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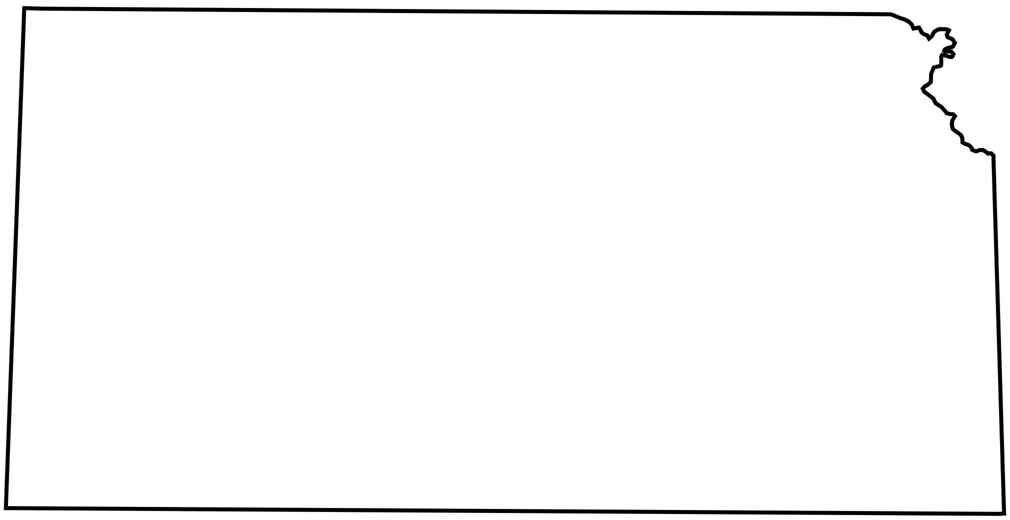
Water Resources Data Kansas Water Year 2005



Water-Data Report KS-05-1

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

Prepared in cooperation with the
State of Kansas and with other agencies

Calendar for Water Year 2005

2004

October

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2005

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Water Resources Data
Kansas
Water Year 2005

By J.E. Putnam and D.R. Schneider

Prepared in cooperation with the State of Kansas and with other agencies

Water-Data Report KS-05-1

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

U.S. DEPARTMENT OF THE INTERIOR
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U.S. GEOLOGICAL SURVEY
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2006

PREFACE

This volume of the annual hydrologic data report for Kansas is one of a series of annual reports that document hydrologic data gathered from the U.S. Geological Survey's surface- and ground-water data-collection networks in each State, Puerto Rico, and the Trust Territories. These records of streamflow, ground-water levels, and water quality provide the hydrologic information needed by local, State, and Federal agencies, and the private sector for developing and managing our Nation's land and water resources.

This report is the culmination of a concerted effort by dedicated personnel of the U.S. Geological Survey who collected, compiled, analyzed, verified, and organized the data, and who typed, edited, and assembled the report. The authors had primary responsibility for assuring that the information contained herein is accurate, complete, and adheres to Geological Survey policy and established guidelines.

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This report was prepared in cooperation with the State of Kansas and with other agencies under the general supervision of James E. Putnam, Hydrologic Data Management Section Chief, and Walter R. Aucott, Director, USGS, Kansas Water Science Center.

February 2006

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13. ABSTRACT (Maximum 200 words)
Water-resources data for the 2005 water year for Kansas consist of records of stage, discharge, and water quality of streams; elevation and contents of lakes and reservoirs; and water levels of ground-water wells. This report contains records for water discharge at 154 complete-record gaging stations; elevation and contents at 14 lakes and reservoirs; water-quality records at 2 precipitation stations, water-level data at 15 observation wells; and records of specific conductance, pH, water temperature, dissolved oxygen, and turbidity at 13 gaging stations and 2 lakes with water-quality monitors. Also included are discharge data for 29 high-flow partial-record stations. These data represent that part of the National Water Information System collected by the U.S. Geological Survey in cooperation with local, State, and Federal agencies in Kansas.

14. SUBJECT TERMS
*Kansas, *Hydrologic data, *Surface water, *Ground water, *Water quality, Flow rate, Gaging stations, Lakes, Reservoirs, Chemical analyses, Water temperatures, Sampling sites, Water levels, Water analyses

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TABLES

SURFACE-WATER STATIONS, IN DOWNSTREAM ORDER, FOR WHICH RECORDS ARE PUBLISHED IN THIS VOLUME

[Letters in parentheses () after station name designate type of data: (d) discharge, (c) chemical, (t) temperature, and (e) elevation]

* * * * * * * * * * * * * * * * * *

DISCONTINUED STREAMFLOW-GAGING STATIONS

The following complete-record streamflow-gaging stations in Kansas have been discontinued, converted to partial-record streamflow-gaging stations, or are now operated by other Federal agencies prior to the 2005 water year. Daily streamflow or stage records were collected and published for the period of record shown for each station.

[Letters in parentheses () after station name designates type of data: (d) discharge. mi^2, square miles]

Station number	Station name	Drainage area (mi^2)	Period of record
	Wolf River Basin		
06815600	Wolf River near Hiawatha, KS (d)	41.00	1961-1970
06818200	Doniphan Creek at Doniphan, KS (d)	4.15	1960-1970
	Kansas River Basin		
06844700	South Fork Sappa Creek near Brewster, KS (d)	74.00	1968-1987
06846300	Beaver Creek at Herndon, KS (d)	1,535.00	1963-1969
06848000	Prairie Dog Creek at Norton, KS (d)	684.00	1943-2002
06854500	Republican River at Scandia, KS (d)	23,560.00	1919-1925
			1928-1944
			1951-1972
06855000	West Buffalo Creek near Jewell, KS (d)	15.20	1934-1938
06855500	West Buffalo Creek at Jewell, KS (d)	16.80	1935-1938
06855800	Buffalo Creek near Jamestown, KS (d)	330.00	1959-1990
06855900	Wolf Creek near Concordia, KS (d)	56.00	1962-1981
06857000	Republican River at Milford, KS (d)	24,900.00	1895-1905
			1951-1964
06858000	Rose Creek near Wallace, KS (d)	28.50	1946-1953
06858500	North Fork Smoky Hill River near McAllaster, KS (d)	670.00	1947-1953
			1959-1984
06859500	Ladder Creek below Chalk Creek near Scott City, KS (d)	1,432.00	1951-1979
06860500	Hackberry Creek near Gove, KS (d)	426.00	1947-1953
06862000	Smoky Hill River at Cedar Bluff Dam, KS (d)	5,530.00	1952-1990
06862500	Smoky Hill River near Ellis, KS (d)	5,630.00	1942-1952
06863000	Smoky Hill River at Pfeifer, KS (d)	6,033.00	1929-1932
06863300	Big Creek near Ogallah, KS (d)	297.00	1956-1968
06863900	North Fork Big Creek near Victoria, KS (d)	54.00	1962-1987
06863990	Big Creek near Russell, KS (d)	824.00	1963-1964
06864000	Smoky Hill River near Russell, KS (d)	6,965.00	1940-1974
06866000	Smoky Hill River at Lindsborg, KS (d)	8,110.00	1905-1923
			1930-1965
06867500	Paradise Creek near Paradise, KS (d)	212.00	1946-1953
			1963-1974
06868000	Saline River near Wilson, KS (d)	1,900.00	1929-1963
06868400	Wolf Creek near Lucas, KS (d)	163.00	1959-1971
06868500	Wolf Creek near Sylvan Grove, KS (d)	261.00	1946-1953
06868700	North Branch Spillman Creek near Ash Grove, KS (d)	26.10	1962-1971
06870500	Smoky Hill River near New Cambria, KS (d)	1,980.00	1949-1953
06871800	North Fork Solomon River at Kirwin, KS (d)	1,367.00	1919-1925
			1928-1932
			1941-2002
06871900	Deer Creek near Phillipsburg, KS (d)	65.00	1967-1981
06872300	Middle Beaver Creek near Smith Center, KS (d)	71.00	1961-1970
06873200	South Fork Solomon River below Webster Reservoir, KS (d)	1,150.00	1956-1902
06873500	South Fork Solomon River at Alton, KS (d)	1,720.00	1919-1925
			1928-1932
			1942-1957
06873700	Kill Creek near Bloomington, KS (d)	52.00	1963-1981
06874500	East Limestone Creek near Ionia, KS (d)	25.60	1934-1938
06875000	Elm Creek near Ionia, KS (d)	22.70	1934-1938

DISCONTINUED STREAMFLOW-GAGING STATIONS--Continued

Station number	Station name	Drainage area (mi^2)	Period of record
	Kansas River Basin--Continued		
06875500	East Limestone Creek at Ionia, KS (d)	51.60	1934-1935
06875800	Limestone Creek near Glen Elder, KS (d)	210.00	1965-1971
06876000	Solomon River at Beloit, KS (d)	5,530.00	1929-1965
06876070	South Fork Solomon River near Simpson, KS (d)	5,538.00	1990-2005
06876440	Solomon River near Minneapolis, KS (d)	6,060.00	1978-1983
06877000	Smoky Hill River at Solomon, KS (d)	8,830.00	1919-1921
			1923-1934
06877500	Turkey Creek near Abilene, KS (d)	143.00	1959-1965
06878500	Lyon Creek near Woodbine, KS (d)	230.00	1954-1974
06878600	Lyon Creek near Junction City, KS (d)	258.00	2004
06879000	Smoky Hill River at Junction City, KS (d)	19,900.00	1952-1957
06879200	Clark Creek near Junction City, KS (d)	200.00	1958-1965
06879500	Kansas River at Ogden, KS (d)	45,240.00	1917-1926
06882500	Big Blue River at Hull, KS (d)	4,540.00	1919-1925
			1928-1940
06884500	Little Blue River at Waterville, KS (d)	3,509.00	1922-1925
			1928-1958
06885000	Snipe Creek near Beattie, KS (d)	18.00	1954-1958
06886000	Big Blue River at Randolph, KS (d)	9,100.00	1918-1960
06886500	Fancy Creek at Winkler, KS (d)	174.00	1954-1971
06888300	Rock Creek near Louisville, KS (d)	128.00	1959-1965
06888925	Unnamed Creek near Kansas Museum of History, Topeka, KS (d)	3.56	1995-1998
06889100	Soldier Creek near Goff, KS (d)	2.06	1964-1987
06889120	Soldier Creek near Bancroft, KS (d)	10.50	1964-1988
06889140	Soldier Creek near Soldier, KS (d)	16.90	1964-1998
06889160	Soldier Creek near Circleville, KS (d)	49.30	1964-2001
06889180	Soldier Creek near St. Clere, KS (d)	80.00	1964-1981
06889580	Shunganunga Creek at Southwest 29th Street, Topeka, KS (d)	14.10	1979-1981
			1994-1996
06889610	South Branch Shunganunga Creek at Southwest 37th Street, Topeka, KS (d)	11.60	1979-1981
			1994-1996
06889700	Shunganunga Creek at Rice Road, Topeka, KS (d)	60.30	1979-1981
			1993-1996
06890000	Little Delaware River near Horton, KS (d)	19.00	1954-1961
			1962-1965
			1977-1978
06890400	Delaware River near Arrington, KS (d)	738.00	1965-1969
06890500	Delaware River at Valley Falls, KS (d)	922.00	1922-1967
06890600	Rock Creek near Meriden, KS (d)	22.00	1963-1970
06891483	Wakarusa River below Clinton Dam, KS (d)	412.00	1973-1980
06891486	West Branch Yankee Tank Creek near Lawrence, KS (d)	1.85	1969-1973
06891488	East Branch Yankee Tank Creek near Lawrence, KS (d)	1.35	1969-1973
06891490	Yankee Tank Creek near Lawrence, KS (d)	3.90	1969-1973
06892440	Cedar Creek at Highway 56 at Olathe, KS (d)	13.30	2000-2005
06892460	Cedar Creek below Olathe Lake near Olathe, KS (d)	17.30	2000-2004
06892490	Cedar Creek near Cedar Junction, KS (d)	38.90	1965-1968
06892500	Kansas River at Bonner Springs, KS (d)	59,928.00	1917-1973
06893350	Tomahawk Creek near Overland Park, KS (d)	23.90	1974-1982

DISCONTINUED STREAMFLOW-GAGING STATIONS--Continued

Station number	Station name	Drainage area (mi^2)	Period of record
	Osage River Basin		
06911000	Marais des Cygnes River at Melvern, KS (d)	351.00	1940-1974
06912000	Switzler Creek at Burlingame, KS (d)	26.30	1954-1961
06914000	Pottawatomie Creek near Garnett, KS (d)	334.00	1939-2001
06914500	Pottawatomie Creek at Lane, KS (d)	513.00	1929-1932
06914960	Rock Creek near Wellsville, KS (d)	15.90	1993-1996
06915977	North Sugar Creek below La Cygne Lake, KS (d)	56.67	1979-1982
06916000	Marais des Cygnes River at Trading Post, KS (d)	2,880.00	1929-1958
06916500	Big Sugar Creek at Farlinville, KS (d)	198.00	1929-1932
			1949-1958
			1959-1970
06917500	Marmaton River near Fort Scott, KS (d)	408.00	1921-1925
			1929-1971
	Arkansas River Basin		
07138062	Arkansas River below Amazon Diversion, KS (d)	26,099.00	1978-1983
07138065	Arkansas River at Lakin, KS (d)	26,941.00	1978-1983
07138650	White Woman Creek near Leoti, KS (d)	750.00	1967-1986
07138660	White Woman Creek 4.2 miles south of Leoti, KS (d)	834.00	1979-1980
07139800	Mulberry Creek near Dodge City, KS (d)	73.80	1968-1990
07140500	Arkansas River at Larned, KS (d)	31,750.00	1922-1940
07140700	Guzzlers Gulch near Ness City, KS (d)	58.20	1961-1981
07142015	Walnut Creek near Heizer, KS (d)	1,486.00	1974-1978
07142620	Rattlesnake Creek near Raymond, KS (d)	1,167.00	1960-1998
07142800	Arkansas River at Hutchinson, KS (d)	37,869.00	1895-1905
07142860	Cow Creek near Claflin, KS (d)	43.00	1967-1981
07142900	Blood Creek near Boyd, KS (d)	61.00	1962-1980
07143400	Arkansas River near Wichita, KS (d)	39,072.00	1922-1935
07143600	Little Arkansas River near Little River, KS (d)	71.00	1960-1972
07144000	East Emma Creek near Halstead, KS (d)	58.00	1963-1971
07144601	North Fork Ninnescah River at Arlington, KS (d)	322.06	1996-2000
07144660	Silver Creek near Arlington, KS (d)	194.00	1996-2000
07144680	Goose Creek near Arlington, KS (d)	46.60	1996-2000
07144730	Red Rock Creek near Pretty Prairie, KS (d)	53.19	1996-2000
07144800	North Fork Ninnescah River near Cheney, KS (d)	930.00	1951-1964
07144850	South Fork South Fork Ninnescah River near Pratt, KS (d)	21.00	1961-1980
07146570	Cole Creek near DeGraff, KS (d)	30.00	1961-1980
07146623	Walnut River below El Dorado Lake, KS (d)	247.00	1981-1990
07146830	Walnut River at Highway 54 east of El Dorado, KS (d)	350.00	1981-1998
07146895	Walnut River at Augusta, KS (d)	452.00	1982-1985
07146990	Whitewater River 3 miles south of Potwin, KS (d)	162.00	1968-1969
07146995	Rock River near Potwin, KS (d)	12.50	2002-2003
07147050	West Branch Whitewater River near Furley, KS (d)	88.00	1968-1969
07147060	West Branch Whitewater River near Benton, KS (d)	177.00	1968-1969
07147100	Whitewater River at Augusta, KS (d)	456.00	1951-1955
07147600	Timber Creek near Wilmot, KS (d)	63.00	1962-1968
07156010	North Fork Cimarron River at Richfield, KS (d)	463.00	1971-1986
07156100	Sand Arroyo Creek near Johnson, KS (d)	619.00	1971-1986
07156220	Bear Creek near Johnson, KS (d)	835.00	1966-1998
07156225	Bear Creek 9 miles northeast of Johnson, KS (d)	879.00	1979-1980

DISCONTINUED STREAMFLOW-GAGING STATIONS--Continued

Station number	Station name	Drainage area (mi^2)	Period of record
	Arkansas River Basin--Continued		
07156500	Cimarron River near Satanta, KS (d)	7,345.00	1942-1946
07156800	Cimarron River near Liberal, KS (d)	8,254.00	1896-1996
			1938-1942
07157740	Cimarron River near Buttermilk, KS (d)	11,120.00	1973-1979
07157900	Cavalry Creek at Coldwater, KS (d)	39.00	1967-1982
07157940	Bluff Creek near Buttermilk, KS (d)	657.00	1973-1979
			2002-2004
07165700	Verdigris River near Madison, KS (d)	181.00	1956-1976
07165750	Verdigris River near Virgil, KS (d)	312.00	1989-1998
07166000	Verdigris River near Coyville, KS (d)	747.00	1939-1998
07167000	Fall River near Eureka, KS (d)	307.00	1947-1976
07168500	Fall River near Fall River, KS (d)	585.00	1904-1906
			1939-1990
07170000	Elk River near Elk City, KS (d)	575.00	1939-1969
07171600	Caney River near Cedar Vale, KS (d)	208.00	1989-1998
07173300	Middle Caney Creek at Sedan, KS (d)	119.00	1989-1998
07173500	Bee Creek near Havana, KS (d)	11.00	1955-1958
07179600	Four Mile Creek near Council Grove, KS (d)	55.00	1963-1972
07179710	Neosho River near Dunlap, KS (d)	528.00	1985
07180000	Cottonwood River near Marion, KS (d)	329.00	1939-1968
07180200	Cottonwood River at Marion, KS (d)	502.00	1984-1999
07181000	Cottonwood River at Elmdale, KS (d)	1,045.00	1923-1932
07181500	Middle Creek near Elmdale, KS (d)	92.00	1939-1950
07182000	Cottonwood River at Cottonwood Falls, KS (d)	1,327.00	1932-1971
07182400	Neosho River at Strawn, KS (d)	2,933.00	1949-1963
07183100	Owl Creek near Piqua, KS (d)	177.00	1959-1970
07183200	Neosho River near Chanute, KS (d)	4,195.00	1963-1975
07184300	Cherry Creek near Hallowell, KS (d)	90.00	1976-1982
07184500	Labette Creek near Oswego, KS (d)	211.00	1939-1945
07186040	Cow Creek near Weir, KS (d)	170.00	1976-1982

DISCONTINUED WATER-QUALITY STREAMFLOW-GAGING STATIONS

The following complete-record water-quality streamflow-gaging stations in Kansas have been discontinued prior to the 2005 water year. Records of sediment, water temperature, specific conductance, dissolved oxygen, chloride, biological, nutrients, major inorganics, minor and trace inorganics, organics, and radiochemical samples were collected and published in a Water Resources Data report or Water-Supply Paper for the record shown for each station. Discontinued stations for which periodic records of water quality are available from the U.S. Geological Survey office in Lawrence, Kansas, are not included in this list but are available on the World Wide Web at http://waterdata.usgs.gov/ks/nwis/qw.

[mi^2, square miles]

Station number	Station name	Drainage area (mi^2)	Type of record[1]	Period of record
		Kansas River Basin		
06827000	South Fork Republican River near Colorado-Kansas State line, KS	1,860.00	Nut., MI, MTI, Sed.	1946-1967
06845000	Sappa Creek near Oberlin, KS	1,086.00	Nut., MI, MTI, Sed.	1951-1970
06846500	Beaver Creek at Cedar Bluffs, KS	1,618.00	Bio., Nut., MI, MTI, Temp., Sed.	1958-1989
06847900	Prairie Dog Creek above Keith Sebelius Lake, KS	590.00	Bio., Nut., MI, MTI, Sed.	1963-2002
06847950	Keith Sebelius Lake near Norton, KS	683.00	Bio., Nut., MI, MTI, Rad. Temp., S.C., pH, D.O.	1970-1982
06848000	Prairie Dog Creek at Norton, KS	684.00	Bio., Nut., MI, MTI, Temp., Sed.	1947-1986
06853500	Republican River near Hardy, NE	22,401.00	Bio., Nut., MI, MTI, Sed., S.C.	1956-2000
06854000	White Rock Creek at Lovewell, KS	345.00	Bio., Nut., Org., MI, MTI, Sed., Temp.	1949-1993
06854500	Republican River at Scandia, KS	23,560.00	Bio., Nut., Org., MI, MTI, Temp., S.C., Sed.	1957-1982
06856600	Republican River at Clay Center, KS	24,542.00	NASQAN, Sed.	1949-1999
06857000	Republican River at Milford, KS	24,900.00	Nut., MI, MTI, Temp., S.C., Sed.	1916-1964
06861500	Cedar Bluff Resevoir near Ellis, KS	5,530.00	Temp., S.C., pH, D.O. Bio., Nut., MI, MTI	1962-1982
06862500	Smoky Hill River near Ellis, KS	5,630.00	Nut., MI, MTI, Sed.	1944-1950
06862700	Smoky Hill River near Schoenchen, KS	5,750.00	Bio., Nut., Org., MI, MTI, S.C.	1965-1970
06863300	Big Creek near Ogallah, KS	297.00	Nut., MI, MTI, Temp., S.C., Sed.	1955-1968
06866900	Saline River near WaKeeney, KS	696.00	Bio., Nut., MI, MTI, Temp., S.C., Sed.	1955-1999
06867000	Saline River near Russell, KS	1,502.00	Bio., Nut., Org., MI, MTI, Temp., S.C., Sed.	1945-1999
06867500	Paradise Creek near Paradise, KS	212.00	Nut., MI, MTI, Temp., S.C., Sed.	1947-1971
06868000	Saline River near Wilson, KS	1,900.00	Nut., Org., MI, MTI, Temp., S.C.	1946-1958
06868500	Wolf Creek near Sylvan Grove, KS	261.00	Nut., MI, MTI, Temp., Sed.	1941-1950
06869500	Saline River at Tescott, KS	2,820.00	Nut., MI, MTI, Temp., S.C., Sed.	1948-1999
06870200	Smoky Hill River at New Cambria, KS	11,730.00	Bio., Nut., MI, MTI, Temp., S.C., Cl., Sed.	1962-1984
06871800	North Fork Solomon River at Kirwin, KS	1,367.00	Bio., Nut., MI, MTI, Temp., Sed.	1945-1975
06872500	North Fork Solomon River at Portis, KS	2,315.00	MRB, Sed.	1961-1999
06873500	South Fork Solomon River at Alton, KS	1,720.00	Nut., MI, MTI, Temp., Sed.	1948-1952
06874000	South Fork Solomon River at Osborne, KS	2,012.00	NASQAN, Sed.	1958-1994
06876000	Solomon River at Beloit, KS	5,530.00	Nut., Org., MI, MTI, Temp., S.C., Sed.	1948-1965
06876440	Solomon River near Minneapolis, KS	6,060.00	Bio., Nut., MI, MTI, Rad., Temp., S.C., pH, D.O.	1978-1983
06876900	Solomon River at Niles, KS	6,770.00	Bio., Nut., MI, MTI, Temp., S.C., Cl., Sed.	1957-2003
06877500	Turkey Creek near Abilene, KS	143.00	Sed.	1958-1977

DISCONTINUED WATER-QUALITY STREAMFLOW-GAGING STATIONS--Continued

Station number	Station name	Drainage area (mi^2)	Type of record[1]	Period of record
	Kansas River Basin--Continued			
06877600	Smoky Hill River at Enterprise, KS	19,260.00	Temp., S.C., Cl., Sed., NASQAN	1956-2003
06878000	Chapman Creek near Chapman, KS	300.00	Bio., Nut., MI, Sed.	1958-1978
06878500	Lyon Creek near Woodbine, KS	230.00	Nut., MI, MTI, Sed.	1958-1971
06879200	Clark Creek near Junction City, KS	200.00	Sed.	1958-1962
06879650	Kings Creek near Manhattan, KS	4.09	Benchmark	1980-1996
06884400	Little Blue River near Barnes, KS	3,324.00	Bio., Nut., Org., MI, MTI, Rad., Temp., S.C., pH, D.O., Sed.	1962-1990
06885500	Black Vermillion River near Frankfort, KS	410.00	Bio., Nut., Org., MI, MTI, Rad., Sed.	1976-2003
06887000	Big Blue River near Manhattan, KS	9,640.00	NASQAN, Sed.	1955-1998
06887500	Kansas River at Wamego, KS	5,280.00	Bio., Nut., Org., MI, MTI, Temp., S.C., pH, D.O., Sed., Turb.	1956-2005
06888000	Vermillion Creek near Wamego, KS	243.00	Bio., Nut., MI, MTI,Temp.	1958-2002
06889000	Kansas River at Topeka, KS	56,720.00	Bio., Nut., Org., MI, MTI, Rad., Temp., S.C., pH, D.O., Sed., Turb.	1953-2005
06889610	South Branch Shunganunga Creek at Southwest 37th St, Topeka, KS	11.60	Bio., Nut., Org., MI, MTI, D.O., Sed.	1979-1996
06889700	Shunganunga Creek at Rice Road, Topeka, KS	58.70	Bio., Nut., Org., MI, MTI, D.O., Sed.	1979-2002
06890000	Little Delaware River near Horton, KS	19.00	Bio., Nut., MI, MTI,Temp., S.C., Sed.	1976-1978
06890100	Delaware River near Muscotah, KS	431.00	Bio., Nut., Org., MI, MTI, Rad., Sed.	1969-2003
06890500	Delaware River at Valley Falls, KS	922.00	Nut., MI, MTI, Sed.	1957-1967
06891490	Yankee Tank Creek near Lawrence, KS	3.90	Nut., MI, MTI, Temp., S.C.	1968-1973
06891500	Wakarusa River near Lawrence, KS	425.00	Bio., Nut., Org., MI, MTI, Rad., Sed.	1958-1990
06892000	Stranger Creek near Tonganoxie, KS	406.00	Bio., Nut., Org., MI, MTI, Rad., Sed.	1957-1989
06892350	Kansas River at DeSoto, KS	59,756.00	NASQAN, Temp., S.C., pH, D.O., Sed., Turb.	1975-2005
06892440	Cedar Creek at Highway 56 at Olathe, KS	13.30	Temp., S.C., pH, D.O., Turb.	2000-2005
06892450	Olathe Lake near Olathe, KS	16.97	Temp., S.C., pH, D.O., Turb.	2000-2005
06892500	Kansas River at Bonner Springs, KS	59,928.00	Bio., Nut., Org., MI, MTI, Rad., Temp., S.C.	1948-2002
	Osage River Basin			
06911900	Dragoon Creek near Burlingame, KS	114.00	Bio., Sed.	1975-2003
06913500	Marais des Cygnes River near Ottawa, KS	1,250.00	Nut., MI, MTI, Temp., S.C.	1958-1975
06915988	North Sugar Creek near Trading Post, KS	72.13	Bio., Nut., Org., MI, MTI, Rad., Temp., S.C., Sed.	1980-1981
06916600	Marais des Cygnes River near Kansas-Missouri State line, KS	3,230.00	Bio., Nut., Org., MI, MTI, Rad., Sed.	1961-2003
	Arkansas River Basin			
07137500	Arkansas River near Coolidge, KS	25,410.00	NASQAN, Sed.	1963-1995
07139500	Arkansas River at Dodge City, KS	30,600.00	NASQAN, Sed.	1958-1999
07140000	Arkansas River near Kinsley, KS	31,066.00	Bio., Nut., MI, MTI, Temp., Sed.	1958-1999
07141900	Walnut Creek at Albert, KS	1,410.00	Bio., Nut., MI, MTI, Temp., Sed.	1958-2003
07142575	Rattlesnake Creek near Zenith, KS	1,047.00	Temp., S.C., pH, D.O., Turb.	1998-2004

DISCONTINUED WATER-QUALITY STREAMFLOW-GAGING STATIONS--Continued

Station number	Station name	Drainage area (mi^2)	Type of record[1]	Period of record
		Arkansas River Basin--Continued		
07142620	Rattlesnake Creek near Raymond, KS	1,167.00	Bio., Nut., Org., MI, MTI, S.C., Sed	1960-1999
07143330	Arkansas River near Hutchinson, KS	38,910.00	Bio., Nut., MI, MTI, Rad., Temp., S.C., Sed.	1959-1992
07144200	Little Arkansas River at Valley Center, KS	1,327.00	Bio., Nut., MI, MTI, Temp., Sed.	1944-1983
07144550	Arkansas River at Derby, KS	40,830.00	Bio., Nut., MI, MTI, Temp., S.C	1961-2001
07144800	North Fork Ninnescah River near Cheney, KS	930.00	Nut., MI, MTI, Temp., Sed.	1958-1965
07145200	South Fork Ninnescah River near Murdock, KS	650.00	Bio., Nut., MI, MTI, Temp., S.C., Sed.	1961-1999
07145500	Ninnescah River near Peck, KS	2,129.00	Bio., Nut., MI, MTI, Temp., Sed.	1940-1999
07146500	Arkansas River at Arkansas City, KS	43,713.00	NASQAN, Sed.	1943-2003
07146990	Whitewater River 3 miles south of Potwin, KS	162.00	Bio., Nut., Org., MI, MTI, S.C., Sed.	1967-1978
07147050	West Branch Whitewater River near Furley, KS	88.00	Nut., MI, MTI, S.C., Sed.	1967-1969
07147060	West Branch Whitewater River near Benton, KS	177.00	Bio., Nut., MI, MTI, Rad., S.C., Sed.	1967-1978
07147070	Whitewater River at Towanda, KS	426.00	Bio., Nut., Org., MI, MTI, Temp., S.C., Sed.	1961-1987
07147800	Walnut River at Winfield, KS	1,880.00	Bio., Nut., MI, MTI, Rad., Temp., S.C., Sed.	1959-2003
07148600	Medicine Lodge River at Sun City, KS	335.00	Bio., Nut., MI, MTI, Temp., S.C., Cl.	1954-1999
07149000	Medicine Lodge River near Kiowa, KS	903.00	Bio., Nut., MI, MTI, Temp., S.C., Cl., Sed.	1938-1999
07151300	Chikaskia River near Spivey, KS	315.00	Bio., Nut., MI, MTI, Temp., S.C., Cl.	1956-1999
07151500	Chikaskia River near Corbin, KS	794.00	Bio., Nut., MI, MTI, Temp., Sed.	1958-1999
07157500	Crooked Creek near Nye, KS	1,157.00	Bio., Nut., Org., MI, MTI, Temp., Sed.	1946-1999
07157740	Cimarron River near Buttermilk, KS	1,120.00	Temp., S.C., Cl.	1973-1979
07157940	Bluff Creek near Buttermilk, KS	657.00	Bio., Nut., MI, Temp., Cl., Sed.	1973-1979
07169800	Elk River at Elk Falls, KS	220.00	Bio., Nut., MI, MTI, Sed.	1967-2003
07170500	Verdigris River at Independence, KS	2,892.00	Bio., Nut., MI, MTI, Temp., S.C., Sed.	1945-1990
07183500	Neosho River near Parsons, KS	4,905.00	NASQAN, Sed	1958-2003
07184070	Deer Creek near Hallowell, KS	7.00	Bio., Nut., MI, MTI, Temp., S.C., Sed.	1976-1980
07184100	Lightning Creek near Oswego, KS	250.00	Bio., Nut., MI, MTI, Temp., S.C., Sed.	1976-1979
07184220	Cherry Creek near West Mineral, KS	27.00	Bio., Nut., MI, MTI, Temp., S.C., Sed.	1976-1980
07184240	Little Cherry Creek near West Mineral, KS	34.00	Bio., Nut., MI, MTI, Temp., S.C., Sed.	1977-1980
07184300	Cherry Creek near Hallowell, KS	90.00	Bio., Nut., MI, MTI, Temp., S.C., Sed.	1977-1981
07186010	Second Cow Creek at Pittsburg, KS	60.00	Bio., Nut., MI, MTI, Temp., S.C., Sed.	1977-1980
07186040	Cow Creek near Weir, KS	170.00	Bio., Nut., MI, MTI, Temp., S.C., Sed.	1977-1981
07186050	Brush Creek near Weir, KS	30.00	Bio., Nut., MI, MTI, Temp., S.C., Sed.	1977-1980

[1]Type of record: Bio. (biological), Cl. (chloride), D.O. (dissolved oxygen), MI (major inorganics), MRB (Missouri River Basin), MTI (minor and trace inorganics), NASQAN (National Stream-Quality Accounting Network), Nut. (nutrients), Org. (organics), Rad. (radiochemical), S.C. (specific conductance), Sed. (sediment), Temp. (temperature), Turb. (turbidity).

INTRODUCTION

The U.S. Geological Survey, in cooperation with local, State, and Federal agencies, collects a large amount of data pertaining to the water resources of Kansas each water year (October 1 to September 30). These data, accumulated during many water years, constitute a valuable database for developing an improved understanding of the water resources of the State. To make these data readily available to interested parties outside the Geological Survey, the data are published annually in this report series entitled “Water Resources Data - Kansas.” Historic and current streamflow, water-quality, and ground-water data also are available on the World Wide Web at: *http://ks.water.usgs.gov/* and *http://ks.waterdata.usgs.gov/nwis/*.

This report contains records for water discharge at 154 complete-record streamflow-gaging stations; complete records of elevation and contents at 14 lakes and reservoirs; water-quality records at 2 precipitation stations; water levels at 15 observation wells; and records of specific conductance, pH, water temperature, dissolved oxygen, and turbidity at 13 gaging stations (includes one gaging station with specific conductance and water temperature only) and 2 lakes with water-quality monitors. Also included are discharge data for 29 high-flow partial-record streamflow-gaging stations. Locations of complete-record surface-water stations, 2005 water year, are shown in figure 1. Locations of complete-record water-quality stations, 2005 water year, are shown in figure 2. Locations of high-flow partial-record streamflow-gaging stations, 2005 water year, are shown in figure 3. The number of ground-water-level observation wells per county, 2005 water year, is shown in figure 10.

This series of annual reports for Kansas began with the 1961 water year with a report that contained only data relating to the quantities of surface water. For the 1964 water year, a similar report was introduced that contained only data relating to water quality. Beginning with the 1975 water year, the report format was changed to present, in one volume, data on quantities of surface water, quality of surface and ground water, and ground-water levels.

Prior to introduction of this series and for several water years concurrent with it, water-resources data for Kansas were published in U.S. Geological Survey Water-Supply Papers. Data on stream discharge and stage and on lake or reservoir elevation and contents, through September 1960, were published annually under the title “Surface-Water Supply of the United States, Parts 6 and 7.” For the 1961 through 1970 water years, the data were published in two 5-year reports, 1961-65 and 1966-70. Data on chemical quality, temperature, and suspended sediment for the 1941 through 1970 water years were published annually under the title “Quality of Surface Waters of the United States,” and ground-water levels for the 1935 through 1974 water years were published under the title “Ground-Water Levels in the United States.” The above-mentioned Water-Supply Papers may be consulted in the libraries of the principal cities in the United States or may be purchased from the Branch of Information Services, Federal Center, Box 25286, Denver, CO 80225.

Publications similar to this report are published annually by the Geological Survey for all States. These official Survey reports have an identification number consisting of the two-letter State abbreviation, the last two digits of the water year, and the volume number. For example, this volume is identified as “U.S. Geological Survey Water-Data Report KS-05-1.” For archiving and general distribution, the reports for the 1971-74 water years also are identified as water-data reports. These water-data reports are for sale in paper copy or in microfiche by the National Technical Information Service, U.S. Department of Commerce, 5285 Port Royal Road, Springfield, VA 22161.

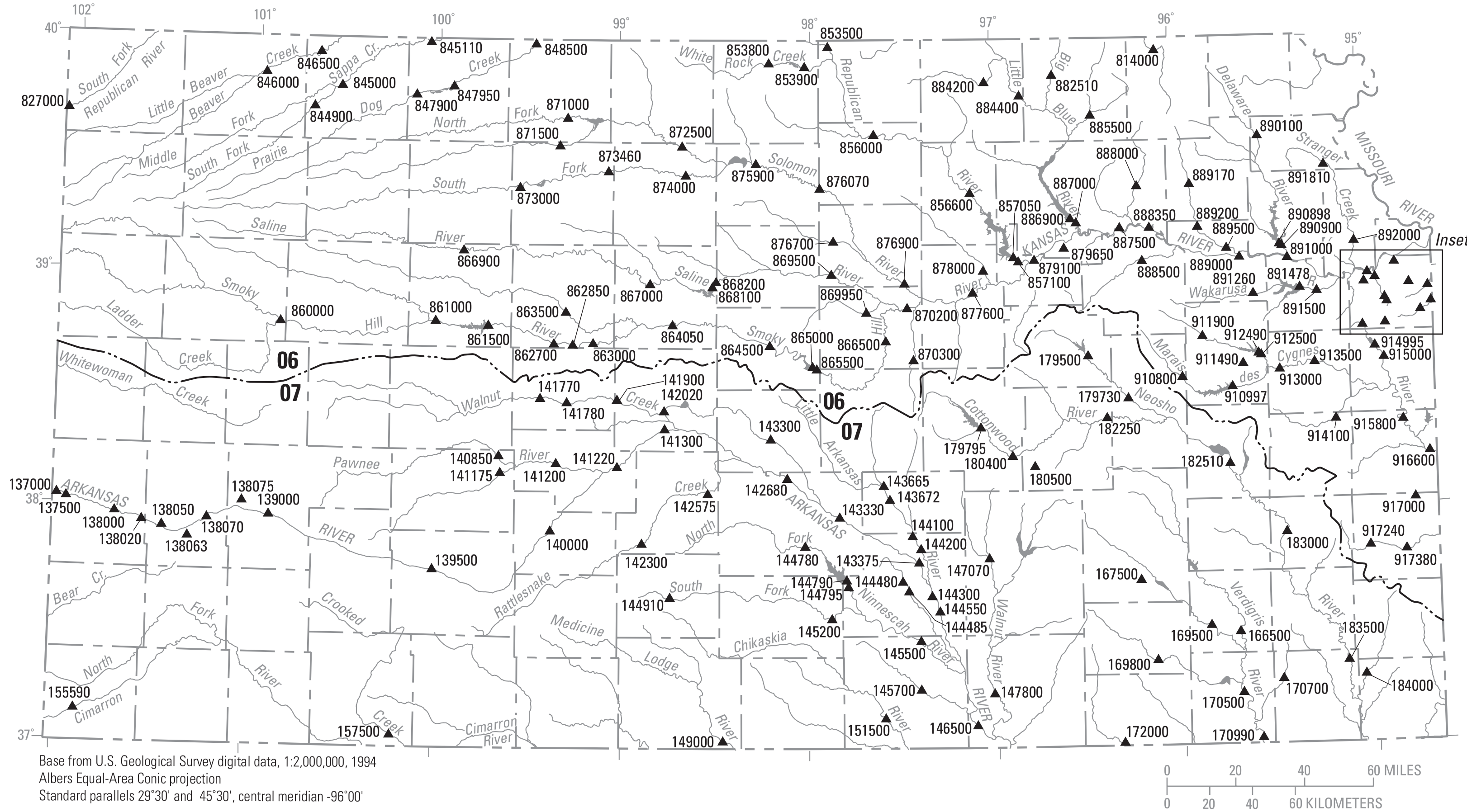
Additional information, including current prices, for ordering specific reports may be obtained from the USGS Water Science Center Director at the address given on the back of the title page or by telephone (785) 842-9909.

COOPERATION

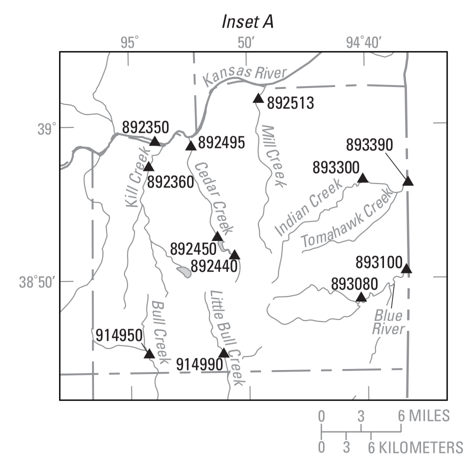
The U.S. Geological Survey and agencies of the State of Kansas have had cooperative agreements for the collection of water-resources records since 1895. Organizations that helped support this program through cooperative funding agreements with the Survey are: Kansas Water Office; Kansas Department of Transportation; Kansas Department of Agriculture, Division of Water Resources; city of Wichita; Kansas Department of Health and Environment; Arkansas River Compact Administration; city of Hays; Johnson County Department of Public Works; Johnson County Stormwater Program; city of Olathe; city of Russell; city of Hutchinson; city of Augusta, and city of Arkansas City.

The following Federal agencies assisted in the data-collection program by providing funds: U.S. Army Corps of Engineers and U.S. Department of the Interior, Bureau of Reclamation.

The U.S. Geological Survey, the Kansas Water Office, using State Water Plan Funds, and the U.S. Army Corps of Engineers provide the largest share of funds for operation of data-collection stations.



Base from U.S. Geological Survey digital data, 1:2,000,000, 1994
Albers Equal-Area Conic projection
Standard parallels 29°30' and 45°30', central meridian -96°00'



EXPLANATION

149000▲ **Complete-record station and number**—Includes complete-record streamflow-gaging stations and stations that measure elevation and contents of lakes and reservoirs

Note: Numbers are abbreviated versions of the complete identification numbers

Drainage basin

06 Missouri River Basin

07 Lower Mississippi River Basin

—·-·— **Basin boundary**

Figure 1. Location of complete-record surface-water stations, 2005 water year.

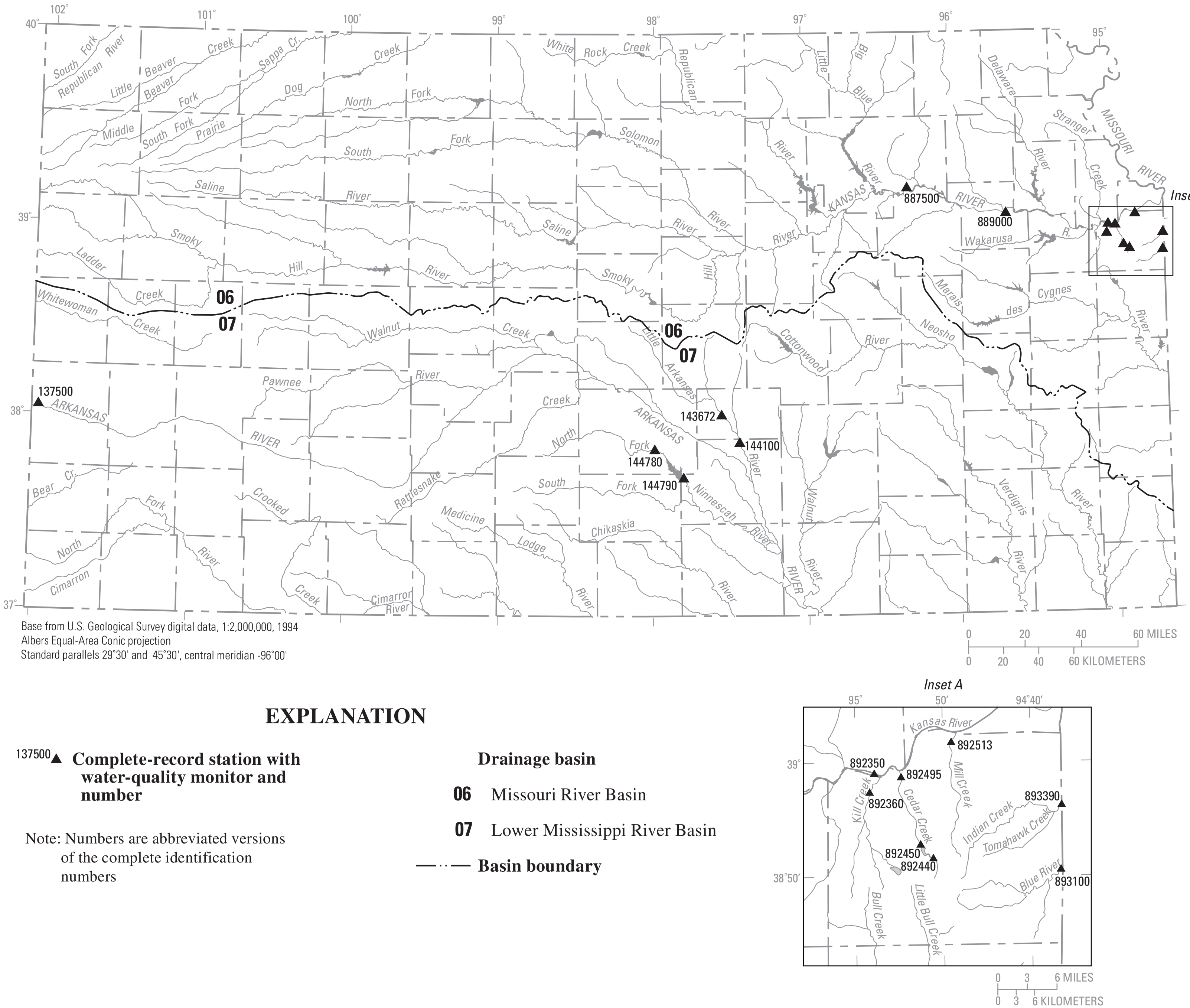
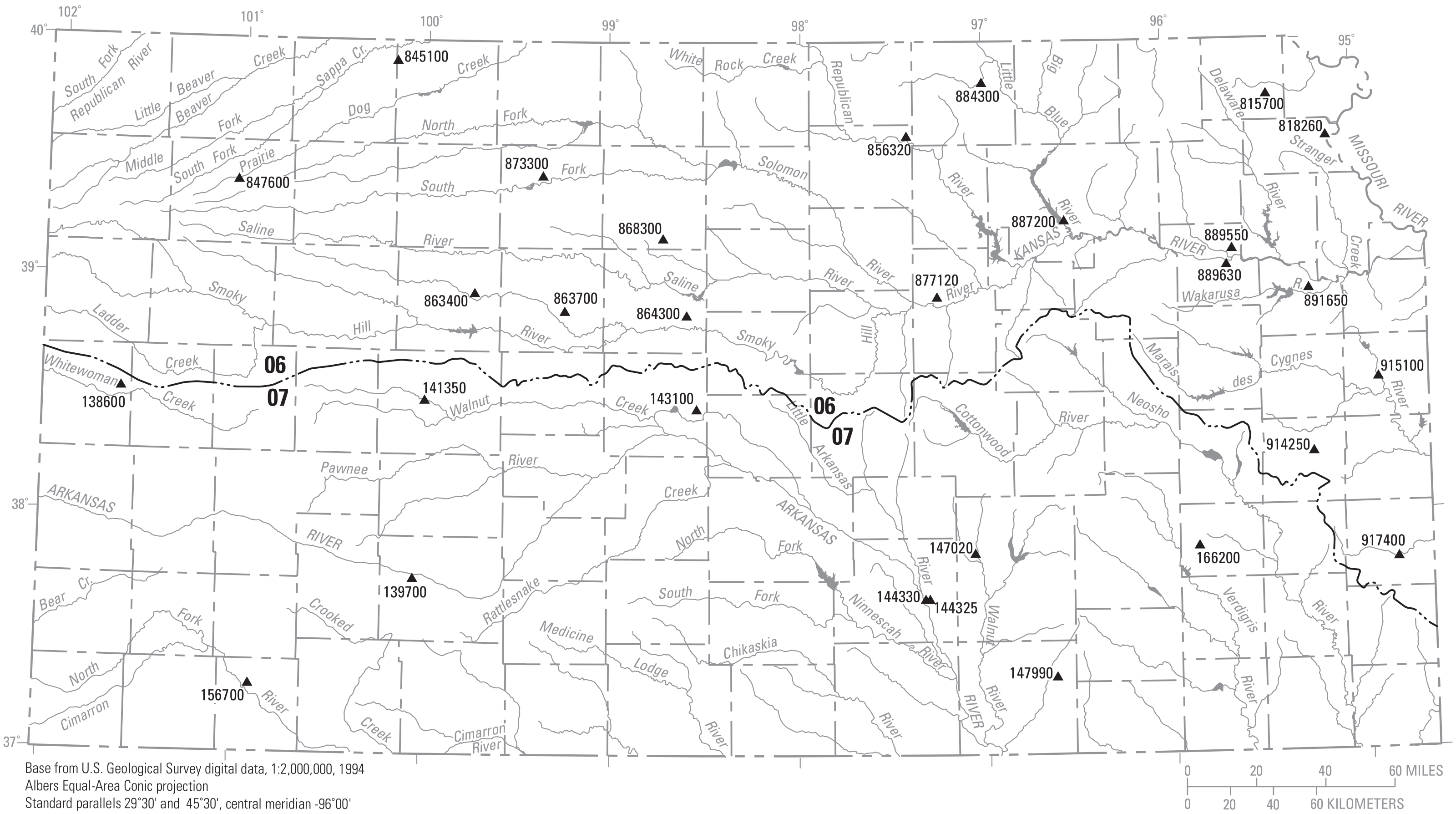


Figure 2. Location of complete-record water-quality stations, 2005 water year.



Base from U.S. Geological Survey digital data, 1:2,000,000, 1994
Albers Equal-Area Conic projection
Standard parallels 29°30' and 45°30', central meridian -96°00'

EXPLANATION

139700▲ **High-flow station and number**

Note: Numbers are abbreviated versions of the complete identification numbers

Drainage basin

06 Missouri River Basin

07 Lower Mississippi River Basin

—··— **Basin boundary**

Figure 3. Location of high-flow partial-record streamflow-gaging stations, 2005 water year.

SUMMARY OF HYDROLOGIC CONDITIONS

Surface Water

Streamflow

Large spatial and temporal variations in streamflow characterize hydrologic conditions in Kansas. In the extreme southeastern part of the State, mean annual precipitation exceeds 40 in., and mean annual runoff exceeds 10 in. In the east, stream channels are deeply incised in wide, alluvial flood plains, and streamflow generally is perennial. In the extreme western part of the State, mean annual precipitation is less than 20 in., and mean annual runoff is less than 0.1 in. (Busby, 1963; NOAA, 1979). In western Kansas, streams generally have shallow, ill-defined channels, and streamflow generally is ephemeral.

Precipitation data from monthly reports of the National Weather Service (NOAA, 2003-05) for reporting areas in Kansas (fig. 4) are summarized in table 1. Precipitation during the 2005 water year was above normal in all National Weater Service Reporting areas. The only significant below-normal precipitation occurred in the first quarter of the water year (October-December) in north-central Kansas, 1.01 in. below normal, and in northeast Kansas, 1.36 in. below normal. Precipitation totals for the 2005 water year ranged from 106 percent of normal in west-central Kansas to 128 percent of normal in east-central Kansas. Figure 5 shows a comparison of precipitation for water years 2003-05 with normal precipitation for the period 1971-2000.

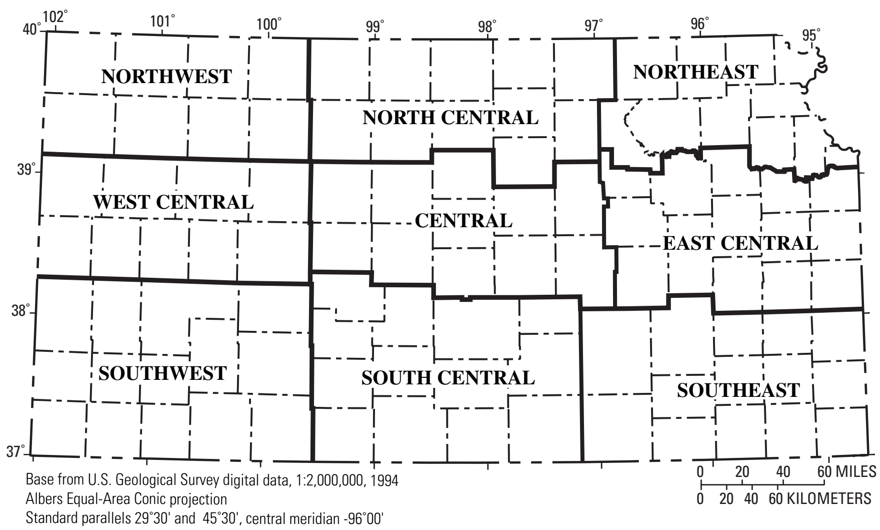


Figure 4. Reporting areas of the National Weather Service.

Table 1. Precipitation during 2005 water year and departure from normal.
[All values are in inches. Period of record for normal, 1971-2000. Source: U.S. Department of Commerce, National Oceanic and Atmospheric Administration, National Weather Service published reports]

Reporting area of the State	First quarter (October-December)		Second quarter (January-March)		Third quarter (April-June)		Fourth quarter (July-September)		Water-year totals	
	Precipitation	Departure from normal	Precipitation	Departure from normal	Precipitation	Departure from normal	Precipitation	Departure from normal	Precipitation	Departure from normal
Northwest	3.47	1.00	2.49	0.15	9.24	0.39	7.46	0.28	22.66	1.82
North central	2.69	-1.01	4.91	1.66	10.39	.19	11.55	1.99	29.54	2.83
Northeast	4.74	-1.36	5.18	1.04	14.45	1.48	12.66	.46	37.03	1.62
West central	2.69	.27	2.88	.57	7.90	.08	7.53	.37	21.00	1.29
Central	3.75	-.67	5.37	1.85	11.09	.51	9.60	.04	29.81	1.73
East central	8.00	1.22	6.16	1.38	15.64	2.10	17.56	5.81	47.36	10.51
Southwest	3.65	1.33	3.16	1.01	8.50	.95	7.05	.01	22.36	3.30
South central	5.77	1.32	5.76	2.25	11.72	1.56	10.58	1.59	33.83	6.72
Southeast	11.08	3.18	7.52	1.92	14.68	1.01	13.77	2.07	47.05	8.18

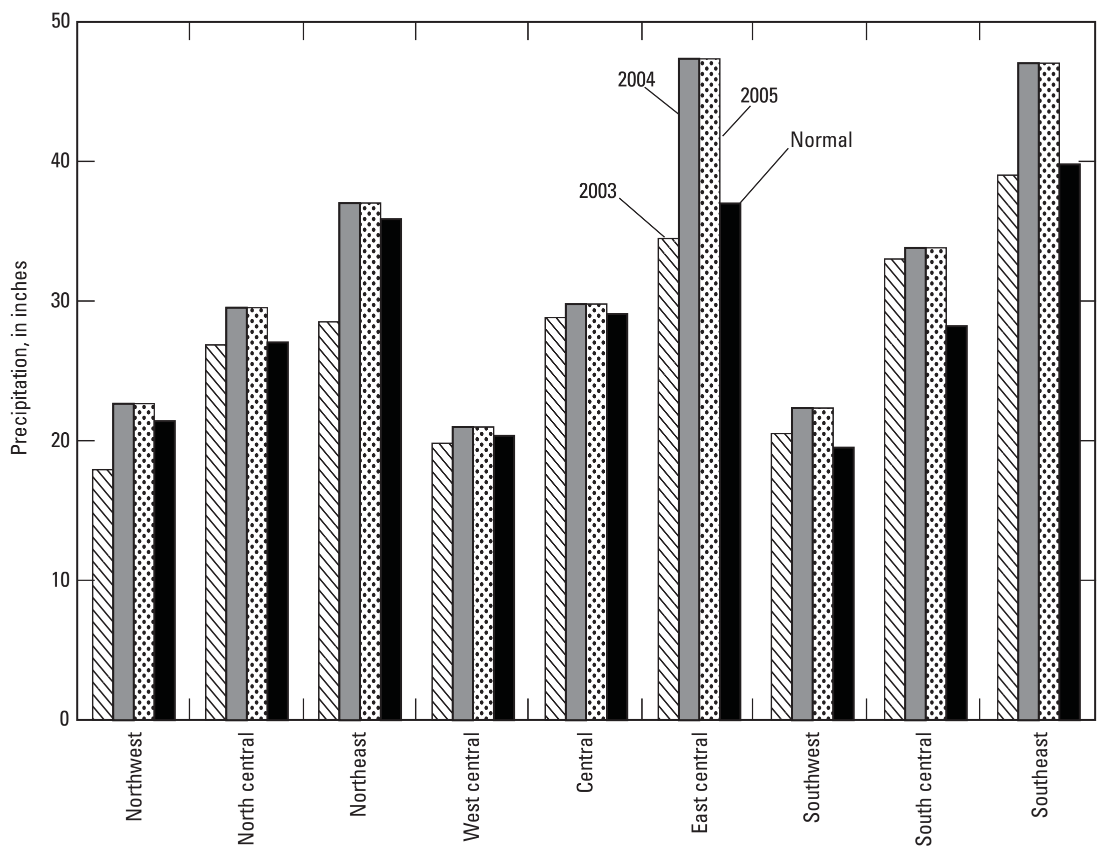


Figure 5. Precipitation for water years 2003-05 and normal precipitation (1971-2000) for nine National Weather Service reporting areas in Kansas (NOAA, 2002-05).

The drought that has significantly affected Kansas since 2002 did not completely leave Kansas in 2005, however, conditions did improve. The U.S. Drought Monitor reports drought information on the Internet at *http://www.drought.unl.edu/dm/monitor.html*. The U.S. Department of Agriculture, the National Drought Mitigation Center (University of Nebraska-Lincoln), U.S. Department of Commerce (National Oceanic and Atmospheric Administration), and the U.S. Geological Survey contribute data and support for this information. According to the U.S. Drought Monitor (Drought Monitor, 2005), the 2005 water year began with moderate to severe drought conditions in northwest Kansas and abnormally dry conditions in the eastern third of the State. By March, drought severity in northwest Kansas remained the same; however, the abnormally dry conditions receded to the northern counties in Kansas due to timely precipitation in east-central and southeast Kansas ranging from 2 to 6 in. Above-normal precipitation in June and August across the State continued to improve drought conditions and by September 2005 only northwest Kansas was in abnormally dry conditions.

Streamflow in the State's larger rivers during the 2005 water year generally was in the normal range except for the Republican River and the Smoky Hill River. Figure 6 shows daily streamflow for six large rivers in Kansas compared with the long-term normal daily streamflow range computed using historic records. Abnormally dry conditions in Nebraska and north-central Kansas contributed to below-normal streamflow for the entire water year in the Republican River at Clay Center except during rainfall in January, April, June, August, and September. Below-normal streamflow conditions also occurred in the Smoky Hill River at Enterprise for most of the period October through January and much of the period from July through September.

Effects of the continued dry conditions in the Republican River also are evident in a comparison of departure from the annual mean streamflow computed from historic records (fig. 7). Mean annual streamflow has been well below the long-term annual mean streamflow every water year since 1996 and in 15 of the last 20 years.

Monthly and annual mean streamflow during 2005 water year at 10 index streamflow-gaging stations are compared to long-term (reference period through previous water year) monthly and annual streamflow in figure 8. Annual mean streamflow during the 2005 water year was less than the long-term annual streamflow at all of the 10 index stations except Dragoon Creek near Burlingame and Little Arkansas River at Valley Center. These stations are located in areas of the State where precipitation was above normal, east-central Kansas was 10.51 in. above normal, and south-central Kansas was 6.72 in. above normal precipitation.

Although precipitation for the 2005 water year was above normal across the State, monthly streamflows were still generally below long-term monthly streamflows except at sites 6, 9, and 10 (fig. 8). Several years of above-normal precipitation will be necessary to offset the effects of long-term drought in areas of the State where most of these sites are located. Monthly streamflow at sites 6, 9, and 10 was above the long-term monthly streamflows several times during 2005. For example, monthly streamflows were above long-term monthly streamflows November through February, May, June, and August for Dragoon Creek near Burlingame (site 6, fig. 8), an improvement from conditions in the 2004 water year when only 4 months had streamflow greater than long-term monthly flows. Monthly streamflow for the Little Arkansas River at Valley Center (site 9, fig. 8) was above long-term monthly streamflow January through March, May, June, and August compared with only 3 months above long-term monthly flows during the 2004 water year. Site 6 is located in east-central Kansas where 2005 precipitation was 10.51 in. above normal compared with 2.50 in. above normal during the 2004 water year. Site 9 is located in south-central Kansas that received 6.72 in. above-normal precipitation during the 2005 water year compared with 4.87 in. above normal during the 2004 water year.

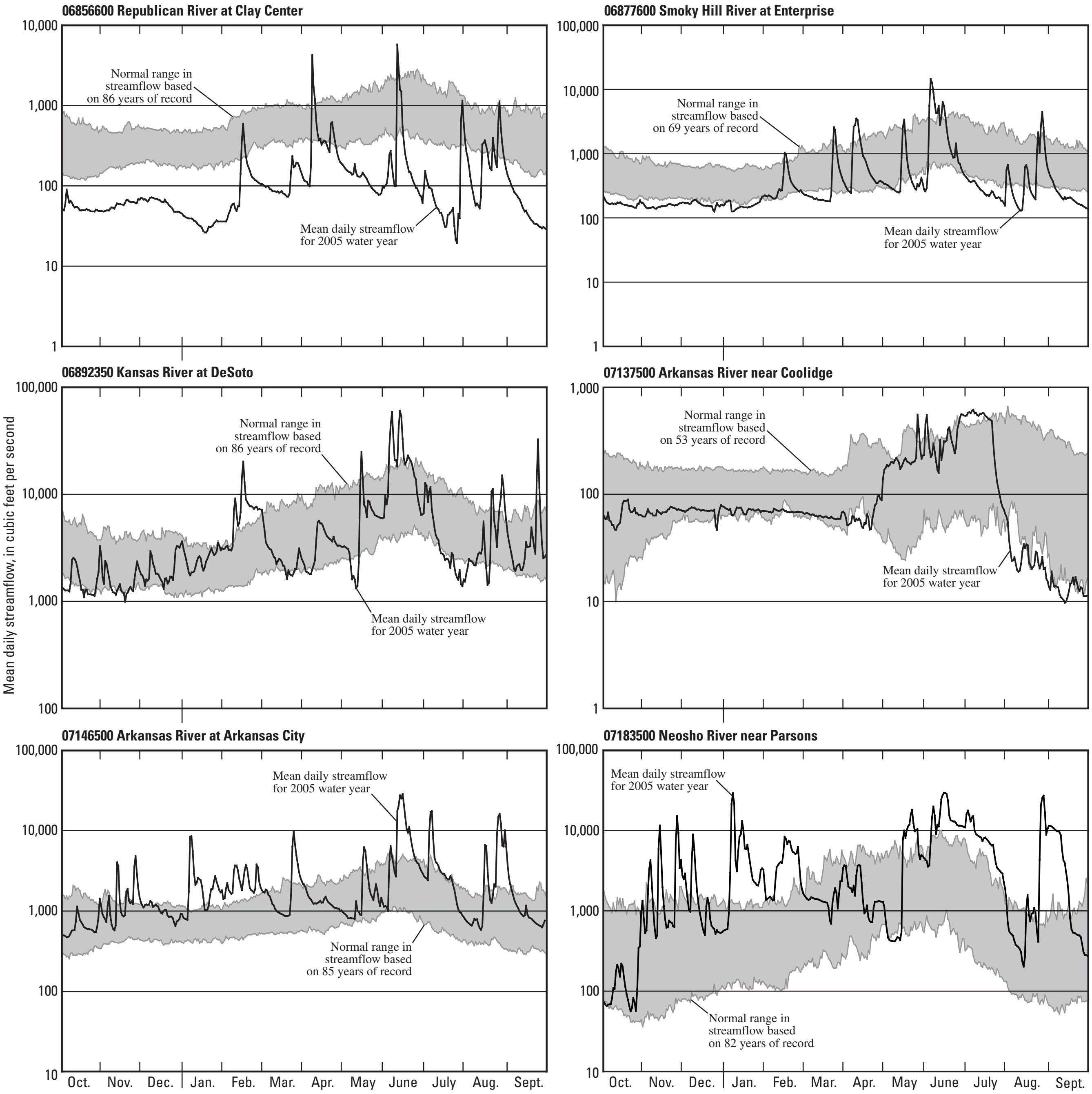


Figure 6. Mean daily streamflow for 2005 water year for selected streamflow-gaging stations in Kansas compared with normal range (daily discharge within 25- to 75-percentile range for period of record; station locations shown in figure 1).

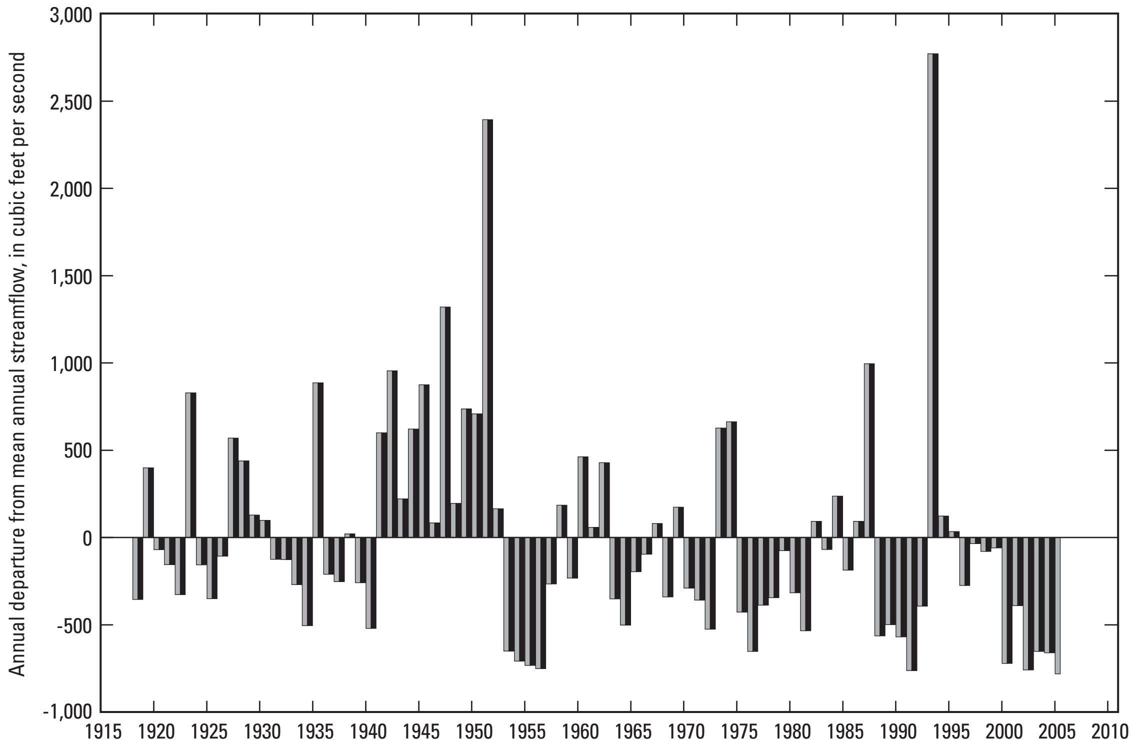


Figure 7. Departure from mean annual streamflow for Republican River at Clay Center, Kansas, water years 1918-2005.

Streamflow-gaging station on South Fork Republican River near Colorado-Kansas state line (station 06827000, fig. 1). Photograph courtsey of C.A. Dare.

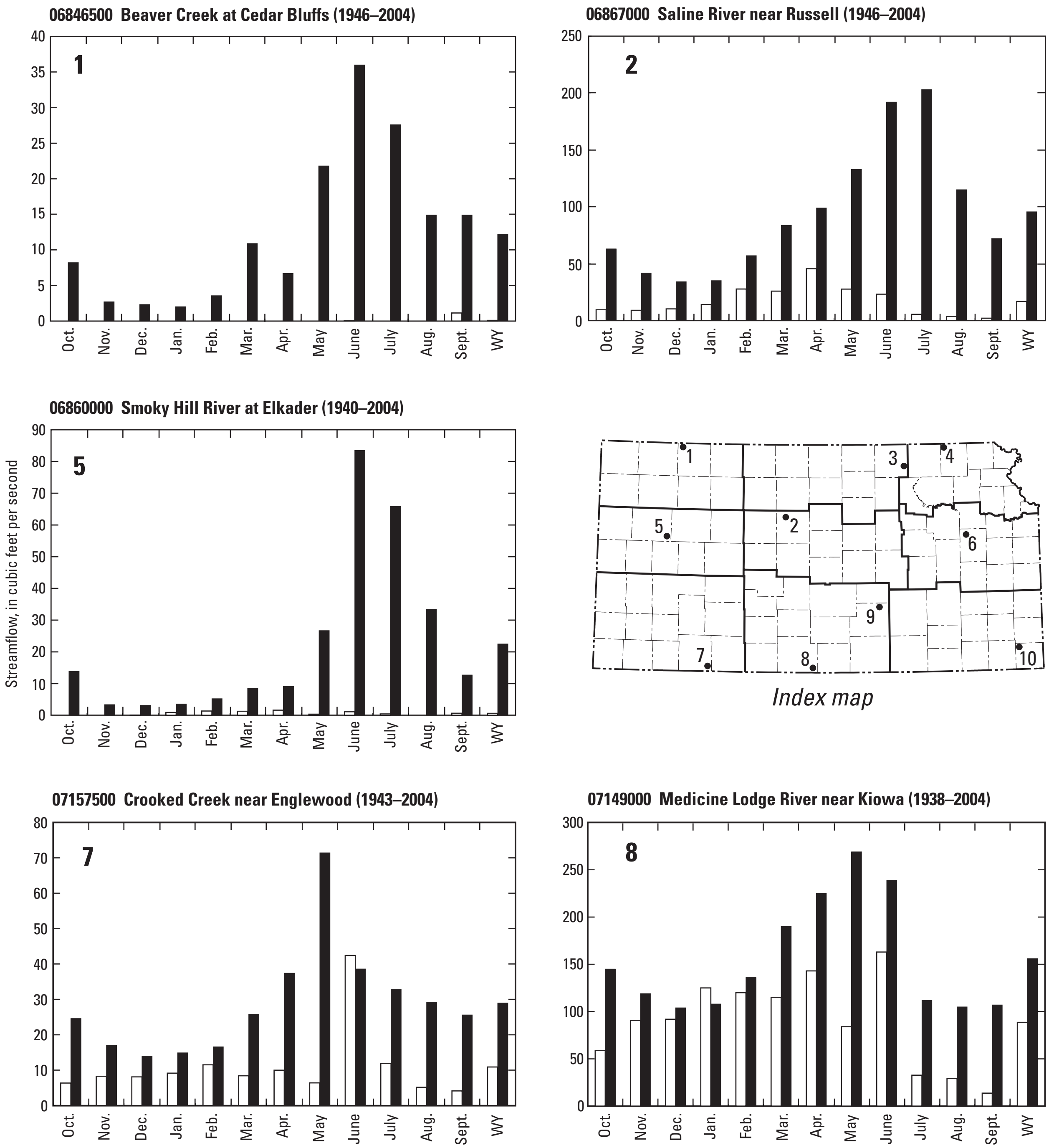
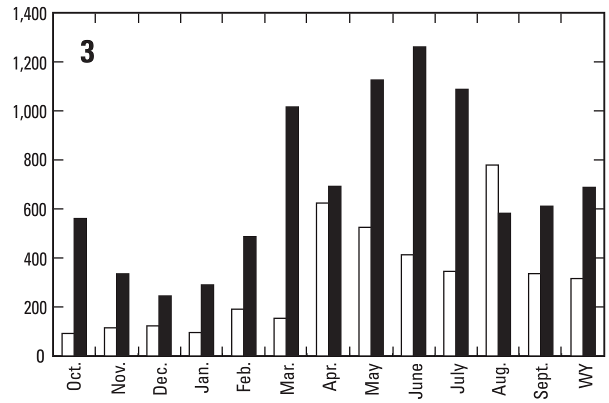
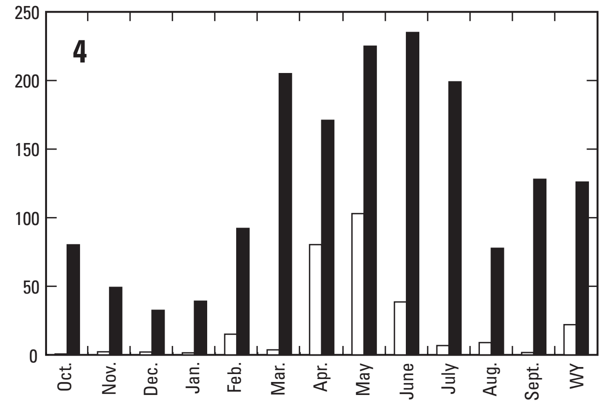


Figure 8. Comparison of 2005 water year monthly and annual mean streamflow to long-term mean of monthly and annual mean streamflow at selected streamflow-gaging stations.

06884400 Little Blue River near Barnes (1959–2004)



06814000 Turkey Creek near Seneca (1949–2004)



EXPLANATION

Monthly and annual mean streamflow for 2005 water year

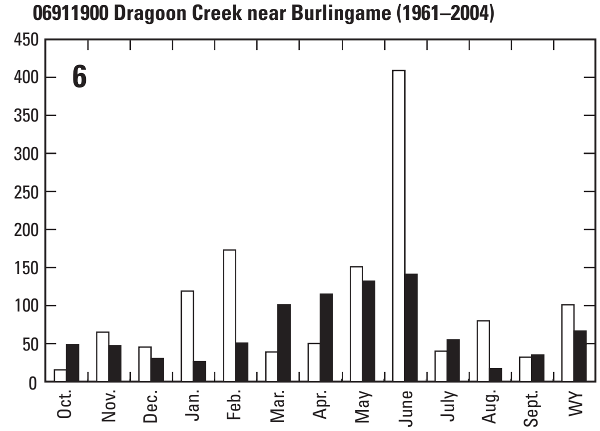
Long-term mean of monthly and annual mean streamflow for reference period

(1923–2004) Reference period

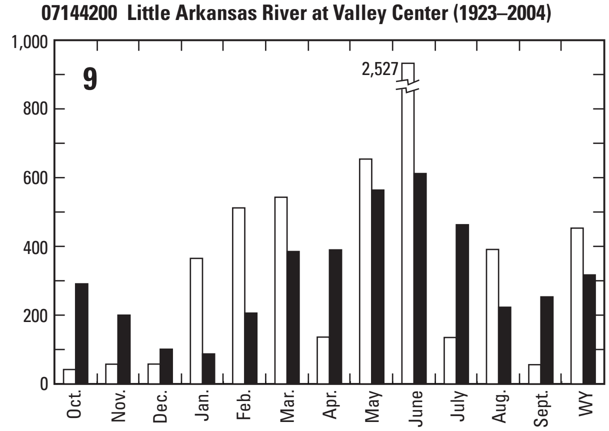
WY Water year

Boundary of National Weather Service reporting areas

06911900 Dragoon Creek near Burlingame (1961–2004)



07144200 Little Arkansas River at Valley Center (1923–2004)



07184000 Lightning Creek near McCune (1939–2004)

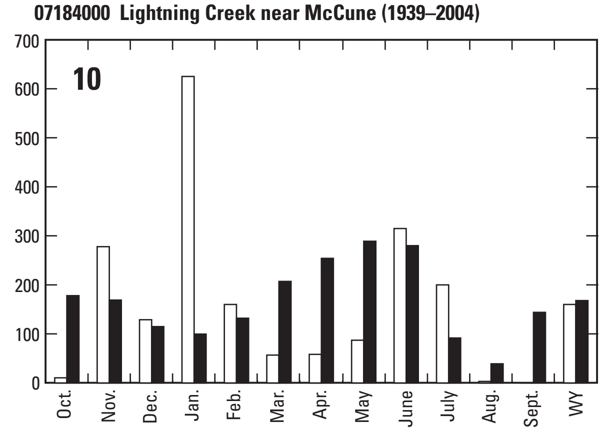


Figure 8. Comparison of 2005 water year monthly and annual mean streamflow to long-term mean of monthly and annual mean streamflow at selected streamflow-gaging stations--Continued.

Because dry conditions were prevalent across Kansas and some areas still were experiencing some level of drought, record low streamflows were recorded at several streamgages. Table 2 shows record low streamflows at sites with greater than 10 years of record compared with previous record low flows. The low streamflows were most evident in the Republican River that has been significantly affected by drought for more than 5 years. Computed annual mean streamflows at all three Republican streamgages near Hardy, at Concordia, and at Clay Center broke previous low-flow records. Previous low-flow records at Concordia and Clay Center stations were computed for the 1991 water year. The annual mean streamflow at Big Creek near Hays was the lowest since 1991, and the annual mean streamflow at Smoky Hill at Ellsworth station was the lowest in over 20 years. The Solomon River also has been adversely affected by the drought as indicated by record low flows recorded at Woodston, Osborne, and near Simpson. Annual mean streamflow for the Arkansas River at Great Bend broke the previous record computed for the 1985 water year. Generally, annual mean streamflow at the Great Bend station has decreased every year since 1999 water year (fig. 9).

Table 2. Record low streamflows at selected streamflow-gaging stations in Kansas, 2005 water year.

[Streamflow values are given in cubic feet per second]

Station identification number and name		Period of record (water years)	Type of streamflow record	2005 water year	Previous low record (water year)	
06853500	Republican River near Hardy, NE	1933-2005	lowest annual mean	24.9	59.2	(2004)
06856000	Republican River at Concordia, KS	1947-2005	lowest annual mean	90.3	117	(1991)
06856600	Republican River at Clay Center, KS	1918-2005	lowest annual mean	171	191	(1991)
06863500	Big Creek near Hays, KS	1947-2005	lowest annual mean	3.34	3.05	(1991)
06864500	Smoky Hill River at Ellsworth, KS	1986-2005	lowest annual mean	33.4	29.1	(1983)
06873460	South Fork Solomon River at Woodston, KS	1978-2005	lowest annual mean	0.43	0.59	(1981)
06874000	South Fork Solomon River at Osborne, KS	1946-2005	lowest annual mean	9.21	9.27	(1991)
06876070	Solomon River near Simpson, KS	1990-2005	lowest annual mean	41.3	62.2	(2004)
07141300	Arkansas River at Great Bend, KS	1941-2005	lowest annual mean	.71	2.46	(1985)

Kansas has established minimum desirable streamflow (MDS) for many streams in the State. Table 3 lists the number of days that streamflow was less than the MDS for selected stations. Dry conditions resulted in more low-flow periods for the Republican River, and therefore, more days of streamflow less than MDS were recorded during the 2005 water year than were noted during the 2004 water year. For example, streamflow at the Clay Center station was below MDS 99 days between the period March through September in 2004 and 165 days in 2005. Worsening streamflow conditions also resulted in more low-flow periods downstream from the Kinsley station on the Arkansas River as indicated by the increase in number of days below MDS at the Great Bend station. The number of days of streamflow less than MDS also increased at the Smoky Hill and Arkansas River at Great Bend stations (table 3). Conditions improved at the Solomon River, Chapman Creek, and Muscotah stations. For example, during the 2004 water year streamflow at Chapman Creek was below MDS 91 days during the March through September period and only 65 days during the same period for the 2005 water year. When streamflow is less than the State MDS for 7 consecutive days, the Division of Water Resources, Kansas Department of Agriculture, begins administrative process to curtail surface-water diversions for those with junior water rights.

The only significant high flow recorded during the 2005 water year occurred in Otter Creek at Climax (station 07167500, fig.1). The maximum high flow recorded at the Climax station, 43,700 ft^3/s, occurred on August 25, the highest high flow since November 1, 1998, when 45,900 ft^3/s was recorded. The 2005 mean annual streamflow computed at Climax, 240 ft^3/s, was a record, higher than the previous record of 231 ft^3/s computed for the 1999 water year. Record monthly streamflows at the Climax station were computed for June and August. High flows that occurred June 4 and August 25 at the Climax station were a result of intense localized precipitation (over 6 in. rain recorded at the Climax station June 3 and June 4 and over 7 in. recorded August 24 and August 25). The Climax station has been in continuous operation since August 1946.

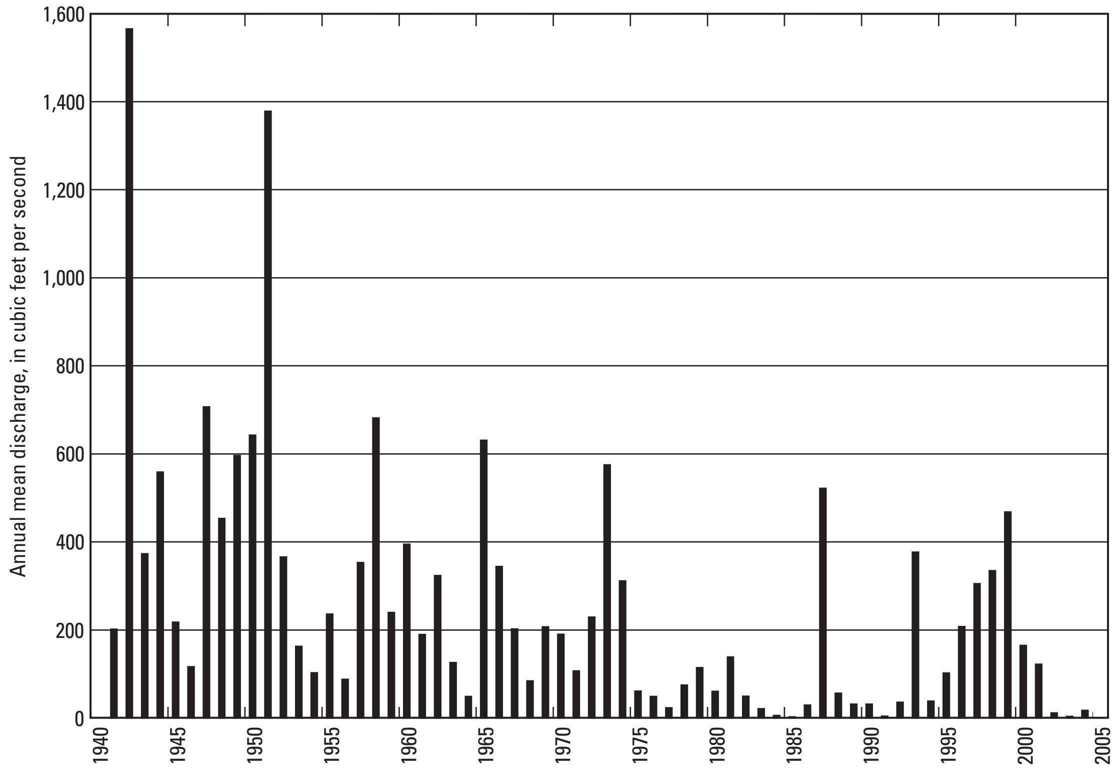


Figure 9. Annual mean streamflow for Arkansas River at Great Bend, Kansas, water years 1941-2005.

Streamflow-gaging station on South Fork Solomon River at Osborne. Photograph courtesy of C.A. Dare.

Intense precipitation in early October 2005 (2006 water year) resulted in record streamflows in Stranger Creek and Soldier Creek. Preliminary information indicated 100-year recurrence interval streamflows for Soldier Creek near Delia (station 06889200, fig. 1), Soldier Creek at Topeka (station 06889500, fig. 1), and Stranger Creek near Tonganoxie (station 06892000, fig. 1).

Water levels in all Federal reservoirs in the State were at or above conservation-pool or irrigation-pool elevation by the end of the 2005 water year. No historic low or high elevations were recorded at the Federal reservoirs in the 2005 water year.

Data from the surface-water network, as well as information about selected stations, are available on the World Wide Web at:

http://ks.water.usgs.gov/

Table 3. Number of days of streamflow less than Kansas minimum desirable streamflow for 2004 water year and 2005 water year at selected streamflow-gaging stations.

Station identification number and name		Number of days less than Kansas minimum desirable streamflow, March to September	
		2004 water year	2005 water year
06856000	Republican River at Concordia	90	176
06856600	Republican River at Clay Center	99	165
06864500	Smoky Hill River at Ellsworth	56	121
06876900	Solomon River at Niles	55	49
06878000	Chapman Creek near Chapman	91	65
06890100	Delaware River near Muscotah	80	64
07140000	Arkansas River near Kinsley	214	214
07141300	Arkansas River at Great Bend	145	214
07142300	Rattlesnake Creek near Macksville	214	197

Streamflow-gaging station on Wakarusa River near Richland (station 06891260, fig. 1). Photograph courtesy of J.R. Barnard.

Surface-Water Quality

Surface-water-quality data contained in this report include continuous records of specific conductance, pH, water temperature, dissolved oxygen, and turbidity collected at 15 stations (fig. 2) and water-quality records collected at 2 precipitation stations (pages 623-629).

Continuous water-quality records include records of turbidity. Two tables of turbidity data, collected using different sensors, are included with some stations. The USGS has adopted a reporting system that denotes the type of instrument design and configuration. Specific parameter codes have been established for each make and model of turbidity sensor used for data collection. Use of manufacturer name does not constitute endorsement by the USGS. For more information, see definition of turbidity in definition of terms at *http://water.usgs.gov/ADR_Defs_2005.pdf* or other information at *http://water.usgs.gov/owq/FieldManual/Chapter6/6.7_contents.html* and *http://water.usgs.gov/pubs/circ/2003/circ1250*.

Conversion of degrees Celsius to degrees Fahrenheit is shown in table 4, and factors for conversion of chemical constituents in milligrams or micrograms per liter to milliequivalents per liter are shown in table 5.

Table 4. Conversion of degrees Celsius (°C) to degrees Fahrenheit (°F)[1].

[Temperature reported to nearest 0.5 °C]

°C	°F	°C	°F	°C	°F	°C	°F	°C	°F
0.0	32	10.0	50	20.0	68	30.0	86	40.0	104
0.5	33	10.5	51	20.5	69	30.5	87	40.5	105
1.0	34	11.0	52	21.0	70	31.0	88	41.0	106
1.5	35	11.5	53	21.5	71	31.5	89	41.5	107
2.0	36	12.0	54	22.0	72	32.0	90	42.0	108
2.5	36	12.5	54	22.5	72	32.5	90	42.5	108
3.0	37	13.0	55	23.0	73	33.0	91	43.0	109
3.5	38	13.5	56	23.5	74	33.5	92	43.5	110
4.0	39	14.0	57	24.0	75	34.0	93	44.0	111
4.5	40	14.5	58	24.5	76	34.5	94	44.5	112
5.0	41	15.0	59	25.0	77	35.0	95	45.0	113
5.5	42	15.5	60	25.5	78	35.5	96	45.5	114
6.0	43	16.0	61	26.0	79	36.0	97	46.0	115
6.5	44	16.5	62	26.5	80	36.5	98	46.5	116
7.0	45	17.0	63	27.0	81	37.0	99	47.0	117
7.5	45	17.5	63	27.5	81	37.5	99	47.5	117
8.0	46	18.0	64	28.0	82	38.0	100	48.0	118
8.5	47	18.5	65	28.5	83	38.5	101	48.5	119
9.0	48	19.0	66	29.0	84	39.0	102	49.0	120
9.5	49	19.5	67	29.5	85	39.5	103	49.5	121

[1]°C = 5/9 (°F - 32) or °F = 9/5 (°C) + 32.

Table 5. Factors for conversion of chemical constituents in milligrams or micrograms per liter to milliequivalents per liter.

Ion	Multiply by	Ion	Multiply by
Ammonia (NH_4^{+1})	0.05544	Nitrate (NO_3^{-1})	0.01613
Calcium (Ca^{+2})	.04990	Phosphate (PO_4^{-3})	.03159
Carbonate (CO_3^{-2})	.03333	Potassium (K^{+1})	.02557
Chloride (Cl^{-2})	.02821	Sodium (Na^{+1})	.04350
Hydrogen (H^{+1})	.99209	Sulfate (SO_4^{-2})	.02082
Magnesium (Mg^{+2})	.08226		

NOTE:Nitrate (N) x 4.427 = Nitrate (NO_3)
Phosphorus (P) x 3.066 = Phosphate (PO_4)

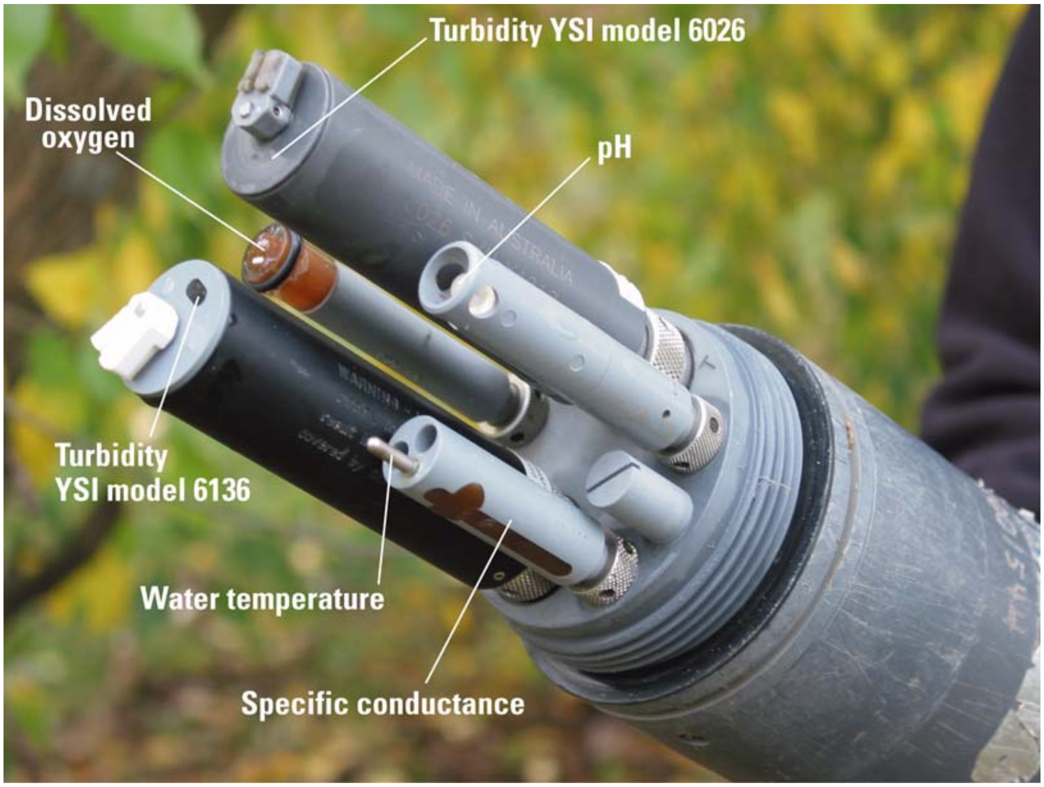
Included in this report are water-quality data recorded at 15 complete-record water-quality monitoring stations--Kansas River at Wamego (see pages 161-178), Kansas River at Topeka (see pages 187-204), Kansas River at DeSoto (see pages 231-248), Kill Creek at 95th Street near DeSoto (see pages 251-265), Cedar Creek at Highway 56 at Olathe (see pages 268-273), Olathe Lake near Olathe (see pages 276-290), Cedar Creek near DeSoto (see pages 293-307), Mill Creek at Johnson Drive, Shawnee (see pages 310-324), Blue River at Kenneth Road, Overland Park (see pages 329-343), Indian Creek at State Line Road, Leawood (see pages 348-362), Arkansas River near Coolidge (see pages 402-407), Little Arkansas River at Highway 50 near Halstead (see pages 460-477), Little Arkansas River near Sedgwick (see pages 480-497), North Fork Ninnescah River above Cheney Reservoir (see pages 510-524), and Cheney Reservoir near Cheney (see pages 527-544). Complete records of specific conductance, pH, water temperature, dissolved oxygen, and turbidity are published except for the station on the Arkansas River near Coolidge where only specific conductance and water temperature data were collected during the 2005 water year. Maximum, minimum, and mean values for each sensor are published for these stations. The median daily value is published for pH because mean daily pH has been found to bias the results toward lower pH. Data for days when water-quality sensors were fouled by debris or accumulation of deposits are not published. If enough data were available, a mean daily value is estimated. Kansas water-quality standards established by the Kansas Department of Health and Environment (KDHE, 2005) have been established for pH (not less than 6.5 and not greater than 9.0 standard units) and for dissolved oxygen (not less than 5 mg/L). Table 6 shows days when the median daily pH or daily mean dissolved oxygen exceeded these standards. Data for water-quality stations, as well as information about surface-water stations, and estimated concentrations of sediment, bacteria, and other constituents are available on the World Wide Web at:

http://ks.water.usgs.gov/Kansas/rtqw

Table 6. Days when median daily pH and mean daily dissolved oxygen exceeded Kansas water-quality standards at selected streamflow-gaging stations, 2005 water year.

[mg/L, milligrams per liter]

Station identification number and name		Median daily pH greater than or equal to 9.0 or less than 6.5 standard units	Mean daily dissolved oxygen less than or equal to 5.0 mg/L
06887500	Kansas River at Wamego	Mar. 6, 7, 12, 17	none
06889000	Kansas River at Topeka	Oct. 5	June 5, 6
06892350	Kansas River at DeSoto	none	none
06892360	Kill Creek at 95th Street near DeSoto	none	Oct. 30, 31, Nov. 1, July 19, 27, Aug. 9, 10
06892440	Cedar Creek at Highway 56 at Olathe	none	Oct. 21-23
06892450	Olathe Lake near Olathe	none	Aug. 14, 26-29, Sept. 7, 16
06892495	Cedar Creek near DeSoto	none	July 21-24, 26, 29-31, Aug. 1-4
06892513	Mill Creek at Johnson Drive, Shawnee	none	Apr. 21, 22, July 30
06893100	Blue River at Kenneth Road, Overland Park	none	July 13-29, Aug. 2-13
06893390	Indian Creek at State Line Road, Leawood	none	June 28, July 26, Sept. 13
07143672	Little Arkansas River at Highway 50 near Halstead	none	May 14-16, June 14, 18
07144100	Little Arkansas River near Sedgwick	none	May 14-16, June 13, 14, 18, 19
07144780	North Fork Ninnescah River above Cheney Reservoir	none	none
07144790	Cheney Reservoir near Cheney	none	none



Sensors used to make in-stream measurements of water quality. Photograph courtesy of T.J. Rasmussen.

Deploying water-quality sensor at Kansas River near DeSoto (station 06892350, fig. 1). Photograph courtesy of L.C. Millikan.

Ground Water

A map indicating the number of monitored ground-water wells in Kansas is shown in figure 10. Ground-water levels in Harvey County and Douglas County observation wells did not change substantially during the 2005 water year (fig. 11). The ground-water elevation at the Thomas County well (fig. 11) recorded in September 2005 was about 0.4 ft below that recorded in September 2004 and a new record low. Lack of significant precipitation and continual drought conditions in northwest Kansas during the previous water year and prior to the September 2005 measurement and the effects of regional ground-water pumpage, which has been occurring since the 1960s, contributed to the decrease in water level. Ground-water elevations are published for wells in the *Equus* Beds Ground Water Recharge Demonstration Project in Wichita and are shown beginning on page 616. Data for the project, as well as information about selected surface-water stations, are available on the World Wide Web at:

http://ks.water.usgs.gov/Kansas/studies/equus

Ground-water levels for all monitored wells in Kansas are available on the World Wide Web at:

http://waterdata.usgs.gov/ks/nwis/gw

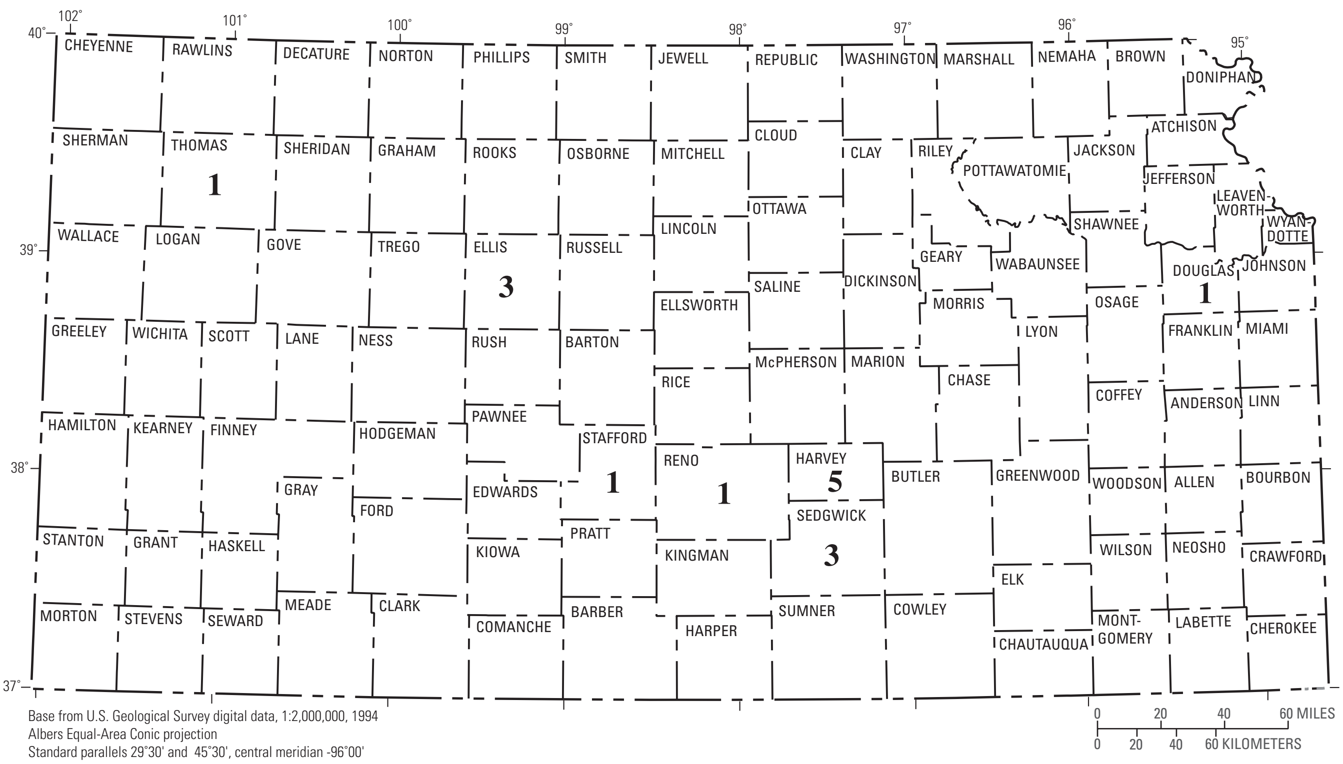


Figure 10. Number of ground-water-level observation wells per county, 2005 water year.

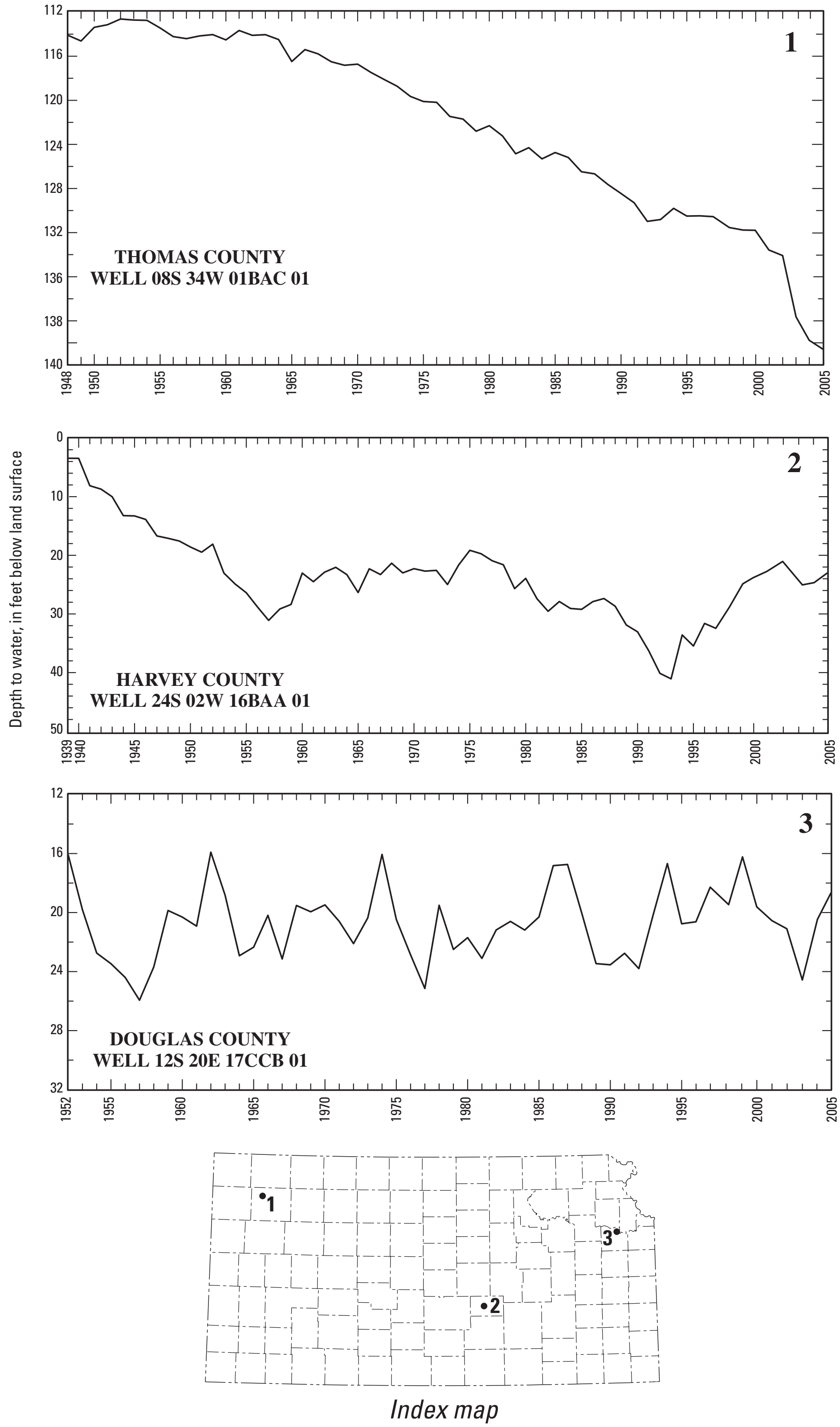


Figure 11. Water levels in selected water-level observation wells.

Real-time ground-water-level monitor at Stafford County well at 21S-13W-27DDDC01. Photograph courtesy of R.W. Gauger.

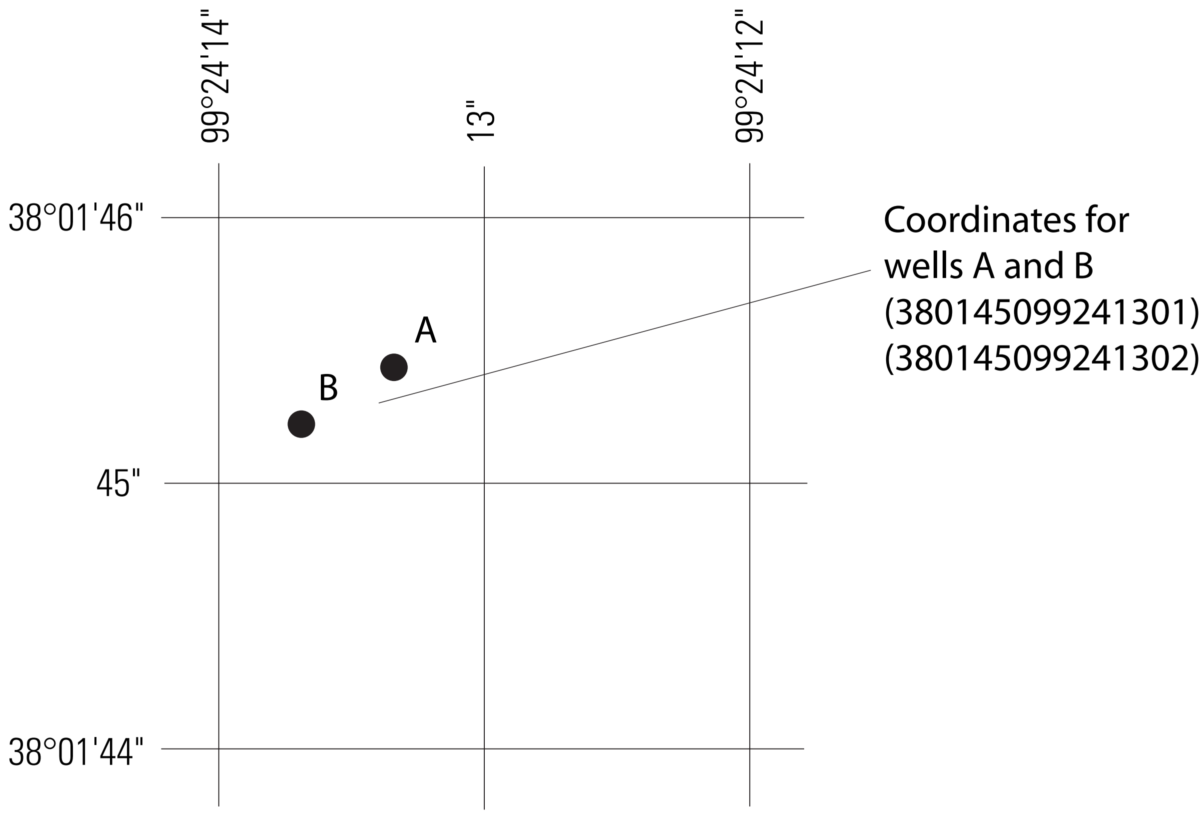
DOWNSTREAM ORDER AND STATION NUMBER

Since October 1, 1950, hydrologic-station records in USGS reports have been listed in order of downstream direction along the main stream. All stations on a tributary entering upstream from a main-stream station are listed before that station. A station on a tributary entering between two main-stream stations is listed between those stations. A similar order is followed in listing stations on first rank, second rank, and other ranks of tributaries. The rank of any tributary on which a station is located with respect to the stream to which it is immediately tributary is indicated by an indention in that list of stations in the front of this report. Each indentation represents one rank. This downstream order and system of indentation indicates which stations are on tributaries between any two stations and the rank of the tributary on which each station is located.

As an added means of identification, each hydrologic station and partial-record station has been assigned a station number. These station numbers are in the same downstream order used in this report. In assigning a station number, no distinction is made between partial-record stations and other stations; therefore, the station number for a partial-record station indicates downstream-order position in a list composed of both types of stations. Gaps are consecutive. The complete 8-digit (or 10-digit) number for each station such as 09004100, which appears just to the left of the station name, includes a 2-digit part number “09” plus the 6-digit (or 8-digit) downstream order number “004100.” In areas of high station density, an additional two digits may be added to the station identification number to yield a 10-digit number. The stations are numbered in downstream order as described above between stations of consecutive 8-digit numbers.

NUMBERING SYSTEM FOR WELLS AND MISCELLANEOUS SITES

The USGS well and miscellaneous site-numbering system is based on the grid system of latitude and longitude. The system provides the geographic location of the well or miscellaneous site and a unique number for each site. The number consists of 15 digits. The first 6 digits denote the degrees, minutes, and seconds of latitude, and the next 7 digits denote degrees, minutes, and seconds of longitude; the last 2 digits are a sequential number for wells within a 1-second grid. In the event that the latitude-longitude coordinates for a well and miscellaneous site are the same, a sequential number such as “01,” “02,” and so forth, would be assigned as one would for wells (see figure below). The 8-digit, downstream order station numbers are not assigned to wells and miscellaneous sites where only random water-quality samples are collected or discharge measurements are made.



SPECIAL NETWORKS AND PROGRAMS

Hydrologic Benchmark Network is a network of 61 sites in small drainage basins in 39 States that was established in 1963 to provide consistent streamflow data representative of undeveloped watersheds nationwide, and from which data could be analyzed on a continuing basis for use in comparison and contrast with conditions observed in basins more obviously affected by human activities. At selected sites, water-quality information is being gathered on major ions and nutrients, primarily to assess the effects of acid deposition on stream chemistry. Additional information on the Hydrologic Benchmark Program may be accessed from http://ny.cf.er.usgs.gov/hbn/.

National Stream-Quality Accounting Network (NASQAN) is a network of sites used to monitor the water quality of large rivers within the Nation's largest river basins. From 1995 through 1999, a network of approximately 40 stations was operated in the Mississippi, Columbia, Colorado, and Rio Grande River Basins. For the period 2000 through 2004, sampling was reduced to a few index stations on the Colorado and Columbia Rivers so that a network of five stations could be implemented on the Yukon River. Samples are collected with sufficient frequency that the flux of a wide range of constituents can be estimated. The objective of NASQAN is to characterize the water quality of these large rivers by measuring concentration and mass transport of a wide range of dissolved and suspended constituents, including nutrients, major ions, dissolved and sediment-bound heavy metals, common pesticides, and inorganic and organic forms of carbon. This information will be used (1) to describe the long-term trends and changes in concentration and transport of these constituents; (2) to test findings of the National Water-Quality Assessment (NAWQA) Program; (3) to characterize processes unique to large-river systems such as storage and re-mobilization of sediments and associated contaminants; and (4) to refine existing estimates of off-continent transport of water, sediment, and chemicals for assessing human effects on the world's oceans and for determining global cycles of carbon, nutrients, and other chemicals. Additional information about the NASQAN Program may be accessed from *http://water.usgs.gov/nasqan/*.

The National Atmospheric Deposition Program/National Trends Network (NADP/NTN) is a network of monitoring sites that provides continuous measurement and assessment of the chemical constituents in precipitation throughout the United States. As the lead Federal agency, the USGS works together with over 100 organizations to provide a long-term, spatial and temporal record of atmospheric deposition generated from this network of 250 precipitation-chemistry monitoring sites. The USGS supports 74 of these 250 sites. This long-term, nationally consistent monitoring program, coupled with ecosystem research, provides critical information toward a national scorecard to evaluate the effectiveness of ongoing and future regulations intended to reduce atmospheric emissions and subsequent impacts to the Nation's land and water resources. Reports and other information on the NADP/NTN Program, as well as data from the individual sites, may be accessed from *http://bqs.usgs.gov/acidrain/*.

The USGS National Water-Quality Assessment (NAWQA) Program is a long-term program with goals to describe the status and trends of water-quality conditions for a large, representative part of the Nation's ground- and surface-water resources; to provide an improved understanding of the primary natural and human factors affecting these observed conditions and trends; and to provide information that supports development and evaluation of management, regulatory, and monitoring decisions by other agencies.

Assessment activities are being conducted in 42 study units (major watersheds and aquifer systems) that represent a wide range of environmental settings nationwide and that account for a large percentage of the Nation's water use. A wide array of chemical constituents is measured in ground water, surface water, streambed sediments, and fish tissues. The coordinated application of comparative hydrologic studies at a wide range of spatial and temporal scales will provide information for water-resources managers to use in making decisions and a foundation for aggregation and comparison of findings to address water-quality issues of regional and national interest.

Communication and coordination between USGS personnel and other local, State, and Federal interests are critical components of the NAWQA Program. Each study unit has a local liaison committee consisting of representatives from key Federal, State, and local water-resources agencies, Indian nations, and universities in the study unit. Liaison committees typically meet semiannually to discuss their information needs, monitoring plans and progress, desired information products, and opportunities for collaboration among the agencies. Additional information about the NAWQA Program may be accessed from *http://water.usgs.gov/nawqa/*.

The USGS National Streamflow Information Program (NSIP) is a long-term program with goals to provide framework streamflow data across the Nation. Included in the program are creation of a permanent Federally funded streamflow network, research on the nature of streamflow, regional assessments of streamflow data and databases, and upgrades in the streamflow information delivery systems. Additional information about NSIP may be accessed from *http://water.usgs.gov/nsip/*.

EXPLANATION OF STAGE- AND WATER-DISCHARGE RECORDS

Data Collection and Computation

The base data collected at gaging stations (fig.1) consist of records of stage and measurements of discharge of streams or canals, and stage, surface area, and volume of lakes or reservoirs. In addition, observations of factors affecting the stage-discharge relation or the stage-capacity relation, weather records, and other information are used to supplement base data in determining the daily flow or volume of water in storage. Records of stage are obtained from a water-stage recorder that either is downloaded electronically in the field to a laptop computer or similar device or is transmitted using telemetry such as GOES satellite, land-line or cellular-phone modems, or by radio transmission. Measurements of discharge are made with a current meter or acoustic Doppler current profiler, using the general methods adopted by the USGS. These methods are described in standard textbooks, USGS Water-Supply Paper 2175, and the Techniques of Water-Resources Investigations of the United States Geological Survey (TWRIs), Book 3, Chapters A1 through A19 and Book 8, Chapters A2 and B2, which may be accessed from *http://water.usgs.gov/pubs/twri/*. The methods are consistent with the American Society for Testing and Materials (ASTM) standards and generally follow the standards of the International Organization for Standardization (ISO).

For stream-gaging stations, discharge-rating tables for any stage are prepared from stage-discharge curves. If extensions to the rating curves are necessary to express discharge greater than measured, the extensions are made on the basis of indirect measurements of peak discharge (such as slope-area or contracted-opening measurements, or computation of flow over dams and weirs), step-backwater techniques, velocity-area studies, and logarithmic plotting. The daily mean discharge is computed from gage heights and rating tables, then the monthly and yearly mean discharges are computed from the daily values. If the stage-discharge relation is subject to change because of frequent or continual change in the physical features of the stream channel, the daily mean discharge is computed by the shifting-control method in which correction factors that are based on individual discharge measurements and notes by engineers and observers are used when applying the gage heights to the rating tables. If the stage-discharge relation for a station is temporarily changed by the presence of aquatic growth or debris on the controlling section, the daily mean discharge is computed by the shifting-control method.

The stage-discharge relation at some stream-gaging stations is affected by backwater from reservoirs, tributary streams, or other sources. Such an occurrence necessitates the use of the slope method in which the slope or fall in a reach of the stream is a factor in computing discharge. The slope or fall is obtained by means of an auxiliary gage at some distance from the base gage.

An index velocity is measured using ultrasonic or acoustic instruments at some stream-gaging stations, and this index velocity is used to calculate an average velocity for the flow in the stream. This average velocity along with a stage-area relation then is used to calculate average discharge.

At some stations, the stage-discharge relation is affected by changing stage. At these stations, the rate of change in stage is used as a factor in computing discharge.

At some streamgaging stations in the northern United States, the stage-discharge relation is affected by ice in the winter; therefore, computation of the discharge in the usual manner is impossible. Discharge for periods of ice effect is computed on the basis of gage-height record and occasional winter-discharge measurements. Consideration is given to the available information on temperature and precipitation, notes by gage observers and hydrologists, and comparable records of discharge from other stations in the same or nearby basins.

For a lake or reservoir station, capacity tables giving the volume or contents for any stage are prepared from stage-area relation curves defined by surveys. The application of the stage to the capacity table gives the contents, from which the daily, monthly, or yearly changes are computed.

If the stage-capacity curve is subject to changes because of deposition of sediment in the reservoir, periodic resurveys of the reservoir are necessary to define new stage-capacity curves. During the period between reservoir surveys, the computed contents may be increasingly in error due to the gradual accumulation of sediment.

For some streamgaging stations, periods of time occur when no gage-height record is obtained or the recorded gage height is faulty and cannot be used to compute daily discharge or contents. Such a situation can happen when the recorder stops or otherwise fails to operate properly, the intakes are plugged, the float is frozen in the well, or for various other reasons. For such periods, the daily discharges are estimated on the basis of recorded range in stage, prior and subsequent records, discharge measurements, weather records, and comparison with records from other stations in the same or nearby basins. Likewise, lake or reservoir volumes may be estimated on the basis of operator's log, prior and subsequent records, inflow-outflow studies, and other information.

Data Presentation

The records published for each continuous-record surface-water discharge station (stream-gaging station) consist of five parts: (1) the station manuscript or description; (2) the data table of daily mean values of discharge for the current water year with summary data; (3) a tabular statistical summary of monthly mean flow data for a designated period, by water year; (4) a summary statistics table that includes statistical data of annual, daily, and instantaneous flows as well as data pertaining to annual runoff, 7-day low-flow minimums, and flow duration; and (5) a hydrograph of discharge.

Station Manuscript

The manuscript provides, under various headings, descriptive information, such as station location; period of record; historical extremes outside the period of record; record accuracy; and other remarks pertinent to station operation and regulation. The following information, as appropriate, is provided with each continuous record of discharge or lake content. Comments follow that clarify information presented under the various headings of the station description.

LOCATION.—Location information is obtained from the most accurate maps available. The location of the gaging station with respect to the cultural and physical features in the vicinity and with respect to the reference place mentioned in the station name is given. River mileages, given for only a few stations, were determined by methods given in "River Mileage Measurement," Bulletin 14, Revision of October 1968, prepared by the Water Resources Council or were provided by the U.S. Army Corps of Engineers.

DRAINAGE AREA.—Drainage areas are measured using the most accurate maps available. Because the type of maps available varies from one drainage basin to another, the accuracy of drainage areas likewise varies. Drainage areas are updated as better maps become available.

PERIOD OF RECORD.—This term indicates the time period for which records have been published for the station or for an equivalent station. An equivalent station is one that was in operation at a time that the present station was not and whose location was such that its flow reasonably can be considered equivalent to flow at the present station.

REVISED RECORDS.—If a critical error in published records is discovered, a revision is included in the first report published following discovery of the error.

GAGE.—The type of gage in current use, the datum of the current gage referred to a standard datum, and a condensed history of the types, locations, and datums of previous gages are given under this heading.

REMARKS.—All periods of estimated daily discharge either will be identified by date in this paragraph of the station description for water-discharge stations or flagged in the daily discharge table. (See section titled Identifying Estimated Daily Discharge.) Information is presented relative to the accuracy of the records, to special methods of computation, and to conditions that affect natural flow at the station. In addition, information may be presented pertaining to average discharge data for the period of record; to extremes data for the period of record and the current year; and, possibly, to other pertinent items. For reservoir stations, information is given on the dam forming the reservoir, the capacity, the outlet works and spillway, and the purpose and use of the reservoir.

COOPERATION.—Records provided by a cooperating organization or obtained for the USGS by a cooperating organization are identified here.

EXTREMES OUTSIDE PERIOD OF RECORD.—Information here documents major floods or unusually low flows that occurred outside the stated period of record. The information may or may not have been obtained by the USGS.

REVISIONS.—Records are revised if errors in published records are discovered. Appropriate updates are made in the USGS distributed data system, NWIS, and subsequently to its Web-based national data system, NWISWeb (*http://water.usgs.gov/nwis/nwis*). Users are encouraged to obtain all required data from NWIS or NWISWeb to ensure that they have the most recent data updates. Updates to NWISWeb are made on an annual basis.

Although rare, occasionally the records of a discontinued gaging station may need revision. Because no current or, possibly, future station manuscript would be published for these stations to document the revision in a REVISED RECORDS entry, users of data for these stations who obtained the record from previously published data reports may wish to contact the USGS Water Science Center (address given on the back of the title page of this report) to determine if the published records were revised after the station was discontinued. If, however, the data for a discontinued station were obtained by computer retrieval, the data would be current. Any published revision of data is always accompanied by revision of the corresponding data in computer storage.

Manuscript information for lake or reservoir stations differs from that for stream stations in the nature of the REMARKS and in the inclusion of a stage-capacity table when daily volumes are given.

Peak Discharge Greater than Base Discharge

Tables of peak discharge above base discharge are included for some stations where secondary instantaneous peak discharge data are used in flood-frequency studies of highway and bridge design, flood-control structures, and other flood-related projects. The base discharge value is selected so an average of three peaks a year will be reported. This base discharge value has a recurrence interval of approximately 1.1 years or a 91-percent chance of exceedence in any 1 year.

Data Table of Daily Mean Values

The daily table of discharge records for streamgaging stations gives mean discharge for each day of the water year. In the monthly summary for the table, the line headed TOTAL gives the sum of the daily figures for each month; the line headed MEAN gives the arithmetic average flow in cubic feet per second for the month; and the lines headed MAX and MIN give the maximum and minimum daily mean discharges, respectively, for each month. Discharge for the month is expressed in cubic feet per second per square mile (line headed CFSM); or in inches (line headed IN); or in acre-feet (line headed AC-FT). Values for cubic feet per second per square mile and runoff in inches or in acre-feet may be omitted if extensive regulation or diversion is in effect or if the drainage area includes large noncontributing areas. At some stations, monthly and (or) yearly observed discharges are adjusted for reservoir storage or diversion, or diversion data or reservoir volumes are given. These values are identified by a symbol and a corresponding footnote.

Statistics of Monthly Mean Data

A tabular summary of the mean (line headed MEAN), maximum (MAX), and minimum (MIN) of monthly mean flows for each month for a designated period is provided below the mean values table. The water years of the first occurrence of the maximum and minimum monthly flows are provided immediately below those values. The designated period will be expressed as FOR WATER YEARS __-__, BY WATER YEAR (WY), and will list the first and last water years of the range of years selected from the PERIOD OF RECORD paragraph in the station manuscript. The designated period will consist of all of the station record within the specified water years, including complete months of record for partial water years, and may coincide with the period of record for the station. The water years for which the statistics are computed are consecutive, unless a break in the station record is indicated in the manuscript.

Summary Statistics

A table titled SUMMARY STATISTICS follows the statistics of monthly mean data tabulation. This table consists of four columns with the first column containing the line headings of the statistics being reported. The table provides a statistical summary of yearly, daily, and instantaneous flows, not only for the current water year but also for the previous calendar year and for a designated period, as appropriate. The designated period selected, WATER YEARS __-__, will consist of all of the station records within the specified water years, including complete months of record for partial water years, and may coincide with the period of record for the station. The water years for which the statistics are computed are consecutive, unless a break in the station record is indicated in the manuscript. All of the calculations for the statistical characteristics designated ANNUAL (see line headings below), except for the ANNUAL 7-DAY MINIMUM statistic, are calculated for the designated period using complete water years. The other statistical characteristics may be calculated using partial water years.

The date or water year, as appropriate, of the first occurrence of each statistic reporting extreme values of discharge is provided adjacent to the statistic. Repeated occurrences may be noted in the REMARKS paragraph of the manuscript or in footnotes. Because the designated period may not be the same as the station period of record published in the manuscript, occasionally the dates of occurrence listed for the daily and instantaneous extremes in the designated-period column may not be within the selected water years listed in the heading. When the dates of occurrence do not fall within the selected water years listed in the heading, it will be noted in the REMARKS paragraph or in footnotes. Selected streamflow duration-curve statistics and runoff data also are given. Runoff data may be omitted if extensive regulation or diversion of flow is in effect in the drainage basin.

The following summary statistics data are provided with each continuous record of discharge. Comments that follow clarify information presented under the various line headings of the SUMMARY STATISTICS table.

ANNUAL TOTAL.—The sum of the daily mean values of discharge for the year.

ANNUAL MEAN.—The arithmetic mean for the individual daily mean discharges for the year noted or for the designated period.

HIGHEST ANNUAL MEAN.—The maximum annual mean discharge occurring for the designated period.

LOWEST ANNUAL MEAN.—The minimum annual mean discharge occurring for the designated period.

HIGHEST DAILY MEAN.—The maximum daily mean discharge for the year or for the designated period.

LOWEST DAILY MEAN.—The minimum daily mean discharge for the year or for the designated period.

ANNUAL 7-DAY MINIMUM.—The lowest mean discharge for 7 consecutive days for a calendar year or a water year. Note that most low-flow frequency analyses of annual 7-day minimum flows use a climatic year (April 1-March 31). The date shown in the summary statistics table is the initial date of the 7-day period. This value should not be confused with the 7-day, 10-year low-flow statistic.

MAXIMUM PEAK FLOW.—The maximum instantaneous peak discharge occurring for the water year or designated period. Occasionally the maximum flow for a year may occur at midnight at the beginning or end of the year, on a recession from or rise toward a higher peak in the adjoining year. In this case, the maximum peak flow is given in the table and the maximum flow may be reported in a footnote or in the REMARKS paragraph in the manuscript.

MAXIMUM PEAK STAGE.—The maximum instantaneous peak stage occurring for the water year or designated period. Occasionally the maximum stage for a year may occur at midnight at the beginning or end of the year, on a recession from or rise toward a higher peak in the adjoining year. In this case, the maximum peak stage is given in the table and the maximum stage may be reported in the REMARKS paragraph in the manuscript or in a footnote. If the dates of occurrence of the maximum peak stage and maximum peak flow are different, the REMARKS paragraph in the manuscript or a footnote may be used to provide further information.

INSTANTANEOUS LOW FLOW.—The minimum instantaneous discharge occurring for the water year or for the designated period.

ANNUAL RUNOFF.—Indicates the total quantity of water in runoff for a drainage area for the year. Data reports may use any of the following units of measurement in presenting annual runoff data:

> Acre-foot (AC-FT) is the quantity of water required to cover 1 acre to a depth of 1 foot and is equivalent to 43,560 cubic feet (ft^3) or about 326,000 gallons (gal) or 1,233 cubic meters (m^3).
>
> Cubic feet per square mile (CFSM) is the average number of cubic feet of water flowing per second from each square mile of area drained, assuming the runoff is distributed uniformly in time and area.
>
> Inches (INCHES) indicate the depth to which the drainage area would be covered if all of the runoff for a given time period were uniformly distributed on it.

10 PERCENT EXCEEDS.—The discharge that has been exceeded 10 percent of the time for the designated period.

50 PERCENT EXCEEDS.—The discharge that has been exceeded 50 percent of the time for the designated period.

90 PERCENT EXCEEDS.—The discharge that has been exceeded 90 percent of the time for the designated period.

Data collected at partial-record stations follow the information for continuous-record sites. Data for partial-record discharge stations are presented in two tables. The first table lists annual maximum stage and discharge at crest-stage stations, and the second table lists discharge measurements at low-flow partial-record stations. The tables of partial-record stations are followed by a listing of discharge measurements made at sites other than continuous-record or partial-record stations. These measurements often are made in times of drought or flood to give better areal coverage to those events. Those measurements and others collected for a special reason are called measurements at miscellaneous sites.

Identifying Estimated Daily Discharge

Estimated daily-discharge values published in the water-discharge tables of annual State data reports are identified. This identification is shown either by flagging individual daily values with the letter “e” and noting in a table footnote, “e–Estimated,” or by listing the dates of the estimated record in the REMARKS paragraph of the station description.

Accuracy of Field Data and Computed Results

The accuracy of streamflow data depends primarily on (1) the stability of the stage-discharge relation or, if the control is unstable, the frequency of discharge measurements, and (2) the accuracy of observations of stage, measurements of discharge, and interpretations of records.

The degree of accuracy of the records is stated in the REMARKS in the station description. “Excellent” indicates that about 95 percent of the daily discharges are within 5 percent of the true value; “good” within 10 percent; and “fair,” within 15 percent. “Poor” indicates that daily discharges have less than “fair” accuracy. Different accuracies may be attributed to different parts of a given record.

Values of daily mean discharge in this report are shown to the nearest hundredth of a cubic foot per second for discharges of less than 1 ft^3/s; to the nearest tenths between 1.0 and 10 ft^3/s; to whole numbers between 10 and 1,000 ft^3/s; and to three significant figures above 1,000 ft^3/s. The number of significant figures used is based solely on the magnitude of the discharge value. The same rounding rules apply to discharge values listed for partial-record stations.

Discharge at many stations, as indicated by the monthly mean, may not reflect natural runoff due to the effects of diversion, consumption, regulation by storage, increase or decrease in evaporation due to artificial causes, or to other factors. For such stations, values of cubic feet per second per square mile and of runoff in inches are not published unless satisfactory adjustments can be made for diversions, for changes in contents of reservoirs, or for other changes incident to use and control. Evaporation from a reservoir is not included in the adjustments for changes in reservoir contents, unless it is so stated. Even at those stations where adjustments are made, large errors in computed runoff may occur if adjustments or losses are large in comparison with the observed discharge.

Other Data Records Available

Information of a more detailed nature than that published for most of the stream-gaging stations such as discharge measurements, gage-height records, and rating tables is available from the USGS Water Science Center. Also, most streamgaging station records are available in computer-usable form and many statistical analyses have been made.

Information on the availability of unpublished data or statistical analyses may be obtained from the USGS Water Science Center (see address that is shown on the back of the title page of this report).

EXPLANATION OF PRECIPITATION RECORDS

Data Collection and Computation

Rainfall data generally are collected using electronic data loggers that measure the rainfall in 0.01-in. increments every 15 minutes using either a tipping-bucket rain gage or a collection well gage. Twenty-four hour rainfall totals are tabulated and presented. A 24-hour period extends from just past midnight of the previous day to midnight of the current day. Snowfall-affected data can result during cold weather when snow fills the rain-gage funnel and then melts as temperatures rise. Snowfall-affected data are subject to errors. Missing values are indicated by this symbol “---” in the table.

Data Presentation

Precipitation records collected at surface-water gaging stations are identified with the same station number and name as the streamgaging station. Where a surface-water daily-record station is not available, the precipitation record is published with its own name and latitude-longitude identification number.

Information pertinent to the history of a precipitation station is provided in descriptive headings preceding the tabular data. These descriptive headings give details regarding location, period of record, and general remarks.

The following information is provided with each precipitation station. Comments that follow clarify information presented under the various headings of the station description.

LOCATION.—See Data Presentation in the EXPLANATION OF STAGE- AND WATER-DISCHARGE RECORDS section of this report (same comments apply).

PERIOD OF RECORD.—See Data Presentation in the EXPLANATION OF STAGE- AND WATER-DISCHARGE RECORDS section of this report (same comments apply).

INSTRUMENTATION.—Information on the type of rainfall collection system is given.

REMARKS.—Remarks provide added information pertinent to the collection, analysis, or computation of records.

EXPLANATION OF WATER-QUALITY RECORDS

Collection and Examination of Data

Surface-water samples for analysis usually are collected at or near streamgaging stations. The quality-of-water records are given immediately following the discharge records at these stations.

The descriptive heading for water-quality records gives the period of record for all water-quality data; the period of daily record for parameters that are measured on a daily basis (specific conductance, water temperature, sediment discharge, and so forth); extremes for the current year; and general remarks.

For ground-water records, no descriptive statements are given; however, the well number, depth of well, sampling date, or other pertinent data are given in the table containing the chemical analyses of the ground water.

Water Analysis

Most of the methods used for collecting and analyzing water samples are described in the TWRIs, which may be accessed from http://water.usgs.gov/pubs/twri/.

One sample can define adequately the water quality at a given time if the mixture of solutes throughout the stream cross section is homogeneous. However, the concentration of solutes at different locations in the cross section may vary considerably with different rates of water discharge, depending on the source of material and the turbulence and mixing of the stream. Some streams must be sampled at several verticals to obtain a representative sample needed for an accurate mean concentration and for use in calculating load.

Chemical-quality data published in this report are considered to be the most representative values available for the stations listed. The values reported represent water-quality conditions at the time of sampling as much as possible, consistent with available sampling techniques and methods of analysis. In the rare case where an apparent inconsistency exists between a reported pH value and the relative abundance of carbon dioxide species (carbonate and bicarbonate), the inconsistency is the result of a slight uptake of carbon dioxide from the air by the sample between measurement of pH in the field and determination of carbonate and bicarbonate in the laboratory.

For chemical-quality stations equipped with digital monitors, the records consist of daily maximum and minimum values (and sometimes mean or median values) for each constituent measured and are based on 15-minute or 1-hour intervals of recorded data beginning at 0000 hours and ending at 2400 hours for the day of record.

SURFACE-WATER-QUALITY RECORDS

Records of surface-water quality ordinarily are obtained at or near streamgaging stations because discharge data are useful in the interpretation of surface-water quality. Records of surface-water quality in this report involve a variety of types of data and measurement frequencies.

Classification of Records

Water-quality data for surface-water sites are grouped into one of three classifications. A *continuous-record station* is a site where data are collected on a regularly scheduled basis. Frequency may be one or more times daily, weekly, monthly, or quarterly. A *partial-record station* is a site where limited water-quality data are collected systematically over a period of years. Frequency of sampling is usually less than quarterly. A *miscellaneous sampling site* is a location other than a continuous- or partial-record station, where samples are collected to give better areal coverage to define water-quality conditions in the river basin.

A careful distinction needs to be made between *continuous records* as used in this report and *continuous recordings* that refer to a continuous graph or a series of discrete values recorded at short intervals. Some records of water quality, such as specific conductance and temperature, may be obtained through continuous recordings; however, because of costs, most data are obtained only monthly or less frequently. Locations of stations for which records on the quality of surface water appear in this report are shown in figure 2.

Accuracy of the Records

One of four accuracy classifications is applied for measured physical properties at continuous-record stations on a scale ranging from poor to excellent. The accuracy rating is based on data values recorded before any shifts or corrections are made. Additional consideration also is given to the amount of publishable record and to the amount of data that have been corrected or shifted.

Rating classifications for continuous water-quality records

[≤, less than or equal to; ±, plus or minus value shown; °C, degree Celsius; >, greater than; %, percent; mg/L, milligram per liter; pH unit, standard pH unit]

	Rating			
Measured physical property	Excellent	Good	Fair	Poor
Specific conductance	≤ ±3%	> ±3 - 10%	> ±10 - 15%	> ±15%
pH	≤ ±0.2 units	> ±0.2 - 0.5 unit	> ±0.5 - 0.8 units	> ±0.8 units
Water temperature	≤ ±0.2 °C	> ±0.2 - 0.5 °C	> ±0.5 - 0.8 °C	> ±0.8 °C
Dissolved oxygen	≤ ±0.3 mg/L or ≤ ±5%, whichever is greater	> ±0.3 - 0.5 mg/L or > ±5 - 10%, whichever is greater	> ±0.5 - 0.8 mg/L or > ±10 - 15%, whichever is greater	> ±0.8 mg/L or > ±15%, whichever is greater
Turbidity	≤ ±0.5 turbidity units or ≤ ±5%, whichever is greater	> ±0.5 - 1.0 turbidity units or > ±5 - 10%, whichever is greater	> ±1.0 - 1.5 turbidity units or > ±10 - 15%, whichever is greater	> ±1.5 turbidity units or > ±15%, whichever is greater

Arrangement of Records

Water-quality records collected at a surface-water daily record station are published immediately following that record, regardless of the frequency of sample collection. Station number and name are the same for both records. Where a surface-water daily record station is not available or where the water quality differs significantly from that at the nearby surface-water station, the continuing water-quality record is published with its own station number and name in the regular downstream-order sequence. Water-quality data for partial-record stations and for miscellaneous sampling sites appear in separate tables following the table of discharge measurements at miscellaneous sites.

Onsite Measurements and Sample Collection

In obtaining water-quality data, a major concern is assuring that the data obtained represent the naturally occurring quality of the water. To ensure this, certain measurements, such as pH, water temperature, and dissolved oxygen, must be made onsite when the samples are collected. To assure that measurements made in the laboratory also represent the naturally occurring water, carefully prescribed procedures must be followed in collecting the samples, in treating the samples to prevent changes in quality pending analysis, and in shipping the samples to the laboratory. Procedures for onsite measurements and for collecting, treating, and shipping samples are given in TWRIs Book 1, Chapter D2; Book 3, Chapters A1, A3, and A4; and Book 9, Chapters A1-A9. Most of the methods used for collecting and analyzing water samples are described in the TWRIs, which may be accessed from *http://water.usgs.gov/pubs/twri/*. Also, detailed information on collecting, treating, and shipping samples can be obtained from the USGS Water Science Center (see address that is shown on the back of title page in this report).

Water Temperature

Water temperatures are measured at most of the water-quality stations. In addition, water temperatures are taken at the time of discharge measurements for water-discharge stations. For stations where water temperatures are taken manually once or twice daily, the water temperatures are taken at about the same time each day. Large streams have a small diurnal temperature change; shallow streams may have a daily range of several degrees and may follow closely the changes in air temperature. Some streams may be affected by waste-heat discharges.

At stations where recording instruments are used, either mean temperatures or maximum and minimum temperatures for each day are published. Water temperatures measured at the time of water-discharge measurements are on file in the USGS Water Science Center.

Sediment

Suspended-sediment concentrations are determined from samples collected by using depth-integrating samplers. Samples usually are obtained at several verticals in the cross section, or a single sample may be obtained at a fixed point and a coefficient applied to determine the mean concentration in the cross section.

During periods of rapidly changing flow or rapidly changing concentration, samples may be collected more frequently (twice daily or, in some instances, hourly). The published sediment discharges for days of rapidly changing flow or concentration are computed by the subdivided-day method (time-discharge weighted average). Therefore, for those days when the published sediment discharge value differs from the value computed as the product of discharge times mean concentration times 0.0027, the reader can assume that the sediment discharge for that day was computed by the subdivided-day method. For periods when no samples were collected, daily discharges of suspended sediment were estimated on the basis of water discharge, sediment concentrations observed immediately before and after the periods, and suspended-sediment loads for other periods of similar discharge.

At other stations, suspended-sediment samples are collected periodically at many verticals in the stream cross section. Although data collected periodically may represent conditions only at the time of observation, such data are useful in establishing seasonal relations between quality and streamflow and in predicting long-term sediment-discharge characteristics of the stream.

In addition to the records of suspended-sediment discharge, records of the periodic measurements of the particle-size distribution of the suspended sediment and bed material are included for some stations.

Laboratory Measurements

Samples for biochemical oxygen demand (BOD) and indicator bacteria are analyzed locally. All other samples are analyzed in the USGS National Water Quality Laboratory in Lakewood, Colorado, unless otherwise noted. Methods used in analyzing sediment samples and computing sediment records are given in TWRI, Book 5, Chapter C1. Methods used by the USGS laboratories are given in the TWRIs, Book 1, Chapter D2; Book 3, Chapter C2; and Book 5, Chapters A1, A3, and A4. The TWRI publications may be accessed from http://water.usgs.gov/pubs/twri/. These methods are consistent with ASTM standards and generally follow ISO standards.

Data Presentation

For continuing-record stations, information pertinent to the history of station operation is provided in descriptive headings preceding the tabular data. These descriptive headings give details regarding location, drainage area, period of record, type of data available, instrumentation, general remarks, cooperation, and extremes for parameters currently measured daily. Tables of chemical, physical, biological, radiochemical data, and so forth, obtained at a frequency less than daily are presented first. Tables of "daily values" of specific conductance, pH, water temperature, dissolved oxygen, turbidity, and suspended sediment then follow in sequence.

In the descriptive headings, if the location is identical to that of the discharge gaging station, neither the LOCATION nor the DRAINAGE AREA statements are repeated. The following information is provided with each continuous-record station. Comments that follow clarify information presented under the various headings of the station description.

LOCATION.—See Data Presentation information in the EXPLANATION OF STAGE- AND WATER-DISCHARGE RECORDS section of this report (same comments apply).

DRAINAGE AREA.—See Data Presentation information in the EXPLANATION OF STAGE- AND WATER-DISCHARGE RECORDS section of this report (same comments apply).

PERIOD OF RECORD.—This indicates the time periods for which published water-quality records for the station are available. The periods are shown separately for records of parameters measured daily or continuously and those measured less than daily. For those measured daily or continuously, periods of record are given for the physical properties individually.

INSTRUMENTATION.—Information on instrumentation is given only if a water-quality monitor temperature record, sediment pumping sampler, or other sampling device is in operation at a station.

REMARKS.—Remarks provide added information pertinent to the collection, analysis, or computation of the records.

COOPERATION.—Records provided by a cooperating organization or obtained for the USGS by a cooperating organization are identified here.

EXTREMES.—Maximums and minimums are given only for physical properties measured daily or more frequently. For physical properties measured weekly or less frequently, true maximums or minimums may not have been obtained. Extremes, when given, are provided for both the period of record and for the current water year.

REVISIONS.—Records are revised if errors in published water-quality records are discovered. Appropriate updates are made in the USGS distributed data system, NWIS, and subsequently to its Web-based national data system, NWISWeb (http://waterdata.usgs.gov/nwis). Users of USGS water-quality data are encouraged to obtain all required data from NWIS or NWISWeb to ensure that they have the most recent updates. Updates to the NWISWeb are made on an annual basis.

The surface-water-quality records for partial-record stations and miscellaneous sampling sites are published in separate tables following the table of discharge measurements at miscellaneous sites. No descriptive statements are given for these records. Each station is published with its own station number and name in the regular downstream-order sequence.

Remark Codes

The following remark codes may appear with the water-quality data in this section:

Printed Output	Remark
E or e	Value is estimated.
>	Actual value is known to be greater than the value shown.
<	Actual value is known to be less than the value shown.
M	Presence of material verified, but not quantified.
N	Presumptive evidence of presence of material.
U	Material specifically analyzed for, but not detected.
A	Value is an average.
V	Analyte was detected in both the environmental sample and the associated blanks.
S	Most probable value.

Water-Quality Control Data

The USGS National Water Quality Laboratory in Lakewood, Colorado, collects quality-control data on a continuing basis to evaluate selected analytical methods to determine long-term method detection levels (LT-MDLs) and laboratory reporting levels (LRLs). These values are re-evaluated each year on the basis of the most recent quality-control data and, consequently, may change from year to year.

This reporting procedure limits the occurrence of false positive error. Falsely reporting a concentration greater than the LT-MDL for a sample in which the analyte is not present is 1 percent or less. Application of the LRL limits the occurrence of false negative error. The chance of falsely reporting a nondetection for a sample in which the analyte is present at a concentration equal to or greater than the LRL is 1 percent or less.

Accordingly, concentrations are reported as less than LRL for samples in which the analyte either was not detected or did not pass identification. Analytes detected at concentrations between the LT-MDL and the LRL and that pass identification criteria are estimated. Estimated concentrations will be noted with a remark code of “E.” These data should be used with the understanding that their uncertainty is greater than that of data reported without the E remark code.

Data generated from quality-control (QC) samples are a requisite for evaluating the quality of the sampling and processing techniques as well as data from the actual samples themselves. Without QC data, environmental sample data cannot be adequately interpreted because the errors associated with the sample data are unknown. The various types of QC samples collected by the USGS Water Science Center are described in the following section. Procedures have been established for the storage of water-quality-control data within the USGS. These procedures allow for storage of all derived QC data and are identified so that they can be related to corresponding environmental samples. These data are not presented in this report but are available from the USGS Water Science Center.

Blank Samples

Blank samples are collected and analyzed to ensure that environmental samples have not been contaminated in the overall data-collection process. The blank solution used to develop specific types of blank samples is a solution that is free of the analytes of interest. Any measured value signal in a blank sample for an analyte (a specific component measured in a chemical analysis) that was absent in the blank solution is believed to be due to contamination. Many types of blank samples are possible; each is designed to segregate a different part of the overall data-collection process. The types of blank samples that can be by collected by the USGS Water Science Center are:

Field blank—A blank solution that is subjected to all aspects of sample collection, field processing preservation, transportation, and laboratory handling as an environmental sample.

Trip blank—A blank solution that is put in the same type of bottle used for an environmental sample and kept with the set of sample bottles before and after sample collection.

Equipment blank—A blank solution that is processed through all equipment used for collecting and processing an environmental sample (similar to a field blank but normally done in the more controlled conditions of the office).

Sampler blank—A blank solution that is poured or pumped through the same field sampler used for collecting an environmental sample.

Filter blank—A blank solution that is filtered in the same manner and through the same filter apparatus used for an environmental sample.

Splitter blank—A blank solution that is mixed and separated using a field splitter in the same manner and through the same apparatus used for an environmental sample.

Preservation blank—A blank solution that is treated with the sampler preservatives used for an environmental sample.

Reference Samples

Reference material is a solution or material prepared by a laboratory. The reference material composition is certified for one or more properties so that it can be used to assess a measurement method. Samples of reference material are submitted for analysis to ensure that an analytical method is accurate for the known properties of the reference material. Generally, the selected reference material properties are similar to the environmental sample properties.

Replicate Samples

Replicate samples are a set of environmental samples collected in a manner such that the samples are thought to be essentially identical in composition. Replicate is the general case for which a duplicate is the special case consisting of two samples. Replicate samples are collected and analyzed to establish the amount of variability in the data contributed by some part of the collection and analytical process. Many types of replicate samples are possible, each of which may yield slightly different results in a dynamic hydrologic setting, such as a flowing stream. The types of replicate samples that may be collected by the Water Sceience Center are:

Concurrent samples—A type of replicate sample in which the samples are collected simultaneously with two or more samplers or by using one sampler and alternating the collection of samples into two or more compositing containers.

Sequential samples—A type of replicate sample in which the samples are collected one after the other, typically over a short time.

Split sample—A type of replicate sample in which a sample is split into subsamples, each subsample contemporaneous in time and space.

Spike Samples

Spike samples are samples to which known quantities of a solution with one or more well-established analyte concentrations have been added. These samples are analyzed to determine the extent of matrix interference or degradation on the analyte concentration during sample processing and analysis.

EXPLANATION OF GROUND-WATER-LEVEL RECORDS

Generally, only ground-water-level data from selected wells with continuous recorders from a basic network of observation wells are published in this report. This basic network contains observation wells located so that the most significant data are obtained from the fewest wells in the most important aquifers.

Site Identification Numbers

Each well is identified by means of (1) a 15-digit number that is based on latitude and longitude and (2) a local number that is produced for local needs. (See NUMBERING SYSTEM FOR WELLS AND MISCELLANEOUS SITES in this report for a detailed explanation).

Data Collection and Computation

Measurements are made in many types of wells, under varying conditions of access and at different temperatures; hence, neither the method of measurement nor the equipment can be standardized. At each observation well, however, the equipment and techniques used are those that will ensure that measurements at each well are consistent.

Most methods for collecting and analyzing water samples are described in the TWRIs referred to in the Onsite Measurements and Sample Collection and the Laboratory Measurements sections in this report. In addition, TWRI Book 1, Chapter D2, describes guidelines for the collection and field analysis of ground-water samples for selected unstable constituents. Procedures for onsite measurements and for collecting, treating, and shipping samples are given in TWRIs Book 1, Chapter D2; Book 3, Chapters A1, A3, and A4; and Book 9, Chapters A1 through A9. The TWRI publications may be accessed from *http://water.usgs.gov/pubs/twri/*. The values in this report represent water-quality conditions at the time of sampling, as much as possible, and that are consistent with available sampling techniques and methods of analysis. These methods are consistent with ASTM standards and generally follow ISO standards. Trained personnel collected all samples. The wells sampled were pumped long enough to ensure that the water collected came directly from the aquifer and had not stood for a long time in the well casing where it would have been exposed to the atmosphere and to the material, possibly metal, comprising the casings.

Water-level measurements in this report are given in feet with reference to land-surface datum (lsd). Land-surface datum is a datum plane that is approximately at land surface at each well. If known, the elevation of the land-surface datum above Natioanl Geodetic Vertical Datum of 1929 (NGVD 29) is given in the well description. The height of the measuring point (MP) above or below land-surface datum is given in each well description. Water levels in wells equipped with recording gages are reported for every fifth day and the end of each month (EOM).

Water levels are reported to as many significant figures as can be justified by the local conditions. For example, in a measurement of a depth of water of several hundred feet, the error in determining the absolute value of the total depth to water may be a few tenths of a foot, whereas the error in determining the net change of water level between successive measurements may be only a hundredth or a few hundredths of a foot. For lesser depths to water the accuracy is greater. Accordingly, most measurements are reported to a hundredth of a foot, but some are given only to a tenth of a foot or a larger unit.

Data Presentation

Water-level data are presented in alphabetical order by county. The primary identification number for a given well is the 15-digit site identification number that appears in the upper left corner of the table. The secondary identification number is the local or county well number. The number of ground-water observation wells per county is indicated on a map in this report (fig. 10).

Each well record consists of three parts: the well description, the data table of water levels observed during the water year, and, for most wells, a hydrograph following the data table. Well descriptions are presented in the headings preceding the tabular data.

The following comments clarify information presented in these various headings.

LOCATION.—This paragraph follows the well-identification number and reports the hydrologic-unit number and a geographic point of reference. Latitudes and longitudes used in this report are reported as North American Datum of 1927 unless otherwise specified.

AQUIFER.—This entry designates by name and geologic age the aquifer that the well taps.

WELL CHARACTERISTICS.—This entry describes the well in terms of depth, casing diameter and depth or screened interval, method of construction, use, and changes since construction.

INSTRUMENTATION.—This paragraph provides information on both the frequency of measurement and the collection method used, allowing the user to better evaluate the reported water-level extremes by knowing whether they are based on continuous, monthly, or some other frequency of measurement.

DATUM.—This entry describes both the measuring point and the land-surface elevation at the well. The altitude of the land-surface datum is described in feet above the altitude datum; it is reported with a precision depending on the method of determination. The measuring point is described physically (such as top of casing, top of instrument shelf, and so forth), and in relation to land surface (such as 1.3 ft above land-surface datum). The elevation of the land-surface datum is described in feet above National Geodetic Vertical Datum of 1929 (NGVD 29); it is reported with a precision depending on the method of determination.

REMARKS.—This entry describes factors that may affect the water level in a well or the measurement of the water level, when various methods of measurement were begun, and the network (climatic, terrane, local, or areal effects) or the special project to which the well belongs.

PERIOD OF RECORD.—This entry indicates the time period for which records are published for the well, the month and year at the start of publication of water-level records by the USGS, and the words “to current year” if the records are to be continued into the following year. Time periods for which water-level records are available, but are not published by the USGS, may be noted.

EXTREMES FOR PERIOD OF RECORD.—This entry contains the highest and lowest instantaneously recorded or measured water levels of the period of published record, with respect to land-surface datum or NGVD 29, and the dates of occurrence.

Water-Level Tables

A table of water levels follows the well description for each well. Water-level measurements in this report are given in feet with reference to either NGVD 29 or land-surface datum (lsd). Missing records are indicated by dashes in place of the water-level value.

For wells not equipped with recorders, water-level measurements were obtained periodically by steel or electric tape. Tables of periodic water-level measurements in these wells show the date of measurement and the measured water-level value.

Hydrographs

Hydrographs are a graphic display of water-level fluctuations over a period of time. In this report, current water year and, when appropriate, period-of-record hydrographs are shown. Hydrographs that display periodic water-level measurements show points that may be connected with a dashed line from one measurement to the next. Hydrographs that display recorder data show a solid line representing the mean water level recorded for each day. Missing data are indicated by a blank space or break in a hydrograph. Missing data may occur as a result of recorder malfunctions, battery failures, or mechanical problems related to the response of the recorder’s float mechanism to water-level fluctuations in a well.

GROUND-WATER-QUALITY DATA

Data Collection and Computation

The ground-water-quality data in this report were obtained as a part of special studies in specific areas. Consequently, a number of chemical analyses are presented for some wells within a county but not for others. As a result, the records for this year, by themselves, do not provide a balanced view of ground-water quality statewide.

Most methods for collecting and analyzing water samples are described in the TWRIs, which may be accessed from *http://water.usgs.gov/pubs/twri/*. Procedures for onsite measurements and for collecting, treating, and shipping samples are given in TWRI, Book 1, Chapter D2; Book 3, Chapter C2; and Book 5, Chapters A1, A3, and A4. Also, detailed information on collecting, treating, and shipping samples may be obtained from the USGS Water Science Center (see address shown on back of title page in this report).

Laboratory Measurements

Analysis for sulfide and measurement of specific conductance, pH, water temperature, dissolved oxygen, and alkalinity are performed onsite. All other sample analyses are performed at the USGS National Water Quality Laboratory in Lakewood, Colorado, unless otherwise noted. Methods used by the USGS laboratory are given in TWRI, Book 1, Chapter D2; Book 3, Chapter C2; and Book 5, Chapters A1, A3, and A4, which may be accessed from *http://water.usgs.gov/pubs/twri/*.

ACCESS TO USGS WATER DATA

The USGS provides near real-time stage and discharge data for many of the gaging stations equipped with the necessary telemetry and historic daily-mean and peak-flow discharge data for most current or discontinued gaging stations through the World Wide Web (WWW). These data may be accessed from *http://water.usgs.gov*.

Water-quality data and ground-water data also are available through the WWW. In addition, data can be provided in various machine-readable formats on various media. Information about the availability of specific types of data or products, and user charges, can be obtained locally from each USGS Water Science Center (see address that is shown on the back of the title page of this report).

DEFINITION OF TERMS

Specialized technical terms related to streamflow, water-quality, and other hydrologic data, as used in this report, may be accessed from *http://water.usgs.gov/ADR_Defs_2005.pdf*. Terms such as algae, water level, and precipitation are used in their common everyday meanings, definitions of which are given in standard dictionaries. Not all terms defined in this alphabetical list apply to every State. See also table for converting English units to International System (SI) Units. Other glossaries that also define water-related terms are accessible from *http://water.usgs.gov/glossaries.html*.

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USGS technician prepares for survey of reference point elevations at partial-record station. Photograph courtesy of L.S. Hill.