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

WATER-RESOURCES INVESTIGATIONS REPORT 97-4081
Water-level changes in the High Plains aquifer—SHEET 2 OF 2
McGuire, V.L., and Sharpe, J.B., 1997, Water-level changes in the High Plains aquifer—Predevelopment to 1995

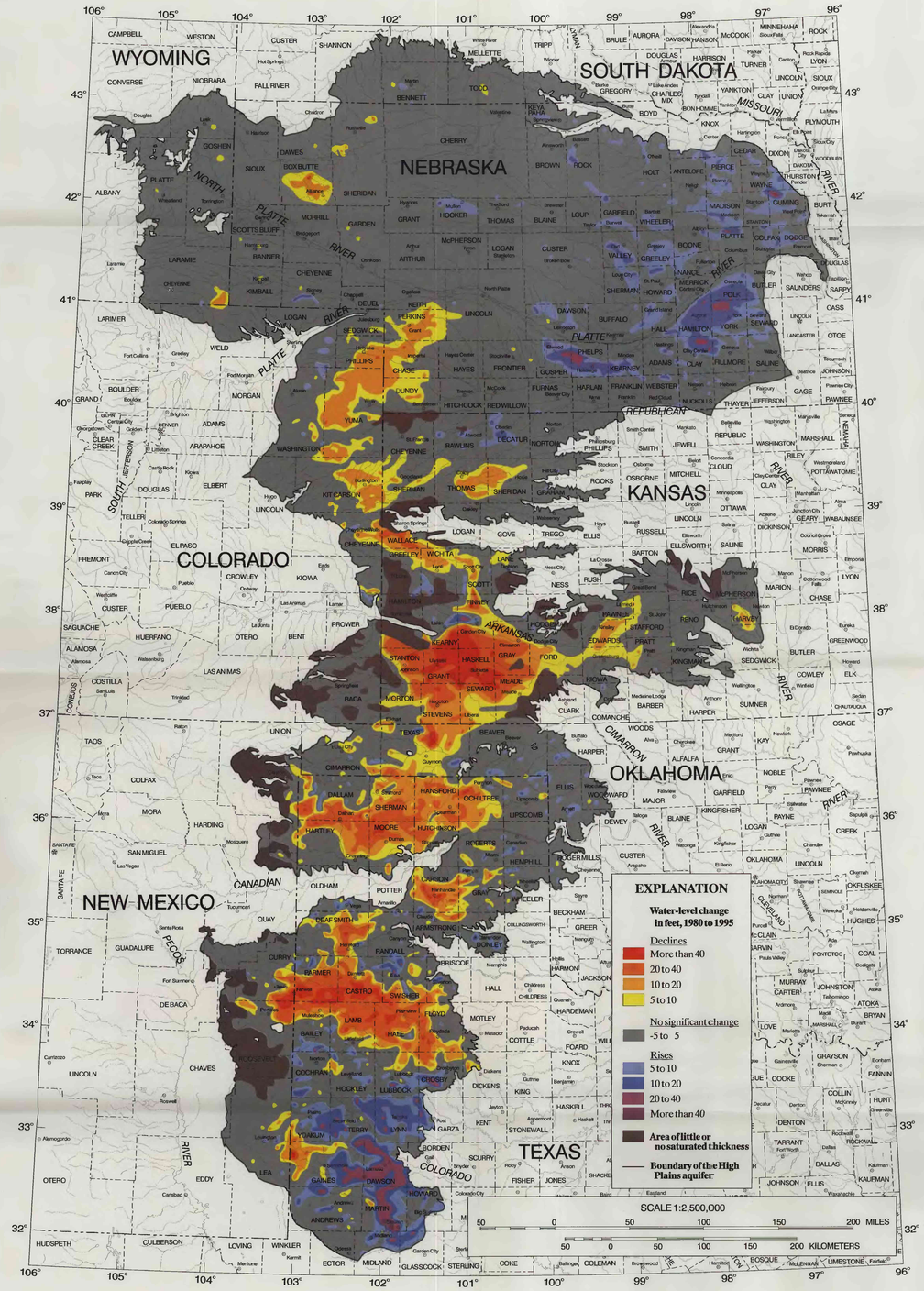


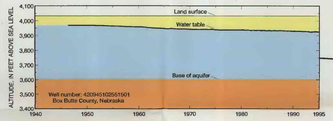
Figure 3. Water-level change in the High Plains aquifer, 1980 to 1995.

HYDROGRAPHS OF REPRESENTATIVE OBSERVATION WELLS

Hydrographs are graphical representations of periodic water-level measurements at selected wells. These hydrographs are colored to show the saturated thickness of the aquifer and elevation of land surface and base of the aquifer at the well site. The water levels are assumed to represent unconfined (water-table) conditions. The water level is inferred from 1940 to the first water-level measurement for the well (beginning of the water-table line).

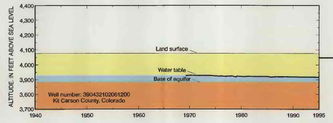
BOX BUTTE COUNTY, NEBRASKA

The water level at this location declined 44.1 feet from 1946 to 1995. Irrigation development began in this area in about 1950, and the water level steadily declined at an average rate of about 1 foot per year. The rate of decline was largest in the early and mid-1960's when the water level declined about 2 feet per year. In 1990, 111,000 acres were irrigated in Box Butte County, a reduction of 8,000 acres from 1985 (Steele, 1988; Nebraska Natural Resources Commission, 1994). Total water use in Box Butte County was 143 Mgal/d in 1990, a 9-Mgal/d reduction from 1985; ground water was the source for more than 90 percent of the water used in the county (Solley, Merk, and Pierce, 1988; Solley, Pierce, and Perlman, 1993).



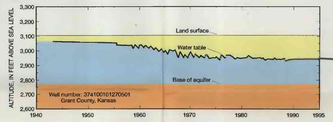
KIT CARSON COUNTY, COLORADO

The water level at this location declined 11.0 feet from 1969 to 1995. In 1994, 166,000 acres were irrigated in Kit Carson County, an increase of 44,000 acres from 1980 (Abbey Mullis, Kit Carson County Tax Assessor, oral commun., 1996). Ground-water use in Kit Carson County was 194 Mgal/d in 1990, an increase of 48 Mgal/d from 1985 (Solley, Merk, and Pierce, 1988; Solley, Pierce, and Perlman, 1993).



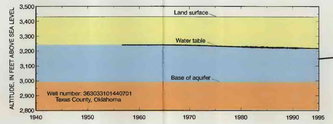
GRANT COUNTY, KANSAS

The water level at this location declined 119.4 feet from 1943 to 1995. The hydrograph's "saw-tooth" pattern from 1960 to 1975 is characteristic of an area where wells are pumped intensely for irrigation during the growing season, which causes water levels to decline, and not pumped during the nongrowing season, which allows water levels to recover at least partially. There were fewer fluctuations in the water level after 1975, probably because of local regulation of pumping. The water level declined nearly 9 feet from 1943 to 1955 and more than 100 feet from 1955 to 1980, about 4 feet per year. After 1980, the water level declined only an additional 5 feet; since 1990, the water level has essentially stabilized at about 160 feet below ground surface, which possibly indicates cessation of pumping in the immediate area. Irrigated acreage in Grant County was: 1975—83,000 acres; 1980—51,000 acres; 1985—154,000 acres; 1990—142,000 acres; and 1994—140,000 acres. Ground-water use in Grant County was 66, 89, 226, 203, and 180 Mgal/d in 1975, 1980, 1985, 1990, and 1994, respectively (data on file at Kansas Department of Agriculture, Water Rights Information System, Division of Water Resources, Topeka, Kans., 1996).



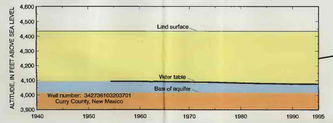
TEXAS COUNTY, OKLAHOMA

The water level at this location declined 23.8 feet from 1956 to 1995. The water level at this location remained relatively steady from 1556 to 1967. From 1967 to 1995, the water level steadily declined about 24 feet, or nearly 0.9 foot per year. Ground-water use in Texas County during 1990 was 210 Mgal/d (Lurry and Tortorilli, 1995).



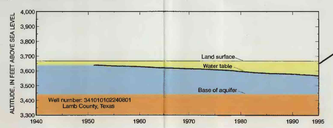
CURRY COUNTY, NEW MEXICO

The water level at this location declined 17.7 feet from 1954 to 1995. This well is situated just west of an intensively irrigated area in the northern part of the High Plains region in New Mexico. In 1954, the depth to water at this location was 341 feet. The water level declined 2 feet from 1954 to 1970 and more than 14 feet from 1970 to 1990. Since 1990, the water level continued to decline gradually; the depth to water in January 1995 was 359 feet. Irrigated acreage in Curry County was: 1980—150,000 acres; 1985—111,000 acres; 1990—147,000 acres; and the preliminary estimate for 1994 is 141,000 acres (Lansford and others, 1990; Lansford and others, 1994; Lansford and others, 1995). Ground-water use in Curry County was 237, 182, and 304 Mgal/d in 1980, 1985, and 1990, respectively (Sorenson, 1982; Wilson, 1986, 1992).



LAMB COUNTY, TEXAS

The water level at this location declined 71.7 feet from 1951 to 1995. The hydrograph for this observation well in the northern portion of the southern High Plains region illustrates both the effect of intensive pumping for irrigation since the early 1950's and constant pumping for industrial purposes—the well is near a hydroelectric plant with high-capacity wells that pump cooling water from the High Plains aquifer. The water-level decline rate at this location from 1951 to 1995 was an average of about 1.6 feet per year; more than 36 percent of the 1951 aquifer saturated thickness at this location was dewatered by 1995. Irrigated acreage decreased in Lamb County from 275,000 acres in 1985 to 204,000 acres in 1990, and ground-water use decreased in Lamb County from 355 Mgal/d in 1985 to 212 Mgal/d in 1990 (Solley, Merk, and Pierce, 1988; Solley, Pierce, and Perlman, 1993).



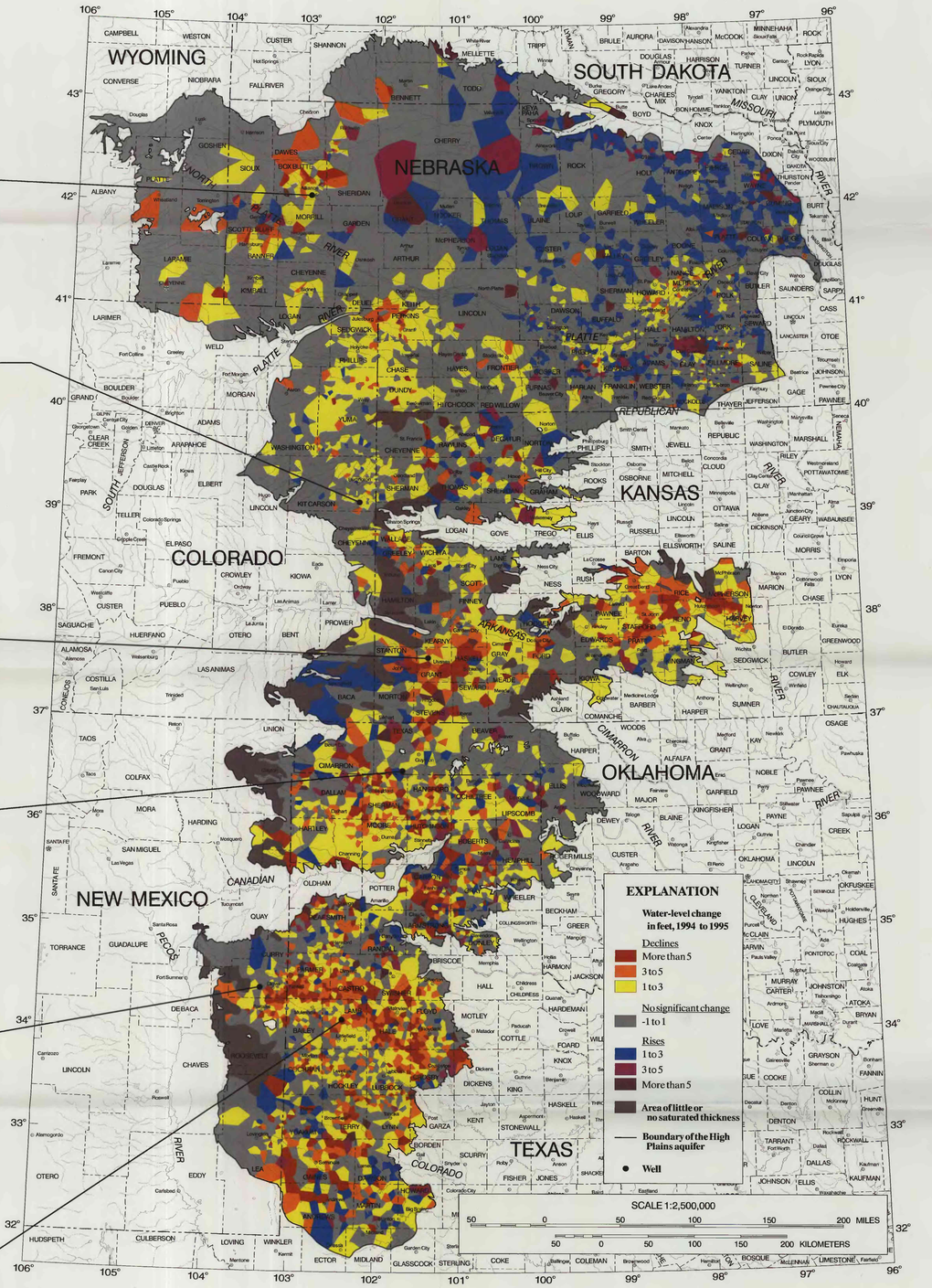


Figure 5. Water-level change in the High Plains aquifer, 1994 to 1995.

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WATER-LEVEL CHANGES IN THE HIGH PLAINS AQUIFER—PREDEVELOPMENT TO 1995

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1997

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