

## INTRODUCTION

The northern High Plains of Colorado is an area of about  $9,500 \text{ mi}^2$  (24,600 km<sup>2</sup>) in the eastern part of the State (index map). The boundaries of the High Plains of Colorado are the State line and the limit of the Ogallala Formation of late Tertiary age. The Ogallala Formation is an unconsolidated or partly consolidated deposit of sand, gravel, clay, and silt and is the major aquifer in the northern High Plains.

Water levels in much of the Ogallala Formation have been declining because groundwater pumping for irrigation is removing ground water from storage. Knowledge of the amount and extent of water-level declines is necessary for management of the ground-water resource.

Water-level records for the northern High Plains of Colorado are collected by the U.S. Geological Survey in cooperation with the Colorado Department of Natural Resources, Division of Water Resources, Office of the State Engineer. Measurements are made generally once a year in the winter, when water levels have recovered from pumping during the previous irrigation season, to determine the effects of the pumping on the amount of ground water in

This report was prepared in cooperation with the Colorado Department of Natural Resources, Division of Water Resources, Office of the State Engineer. The hydrograph for the well near Burlington, Kit Carson County, was prepared from water-level data supplied by D. E. Konrad, Colorado State University Extension Service.

## WATER-LEVEL CHANGES

Water levels in the Ogallala Formation fluctuate slightly in areas with little pumping, often showing long-term gains or declines which are related to changes in recharge from precipitation -- the only source of recharge. In areas where pumping for irrigation predominates, the water levels have steadily declined, the rate of decline depending on the volume of water withdrawn. Water-level changes in the northern High Plains from 1964 to 1976 and from 1972 to 1976 are shown on the principal maps.

Fewer water-level measurements are available for 1964 than for 1972 or 1976. Therefore, the areas of decline for 1964 to 1976 are based on data from the few wells and by comparison with 1972 to 1976 areas of decline. Hydrographs for selected wells show yearly water-level changes.

Water-level changes from 1964 to 1976 ranged from a rise of 8 to 16 ft (2.4 to 4.9 m) along the Phillips-Sedgwick County line and in part of Logan County to a decline of 24 to 40 ft (7.3 to 12 m) near Burlington, Kit Carson

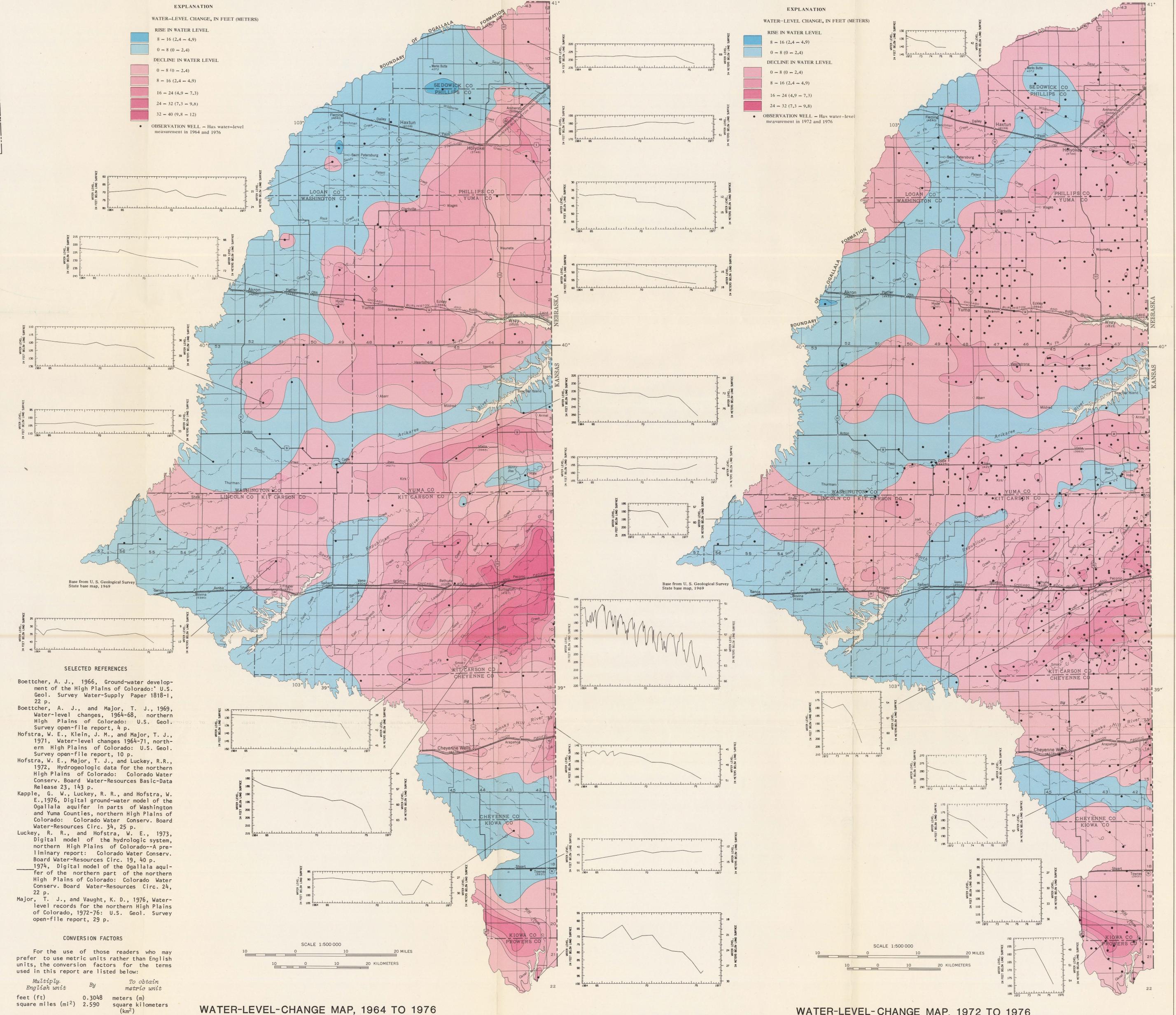
Water levels in much of the area along the western edge of the northern High Plains rose from 0 to 8 ft (0 to 2.4 m). Other areas with a similar rise are in northern Kiowa and southern Cheyenne Counties, near the Arikaree River, and near the South and North Forks of the Republican River. Areas with water-level rises generally have few irrigation wells, because the aquifer is thin and unable to yield sufficient water to numerous irrigation wells.

About 60 percent of the northern High Plains had water-level declines from 1964 to 1976; declines in most of that area were less than 16 ft (4.9 m). The area near Burlington with the greatest declines (32 to 40 ft or 9.8 to 12 m) was ringed by a larger area with a 16- to 32-ft (4.9- to 9.8-m) decline. An area along the Kiowa-Prowers County line also had declines of 16 to 32 ft (4.9 to 9.8 m).

The greatest water-level rise from 1972 to 1976 was 8 to 16 ft (2.4 to 4.9 m) near Akron. Construction details for the well showing this rise are incomplete and the well may be open to another aquifer in addition to the Ogallala Formation. Much of the area with a 0- to 8-ft (0- to 2.4-m) rise from 1964 to 1976 had a similar rise from 1972 to 1976.

The greatest water-level decline was 24 to 32 ft (7.3 to 9.8 m) in a small area northeast of Burlington and along the Kiowa-Prowers County line. Most of the rest of the area had declines less than 8 ft (2.4 m).

Water levels have been declining more rapidly in recent years because of increased pumping. About half of the 1964 to 1976 decline near Burlington has occurred since 1972. Much of the water-level decline near the Kiowa-Prowers County line has taken place since 1972. Some of Sedgwick County, in the northern part of the area, shows an overall rise in water levels from 1964 to 1976, but a decrease in water levels from 1972 to 1976. Many hydrographs of wells in areas where waterlevels have declined also reflect the increase in the rate of declines, especially after 1974.



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WATER-LEVEL-CHANGE MAP, 1972 TO 1976