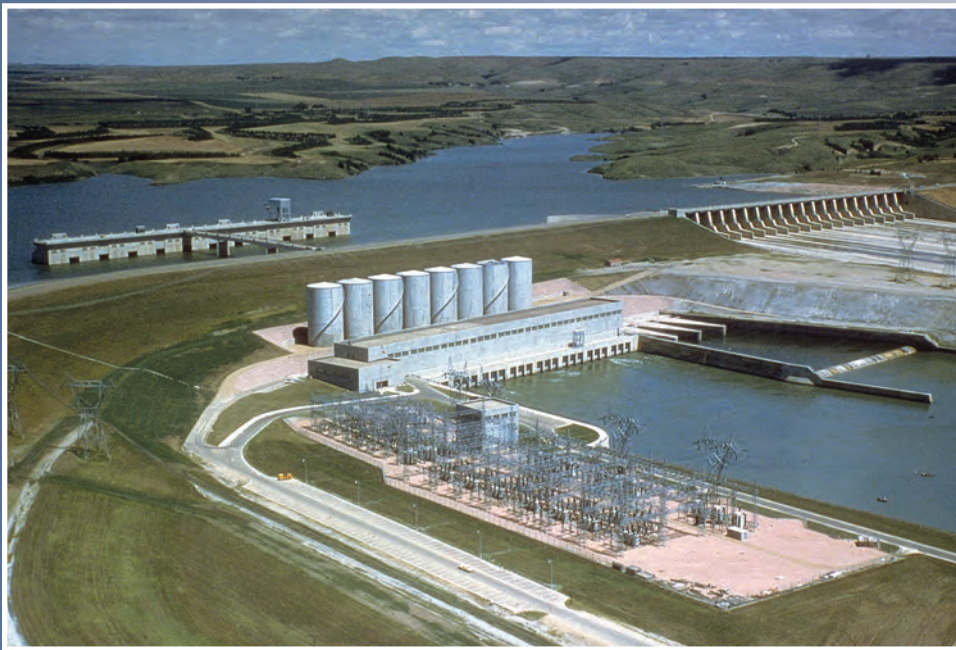
Water used for hydroelectric power generation refers to the water used in the generation of electricity at plants where turbine generators are driven by falling water. Water use for hydroelectric power generation is substantial in South Dakota because of the four hydroelectric powerplants operated by the U.S. Army Corps of Engineers on the Missouri River in South Dakota. During 2005, about 68,400 Mgal/d was used by the hydroelectric powerplants to generate about 3,688 gigawatt-hours of electricity (table 13).

**Table 13.** Estimated hydroelectric power water use for counties with this use in South Dakota, 2005.

County	Instream water use		Power generated, in gigawatt-hours <sup>1</sup>
	Million gallons per day	Thousand acre-feet per year	
Buffalo	17,906.00	20,054.72	606.17
Charles Mix	19,820.00	22,198.40	1,133.79
Hughes	19,470.00	21,806.40	1,356.85
Yankton <sup>2</sup>	11,246.00	12,595.52	591.12
<b>Total</b>	<b>68,442.00</b>	<b>76,655.04</b>	<b>3,687.93</b>

<sup>1</sup>Data from U.S. Army Corps of Engineers (<http://www.nwd-mr.usace.army.mil/rcc/>)

<sup>2</sup>Values presented reflect exactly one-half of the water-use and power-generation data for Gavins Point Dam. The other one-half is reported by Nebraska.



The only instream use reported for South Dakota is for hydroelectric power generation. In South Dakota, four hydroelectric powerplants are operated by the U.S. Army Corps of Engineers on the Missouri River, including Fort Randall Dam near Pickstown, South Dakota (photograph courtesy of the U.S. Army Corps of Engineers).

### Changes in Water Use, 1985–2005

Total water use in South Dakota was about 175 Mgal/d less in 2005 than in 1985 despite an increase in the State’s population of about 70,000 people (fig. 7). Total ground-water use increased slightly (about 21 Mgal/d) between 1985 and 2005, whereas surface-water use decreased by about 195 Mgal/d. The decreases in both total use and surface-water use are mostly attributable to decreases in irrigation water use (fig. 8), which is the largest water use in South Dakota. Total irrigation water use decreased by about 168 Mgal/d between 1985 and 2005, and surface-water irrigation use decreased by about 204 Mgal/d. Ground-water irrigation use increased by about 36 Mgal/d between 1985 and 2005. The smallest irrigation water use occurred in 1995, when the number of irrigated acres also was smallest.

Water use for public supply increased about 20 Mgal/d between 1985 and 2005, and the population served by public suppliers increased by about 118,000 people (fig. 9). Although ground-water withdrawals for public supply remained fairly constant between 1985 and 2005, surface-water withdrawals more than doubled during this 20-year period. In contrast, the number of people relying on self-supplied domestic wells decreased by about 48,000 between 1985 and 2005 (fig. 10), with most of the decrease occurring between 1985 and 1990. All self-supplied domestic water use in 2005 was supplied by ground water. Total self-supplied domestic use decreased about 8 Mgal/d between 1985 and 2005. The increase in use from public supply and the decrease in use from self-supplied domestic supplies can be attributed to growth in cities and increased water availability through rural water systems.

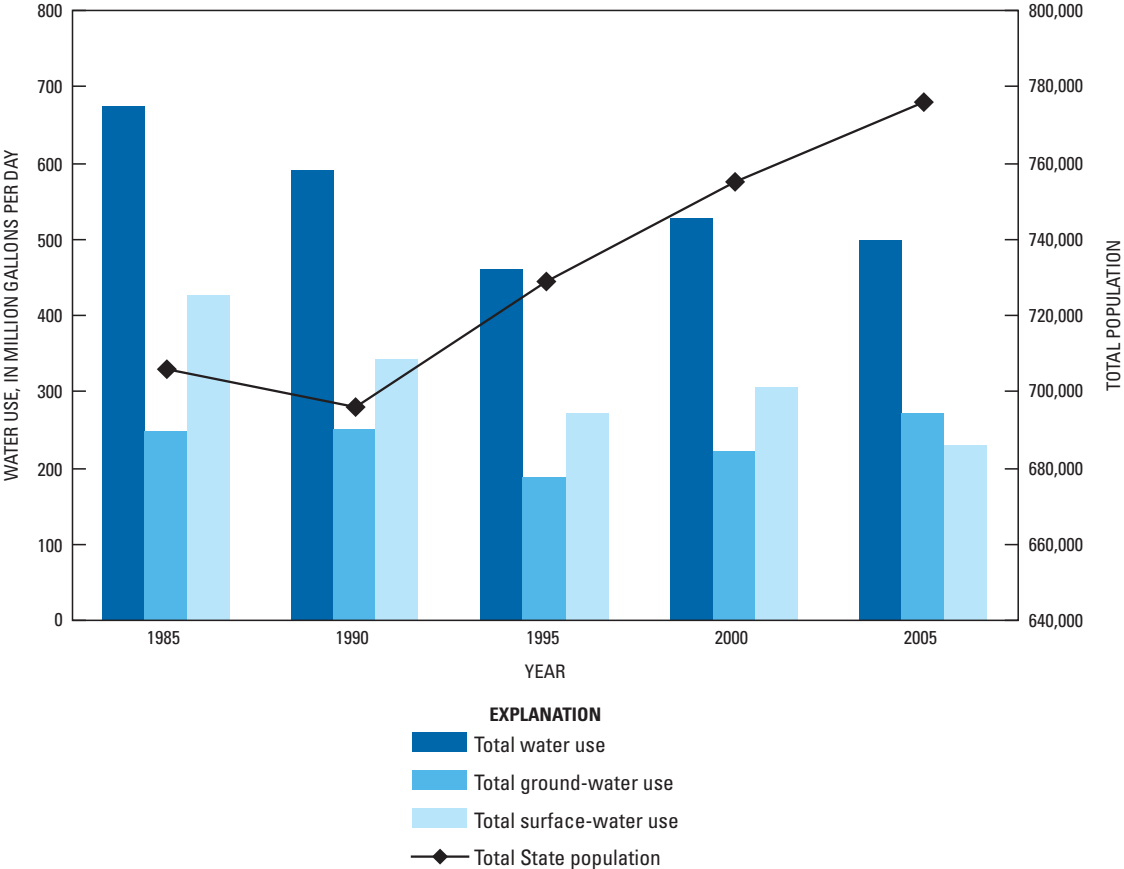


Figure 7. Changes in water use and total State population in South Dakota, 1985–2005.

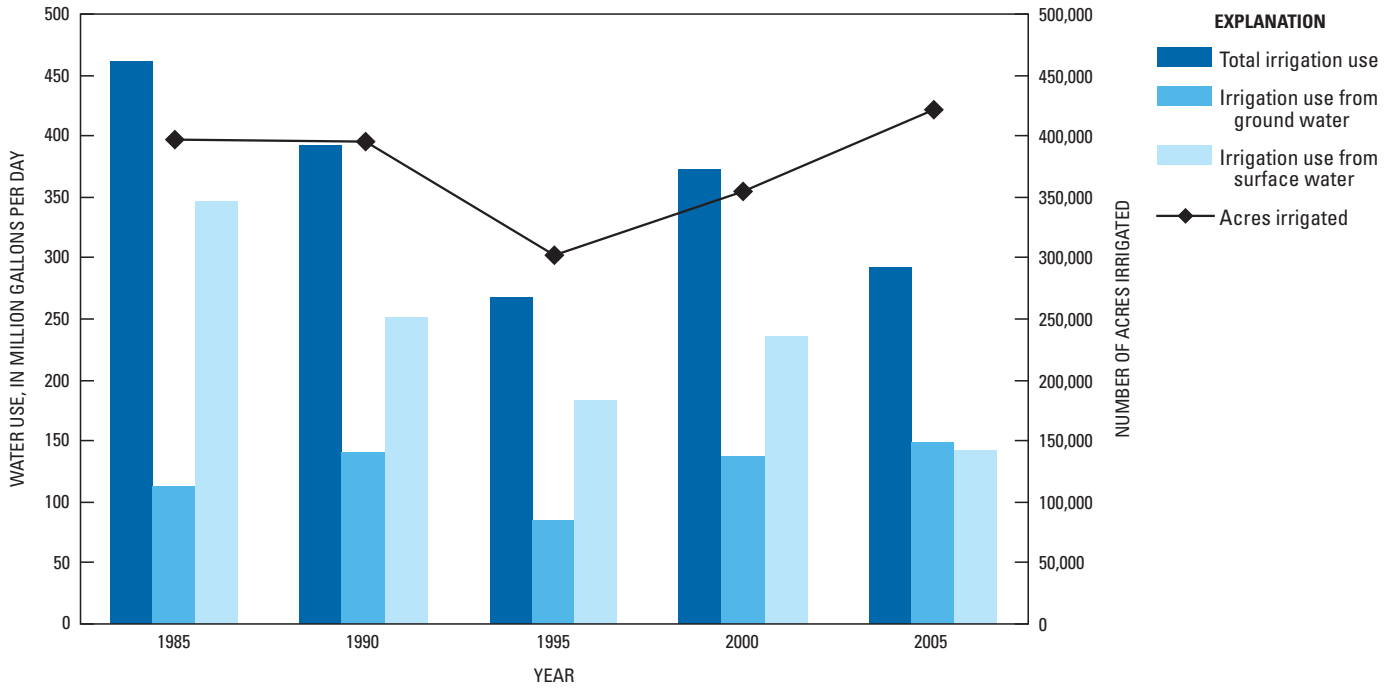


Figure 8. Changes in irrigation water use and acres irrigated in South Dakota, 1985–2005.

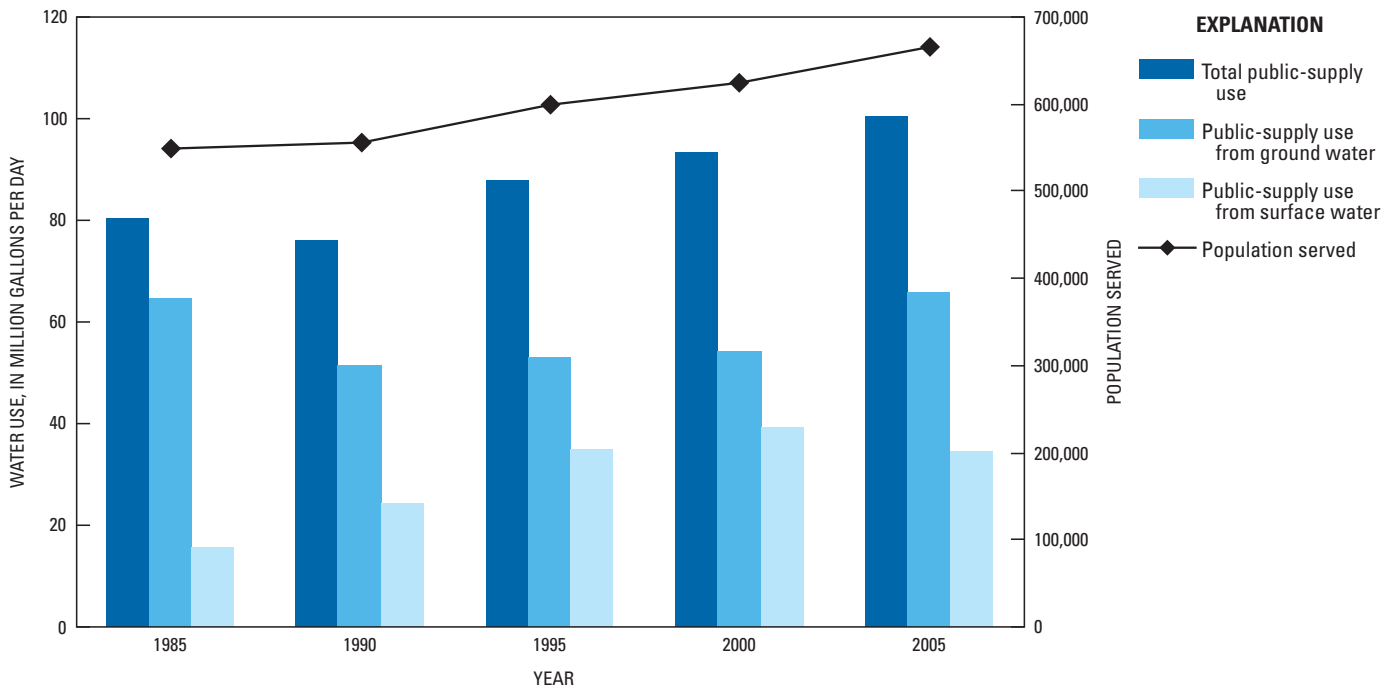
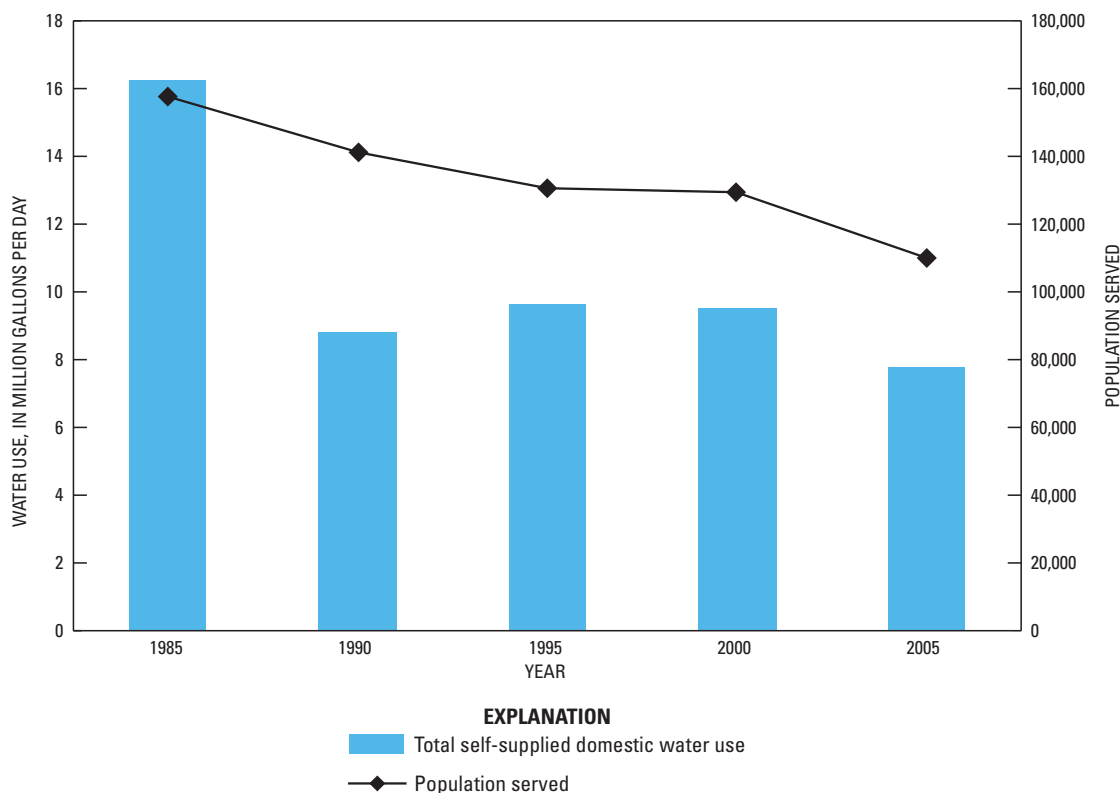


Figure 9. Changes in water use for public supply and population served in South Dakota, 1985–2005.



**Figure 10.** Changes in self-supplied domestic water use and self-supplied population in South Dakota, 1985–2005.

## Summary

The water-use program in South Dakota is a cooperative effort between the U.S. Geological Survey and the South Dakota Department of Environment and Natural Resources, Water Rights Division. This report on estimated water use in South Dakota during 2005 was prepared in cooperation with the South Dakota Department of Agriculture and the South Dakota Department of Environment and Natural Resources.

During 2005, total withdrawals from ground-water and surface-water sources in South Dakota for the eight categories of offstream use were about 500 million gallons per day (Mgal/d). Of total withdrawals, about 271 Mgal/d was from ground water and about 230 Mgal/d was from surface water. The largest withdrawals occurred in Butte, Pennington, Minnehaha, Fall River, Hughes, Spink, and Turner Counties. The largest use of water in South Dakota is irrigation, which accounts for about 58 percent of the total water withdrawn, followed by public supply, which accounts for about 20 percent of withdrawals.

Public-supply systems served about 666,210 people, or about 86 percent of South Dakota’s population in 2005. Public-supply systems withdrew about 100 Mgal/d in 2005. Ground-water withdrawals accounted for about 66 Mgal/d, and surface-water withdrawals accounted for about 35 Mgal/d. Overall total public-supply withdrawals

averaged about 151 gallons per day (gal/d) for each person served. The percentage of the population served by public supplies varied from less than 1 percent in Shannon County to 100 percent in more than one-half of the South Dakota counties.

Domestic water use during 2005 was about 73 Mgal/d. Of this total, about 66 Mgal/d was delivered from public-supply systems to 666,210 people. The average domestic per-capita use by people using public supplies was 99 gallons per day. Self-supplied domestic withdrawals were about 8 Mgal/d, all of which was from ground water. The population using private wells during 2005 was about 109,750, and their per-capita use averaged 70 gal/d. Pennington County had the largest population using self-supplied domestic water (about 25,000 people), followed by Meade County (about 17,000 people). Together, these two counties accounted for about 38 percent of the total self-supplied withdrawals in South Dakota. Less than one-half of the counties in South Dakota (28 out of 66 counties) have a self-supplied population for domestic water use. Counties where more than 70 percent of the population is self-supplied for domestic use (Bennett, Corson, Meade, Shannon, and Todd Counties) are in rural areas that do not have extensive rural water systems.

Industrial water use during 2005 for self supply was about 4 Mgal/d, of which about 98 percent was from ground water and about 2 percent was from surface water. The largest industrial water use occurred in Minnehaha County.

Withdrawals for thermoelectric use during 2005 totaled about 5 Mgal/d, of which about 1 Mgal/d was from ground water and about 4 Mgal/d from surface water. Total water withdrawn for thermoelectric power generation by powerplants using fossil fuel was about 4 Mgal/d. The withdrawal of geothermal water totaled 0.34 Mgal/d during 2005. The largest use for thermoelectric power was in Grant County.

Total mining water use during 2005 was about 10 Mgal/d. Of this total, about 5 Mgal/d was from ground water and about 6 Mgal/d was from surface water. The largest mining use occurred in Lawrence, Minnehaha, Pennington, and Brookings Counties.

Total livestock water use during 2005 was about 48 Mgal/d. Of this total, about 19 Mgal/d was from ground water and about 28 Mgal/d was from surface water.

Total aquaculture use in 2005 was about 33 Mgal/d. Of this total, about 19 Mgal/d was from ground water and about 14 Mgal/d was from surface water. The largest aquaculture use occurred in Pennington County.

Irrigation withdrawals during 2005 totaled about 292 Mgal/d, of which about 149 Mgal/d was from ground-water sources and about 143 Mgal/d was from surface-water sources. An estimated 421,830 acres was irrigated during 2005. Of the total acres irrigated, 298,160 acres was irrigated by sprinkler application and 123,670 acres was irrigated by surface (or flood) application.

The only instream use reported for South Dakota is for hydroelectric power generation. Water use for hydroelectric power generation is substantial in South Dakota because of the four hydroelectric powerplants operated by the U.S. Army Corps of Engineers on the Missouri River in South Dakota. During 2005, about 68,400 Mgal/d was used by the hydroelectric powerplants to generate about 3,688 gigawatt-hours of electricity.

Total water use in South Dakota decreased about 175 Mgal/d between 1985 and 2005 despite an increase in the State's population of about 70,000 people. Total ground-water use increased slightly (about 21 Mgal/d) between 1985 and 2005, whereas surface-water use decreased by about 195 Mgal/d. The decreases in both total use and surface-water use are mostly attributable to decreases in irrigation water use. Total irrigation water use decreased by about 168 Mgal/d between 1985 and 2005, and surface-water irrigation use decreased by about 204 Mgal/d. Ground-water irrigation use increased by about 36 Mgal/d between 1985 and 2005.

Water use for public supply increased about 20 Mgal/d between 1985 and 2005, and the population served by public supplies increased by about 118,000 people. In contrast, the number of people relying on self-supplied domestic wells decreased by about 48,000; all self-supplied domestic water use in 2005 was from ground water. Total self-supplied domestic use decreased about 8 Mgal/d between 1985 and 2005.

## References Cited

- Amundson, F.D., 1998, Estimated use of water in South Dakota, 1995: U.S. Geological Survey Open-File Report 98-268, 18 p.
- Amundson, F.D., 2002, Estimated use of water in South Dakota, 2000: U.S. Geological Survey Open-File Report 02-440, 17 p.
- Benson, R.D., and Winterton, J.E., 1988, Estimated water use in South Dakota, 1985: U.S. Geological Survey Open-File Report 88-313, 1 sheet.
- Hutson, S.S., Barber, N.L., Kenny, J.F., Linsey, K.S., Lumia, D.S., and Maupin, M.A., 2004, Estimated use of water in the United States in 2000: U.S. Geological Survey Circular 1268, 46 p.
- MacKichan, K.A., 1951, Estimated use of water in the United States, 1950: U.S. Geological Survey Circular 115, 13 p.
- MacKichan, K.A., 1957, Estimated use of water in the United States, 1955: U.S. Geological Survey Circular 398, 18 p.
- MacKichan, K.A., and Kammerer, J.C., 1961, Estimated water use in the United States, 1960: U.S. Geological Survey Circular 456, 44 p.
- Murray, C.R., 1968, Estimated use of water in the United States, 1965: U.S. Geological Survey Circular 556, 53 p.
- Murray, C.R., and Reeves, E.B., 1972, Estimated use of water in the United States, 1970: U.S. Geological Survey Circular 676, 37 p.
- Murray, C.R., and Reeves, E.B., 1977, Estimated use of water in the United States, 1975: U.S. Geological Survey Circular 765, 39 p.
- Solley, W.B., Chase, E.B., and Mann, W.B., 1983, Estimated use of water in the United States in 1980: U.S. Geological Survey Circular 1001, 56 p.
- Solley, W.B., Merk, C.F., and Pierce, R.R., 1988, Estimated use of water in the United States in 1985: U.S. Geological Survey Circular 1004, 82 p.
- Solley, W.B., Pierce, R.R., and Perlman, H.A., 1993, Estimated use of water in the United States in 1990: U.S. Geological Survey Circular 1081, 76 p.
- Solley, W.B., Pierce, R.R., and Perlman, H.A., 1998, Estimated use of water in the United States in 1995: U.S. Geological Survey Circular 1200, 71 p.
- U.S. Department of Agriculture, 2004, South Dakota State and county data—2002 Census of Agriculture: U.S. Department of Agriculture, 456 p., accessed August 25, 2008, at <http://www.nass.usda.gov/census/census02/volume1/sd/SDVolume104.pdf>

Publishing support provided by:  
Helena Publishing Service Center

For more information concerning this publication, contact:  
Director, USGS South Dakota Water Science Center  
1608 Mt. View Rd.  
Rapid City, SD 57702  
(605) 394-3200

Or visit the South Dakota Water Science Center Web site at:  
<http://sd.water.usgs.gov>

