UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

WATER-LEVEL CHANGES 1964-71
NORTHERN HIGH PLAINS OF COLORADO

By

Warren E. Hofstra, John M. Klein, and Thomas J. Major

OPEN-FILE REPORT 72-166

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WATER
RESOURCES
DIVISION

Colorado District
Denver, Colorado
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Prepared in cooperation with the
Colorado Water Conservation Board,
Colorado Division of Water Resources, Office of the State Engineer
and the
Management Districts of the northern High Plains

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ILLUSTRATIONS

TABLE

WATER-LEVEL CHANGES 1964-71, NORTHERN HIGH PLAINS OF COLORADO

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Ground-water withdrawals for irrigation increased from about 84,000 acre-feet to 430,000 acre-feet per year between 1960 and 1970 in the northern High Plains of Colorado, causing significant water-level declines in areas where high-capacity wells are concentrated. The number of wells increased from about 500 in 1960 to 2,560 in 1970. In 1968 the U.S. Geological Survey began a study in cooperation with the Colorado Water Conservation Board; the Colorado Division of Water Resources, Office of the State Engineer; and the Management Districts of the northern High Plains to provide information for administration and management of the vital ground-water reserves of the northern High Plains.

The northern High Plains of Colorado is formed from an erosional remanent of the Ogallala Formation of Pliocene Age that extends from the South Platte River on the north to the Arkansas River on the south, and from Limon, Colo. on the west across the Colorado State line on the east (fig. 1). This area includes all

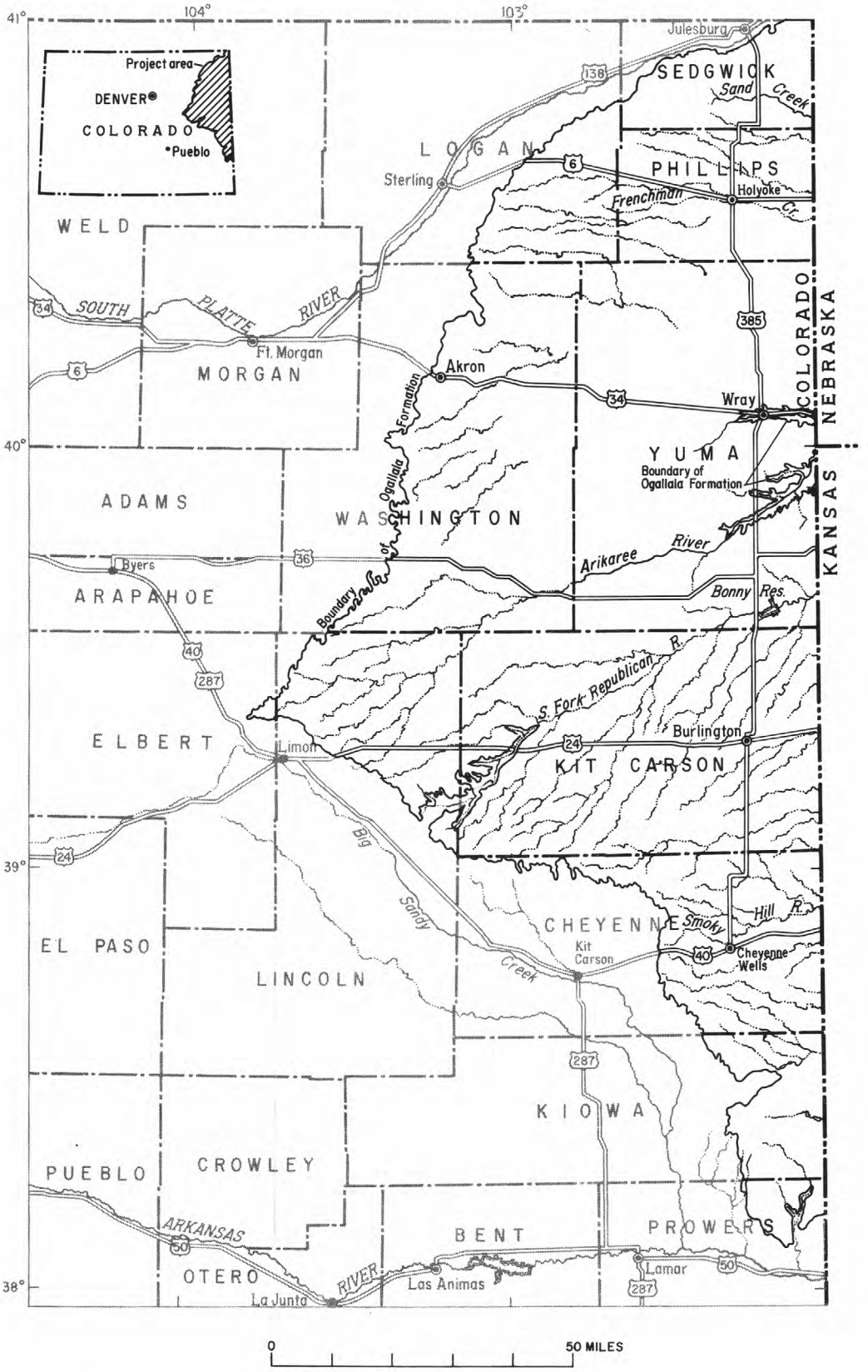

Figure 1. --Index map.

or part of 11 counties and contains about 9,500 square miles. General information describing the ground-water resources of the northern High Plains of Colorado is presented in table 1. Plate 1 shows the net changes in water level between 1964 and 1971. Other published water-level change maps are for the period from 1964-68 and 1964-69 (Boettcher and others, 1969). The map (pl. 1) is based on annual water-level measurements made in 1964 and 1971 in about 300 wells tapping the Ogallala aquifer. Areas with either a net decline or a net rise are shown. Large declines recorded near Yuma and Burlington correspond to relatively high concentrations (2 per sq mi) of high-capacity wells. Also included in this report are 11 hydrographs typical of the water-level changes during this period (figs. 2-4). The hydrographs show water-level changes from 1964, or as early as 1956 to 1971, and illustrate the consistency of water-level change rates. Because proper management of ground-water resources requires systematic and valid basic data, the annual water-level measurements should continue.

Table 1.--*Information on ground-water resources of the northern High Plains of Colorado*

[Values estimated from data available in 1970]

GENERAL INFORMATION	
Location	Eastern Colorado, between the South Platte and Arkansas Rivers
Size	Approximately 9,500 square miles (6,000,000 acres)
Irrigated area	300,000 acres
Precipitation	16 inches per year
CHARACTERISTICS OF THE OGALLALA AQUIFER	
Lithology	Sand and gravel with lenses of clay and silt (some cemented)
Saturated thickness	20-400 feet
Ground water in storage	80,000,000 acre-feet
Estimated recoverable ground water	40,000,000 acre-feet
Annual aquifer recharge	430,000 acre-feet

USE OF GROUND WATER

	Irrigation wells	Estimated withdrawal, acre-feet
1950	220	37,000
1960	500	84,000
1970	2,560	430,000

OBSERVATION WELLS

1971	1,200 measured yearly

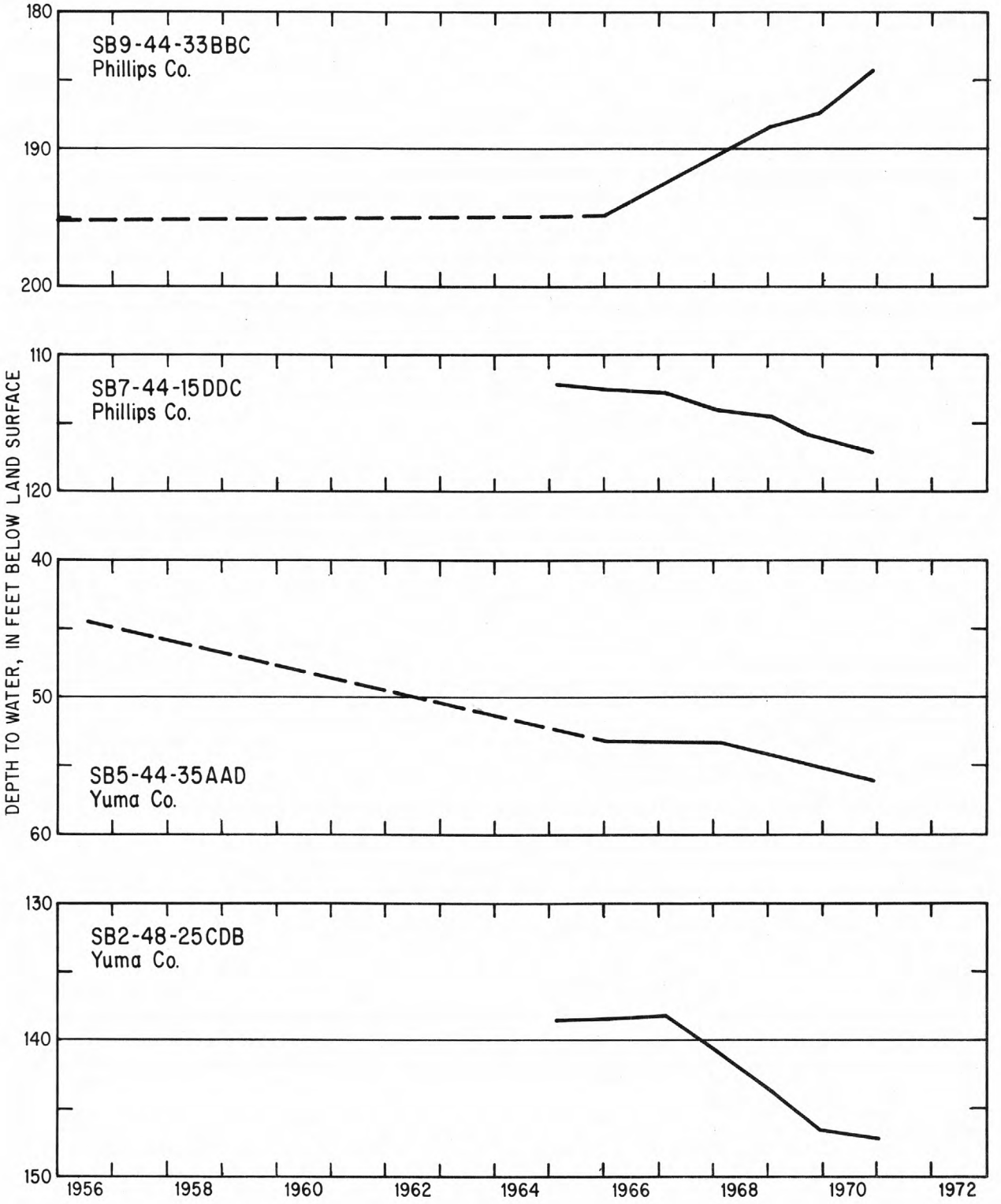

Figure 2. --Hydrographs of typical observation wells.

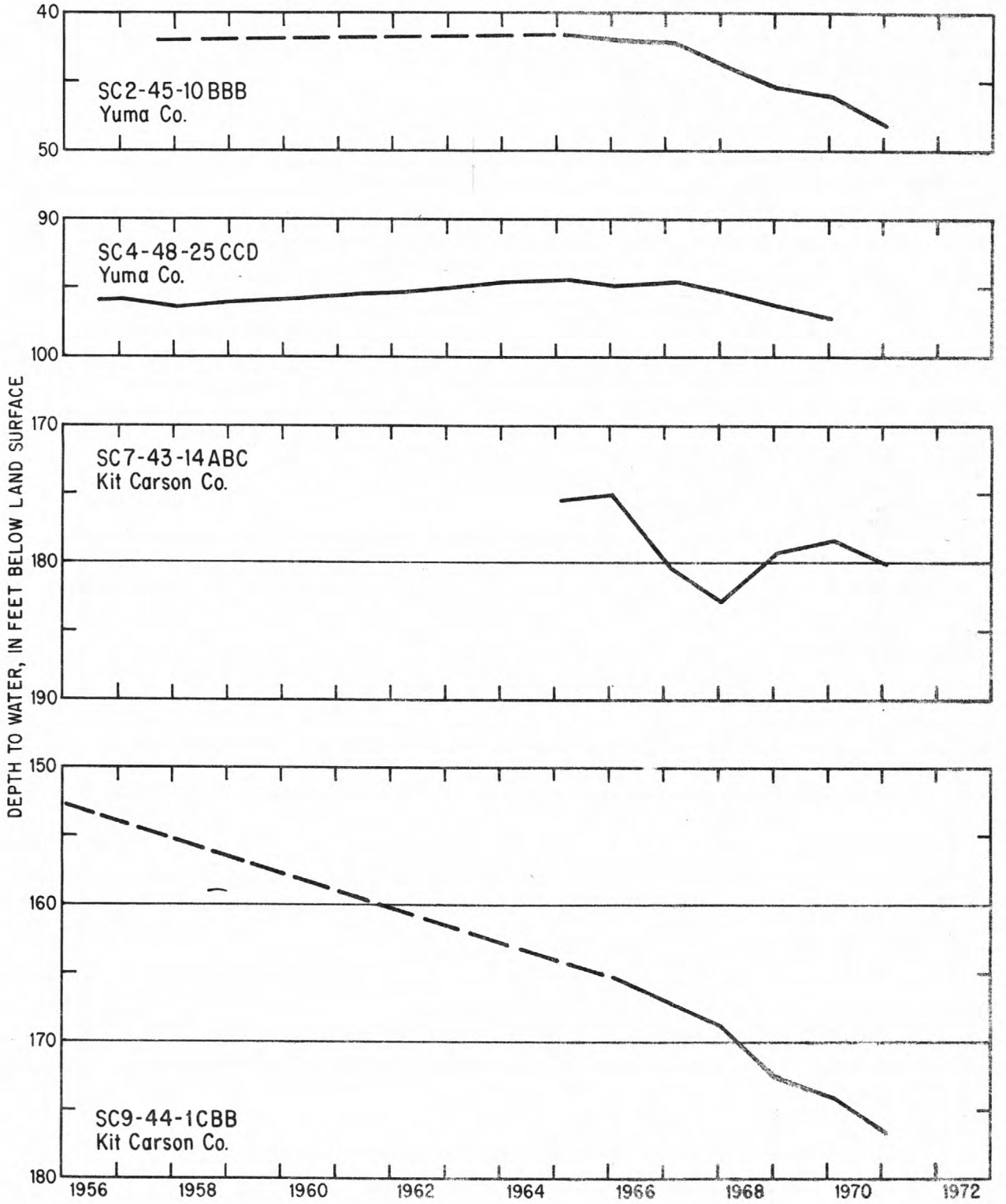

Figure 3. --Hydrographs of typical observation wells.

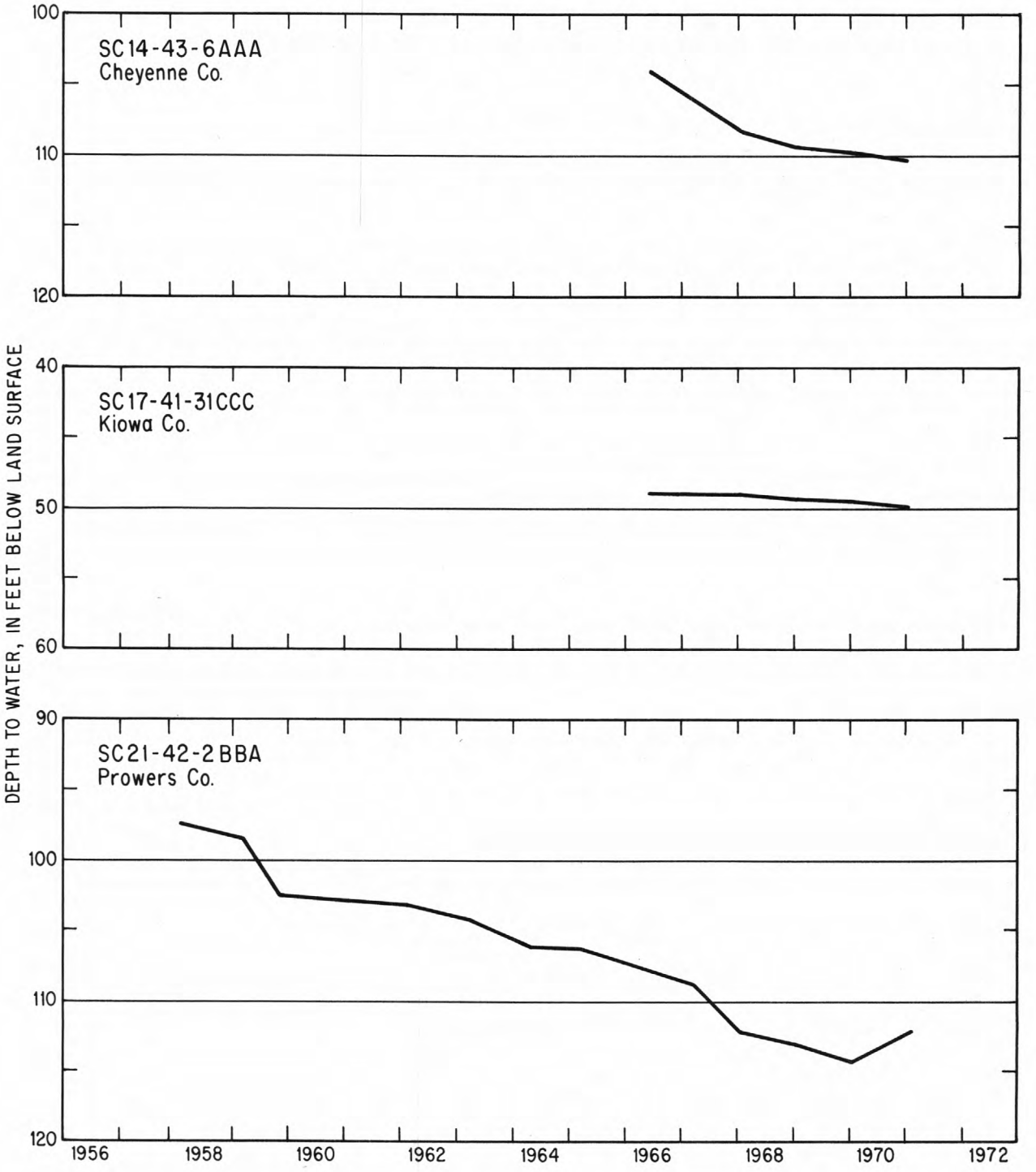

Figure 4. --Hydrographs of typical observation wells.

SYSTEM OF NUMBERING WELLS AND TEST HOLES

The well numbers on the hydrographs (figs. 2-4) indicate the locations of the wells. The numbers are based on the U.S. Bureau of Land Management system of land subdivision, and show the location of the site by principal meridian, quadrant, township, range, section, and position within the section. A graphic illustration of this method of describing the location of a well is shown in figure 5. The first letter, S preceding the location number means that the site is located in the area governed by the sixth principal meridian. The second letter, C (also preceding the location number), indicates the quadrant in which the well is located. Four quadrants are formed by the intersection of the base line (the fortieth parallel) and the principal meridian--A indicates the northeast quadrant, B the northwest, C the southwest, and D the southeast. The first numeral indicates the township, the second the range, and the third the section in which the well is located. The letters following the section number locate the well within the section. The first letter denotes the quarter section, the second the quarter-quarter section, and the third the quarter-quarter-quarter section. The letters are assigned within the section in a counter-clockwise direction, beginning with A in the northeast quarter. Letters are assigned within each quarter section and within each quarter-

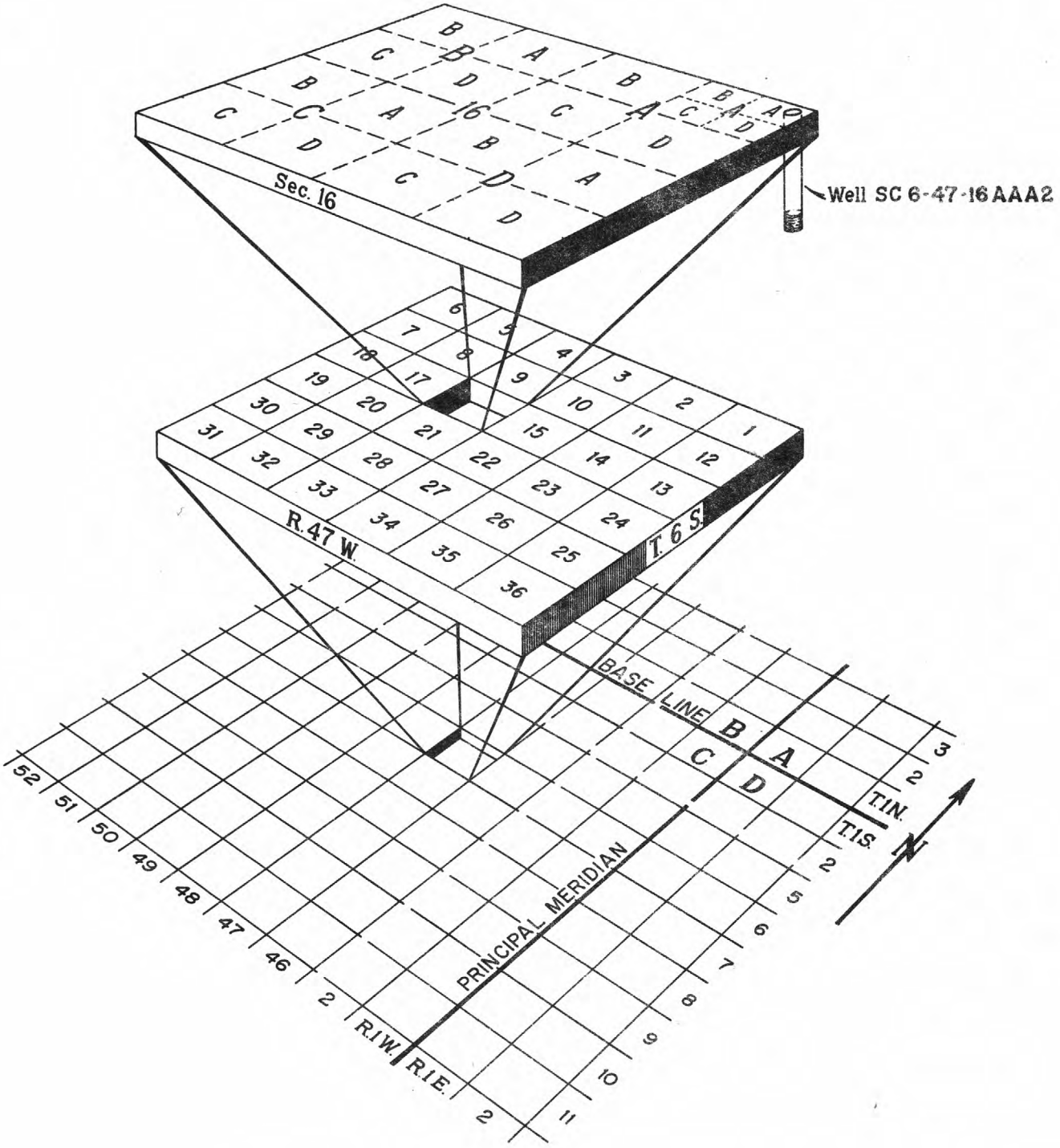

Figure 5. --System of numbering wells and test holes.

quarter section in the same manner. Where two or more locations are within the smallest subdivision, consecutive numbers beginning with 1 are added in the order in which the wells were inventoried. For example, SC6-47-16AAA2 indicates a well in the NE¼NE¼NE¼ sec. 16, T. 6 S., R. 47 W.; the 2 indicates this to be the second well inventoried in the quarter-quarter-quarter section. The C indicates the township is south of the base line and that the range is west of the sixth principal meridian.

The above described well-numbering system is based on the assumption that each section is square, 1 mile on each side and that the section lines are north-south and east-west lines. When sections are not square or 1 mile on a side, or section lines are not properly oriented, the system provides a grid for locating wells and the letter designations may or may not correspond to the legal descriptions of the tracts where the wells are located, depending on the magnitude of deviation of the section from the ideal size, shape, and orientation.

REFERENCE CITED

Boettcher, A. J., Hofstra, W. E., and Major, T. J., 1969, Water-level records for the northern High Plains of Colorado: Colorado Water Conserv. Board Basic-Data Release 20, 189 p.

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