88-711

WATER FACT SHEET

U.S. GEOLOGICAL SURVEY, DEPARTMENT OF THE INTERIOR

WATER SUPPLY AND DEMAND IN SEDGWICK COUNTY, KANSAS

Sedgwick County relies on local resources for water supplies. Although abundant quantities of surface and ground water occur in and adjacent to the county, available supplies are limited by natural conditions (streamflow characteristics, aquifer properties, and water quality) and human activities (water use and contamination).

SURFACE-WATER SUPPLIES

The principal surface-water resources in the county are the Arkansas, Little Arkansas, South Fork Ninnescah, and Ninnescah Rivers; and Cheney Reservoir on the North Fork Ninnescah River. Because streamflow volumes and rates can be depleted during droughts, impoundments are needed to provide the large sustained yields required for water supplies.

Characteristics of rivers in Sedgwick County during 1965-85 are given in table 1. Mean annual streamflow volumes and mean discharge-weighted dissolved-solids concentrations and suspended-sediment loads are indicative of the quantity and quality of water available for impoundments. Median streamflow rates and mean discharge-weighted dissolved-solids concentrations indicate the quantity and quality of water available for direct withdrawals and instream uses. Impounded water, primarily surface runoff, has relatively small concentrations of dissolved solids. However, surface runoff can transport large loads of suspended sediment, which decrease the storage capacity of impoundments, and other nonpoint-source agricultural contaminants (pesticides and fertilizers).

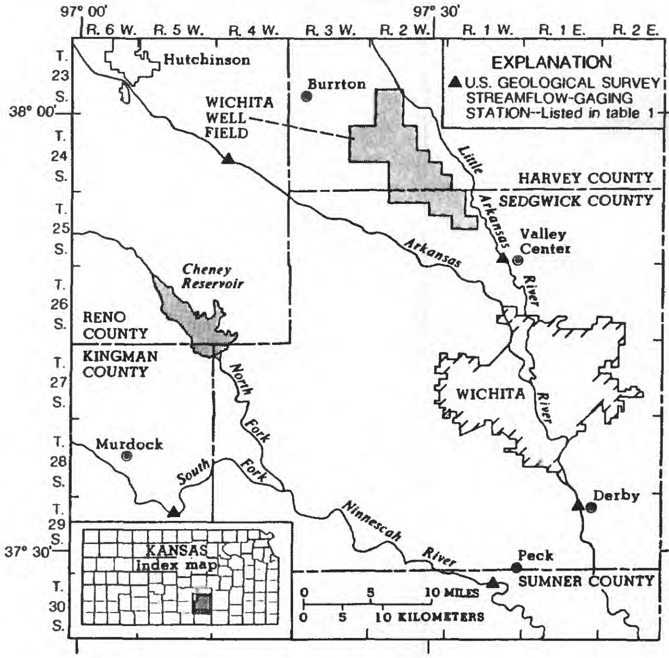
Water in the Arkansas, South Fork Ninnescah, and Ninnescah Rivers is a sodium chloride type. The Arkansas River commonly has dissolved-solids concentrations that exceed the 1988 Kansas guideline for drinking water, 1,000 milligrams per liter (mg/L). Water in the other rivers, including the Little Arkansas River, which has a calcium bicarbonate type water, is suitable for public supplies.

Cheney Reservoir has a controlled storage volume of 247,950 acre-feet. The conservation pool (151,800 acre-feet) should be able to provide a sustained yield of about 40,000 acre-feet per year.

Table 1. *Characteristics of rivers in Sedgwick County*

Streamflow-gaging station (period of record 1965-85, location shown in figure)	Mean annual streamflow volume, (acre-feet)	Median streamflow rate, (cubic feet per second)	Mean[1] dissolved-solids concentration (milligrams per liter)	Median[1] dissolved-solids concentration (milligrams per liter)	Mean[1] annual suspended sediment load (tons)
Arkansas River near Hutchinson	370,000	270	1,040	1,640	406,000
Little Arkansas River at Valley Center	265,000	66	221	488	299,000
Arkansas River at Derby[2]	821,600	510	689	1,140	--
South Fork Ninnescah River near Murdock	148,000	140	555	702	107,000
Ninnescah River near Peck	336,600	195	398	604	130,000

[1] Discharge weighted.
[2] Period of record for this station is 1969-85.



Water in the reservoir is a sodium chloride type with a mean dissolved-solids concentration of about 500 mg/L. The storage capacity of the reservoir is decreased by an estimated 13 to 24 acre-feet per year due to sedimentation (Bevans, 1988).

GROUND-WATER SUPPLIES

Although ground water is present in the subsurface throughout Sedgwick County, quantity and quality characteristics determine its usefulness. Fine-grained shale that occurs at or near the land surface in most upland areas generally yields less than 10 gallons per minute to wells. The water is commonly a calcium bicarbonate type with less than 1,000 mg/L dissolved solids; locally calcium sulfate type water with more than 2,000 mg/L dissolved solids can occur.

Wells completed in unconsolidated deposits of clay, silt, sand, and gravel yield from about 50 gallons per minute in the uplands between the Arkansas and Ninnescah River valleys, where the saturated thickness is less than 40 feet, to as much as 2,000 gallons per minute in the Arkansas River valley, where the maximum saturated thickness is about 220 feet (Lane and Miller, 1965). The volume of water with less than 1,000 mg/L dissolved solids that is stored in unconsolidated deposits of the Arkansas, Little Arkansas, and Ninnescah River valleys in Sedgwick County is about 2,880,000 acre-feet; annual recharge from precipitation to these deposits is about 78,400 acre-feet (Hansen, 1987).

Water from unconsolidated deposits generally is a calcium bicarbonate type with less than 500 mg/L dissolved solids. Alluvium adjacent to the Arkansas River north of Wichita, contains a sodium chloride type water with more than 1,000 mg/L dissolved solids. Most of the water from unconsolidated deposits is suitable for public supplies, but is susceptible to contamination from natural sources (saltwater intrusion) and human activities (sewage disposal, industry, and agriculture).

The Wichita well field is located between the Arkansas and Little Arkansas Rivers in northwest Sedgwick and southwest Harvey Counties. Results of a ground-water modeling study (Spinazola and others, 1985) indicate that the average annual recharge from precipitation at the well field is about 3.25 inches or 19,000 acre-feet. Continued withdrawals from the well field at the 1970-79 rate of pumpage (30,000 acre-feet per year) would cause water levels to decline about 15 feet during 1980-2020 in addition to the declines of greater than 25 feet that have already occurred during 1940-80; withdrawals at twice this rate would cause additional declines of as much as 40 feet during 1980-2020.

Water from the Wichita well field generally is a calcium bicarbonate type with less than 500 mg/L dissolved solids. Oilfield brine from the Burrton oilfield northwest of the well field and saline water from the Arkansas River to the southwest have the potential to degrade water quality. A solute-transport study determined that chloride concentrations in the well field would increase in direct proportion to ground-water withdrawal rates, and that saline-water intrusion from the Arkansas River poses a greater threat to the well field than does residual oilfield brine (Spinazola and others, 1985). Agricultural activities (irrigation, and pesticide and fertilizer use) in the well-field area also may decrease the quantity and degrade the quality of the water.

WATER DEMAND

Appropriated water rights in 1984 and estimated water use during 1985 are shown in table 2. The volume of water appropriated in 1984 totaled 244,300 acre-feet, of which about 77 percent was for ground water. Most of the water was appropriated for public supplies (52 percent), followed by irrigation and self-supplied industry. Water rights are not required for self-supplied domestic use.

An estimated 134,200 acre-feet of water were used during 1985. Most of the water was used for public supplies, but irrigation use was almost as large. Irrigation use required a greater percentage of the appropriated right (77 percent) than any other use category and has more than doubled since 1960. The city of Wichita is the largest single holder of water-rights appropriations and largest water user in the county. During 1985, the city used 18,300 of the 52,600 acre-feet of appropriated surface water from Cheney Reservoir, and 35,200 of the 57,900 acre-feet of appropriated ground water. All the ground water used was withdrawn from the Wichita well field where the city has water rights for 40,000 acre-feet.

During 1985, an estimated 57,000 acre-feet of water were used for public supplies by about 354,000 people, or about 0.16 acre-foot per person. If the county population continues to increase at the same rate as that from 1920-80 (2.8 percent per year), the 126,100 acre-feet per year appropriated for public supplies should meet the demand until about 2015. These same rates of population increase and water use also apply to the city of Wichita, which should have adequate supplies of water until about 2015 if the 110,500 acre-feet appropriated for public supplies can be fully utilized. The rates of population increase for the city and county have been 0.18 and 0.34 percent per year, respectively, during 1960-80, which would allow existing public-supply water rights to meet demand for a much longer time.

The State has mandated that the volume of water needed to maintain minimum desirable streamflow to preserve, maintain, or enhance instream water uses be withheld from surface-water appropriations. Minimum desirable streamflows have been determined and approved for rivers in the county. The monthly streamflow rates, converted to annual volumes, are as follows:

Table 2. *Appropriated water rights (1984) and estimated water use (1985) in Sedgwick County*

[Modified from Bevans, 1988]

Water-use category	Surface water (acre-feet)		Ground water (acre-feet)	
	Appropriated right	Estimated use	Appropriated right	Estimated use
Public supplies	52,600	18,300	73,500	38,700
Irrigation	3,800	3,100	65,900	50,400
Industrial, self-supplied	100	100	48,400	18,800
Domestic, self-supplied	--	0	--	4,800
Total	56,500	21,500	187,800	112,700

Arkansas River near Hutchinson (59,146 acre-feet), Little Arkansas River at Valley Center (14,479 acre-feet), South Fork Ninnescah River near Murdock (47,543 acre-feet), and Ninnescah River near Peck (55,166 acre-feet) (Kansas Water Office, 1986).

The quantity of surface and ground water potentially available for water supplies can be estimated by summing those resources with dissolved-solids concentrations less than 1,000 mg/L. Surface-water resources that meets this criterion are the Little Arkansas River, the Ninnescah River, and Cheney Reservoir. The mean annual streamflow for the two rivers (table 1) minus the minimum desirable streamflow leaves about 532,000 acre-feet which, combined with the sustained yield of Cheney Reservoir (40,000 acre-feet), provides an estimated 572,000 acre-feet of surface water annually. Ground water available from unconsolidated deposits in the county that meets the water-quality criterion is estimated by summing annual precipitation recharge available to unconsolidated deposits in the county (78,400 acre-feet) and the Harvey County part of the Wichita well field (13,000 acre-feet), which provides a total of 91,400 acre-feet. Although there is much more ground water in the unconsolidated deposits, annual withdrawals exceeding the precipitation recharge would be equivalent to mining water, and water levels would decline. Estimated use of surface water during 1985 was less than 4 percent of the potential available supply, whereas the estimated use of ground water was about 120 percent of ground-water recharge by precipitation. Ground-water levels in the county and the well field will continue to decline at current (1985) withdrawal rates. Surface-water resources have a large potential for meeting future water-supply demands.

SELECTED REFERENCES

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