TEXAS BOARD OF WATER ENGINEERS

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BULLETIN 5202

SUMMARY OF GROUND-WATER DEVELOPMENT IN THE PECOS AREA, REEVES AND WARD COUNTIES, TEXAS 1947-51

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INTRODUCTION

This is a progress report which presents a summary of the development of ground water for irrigation in Reeves County and western Ward County, Tex., from 1947 to the spring of 1951.

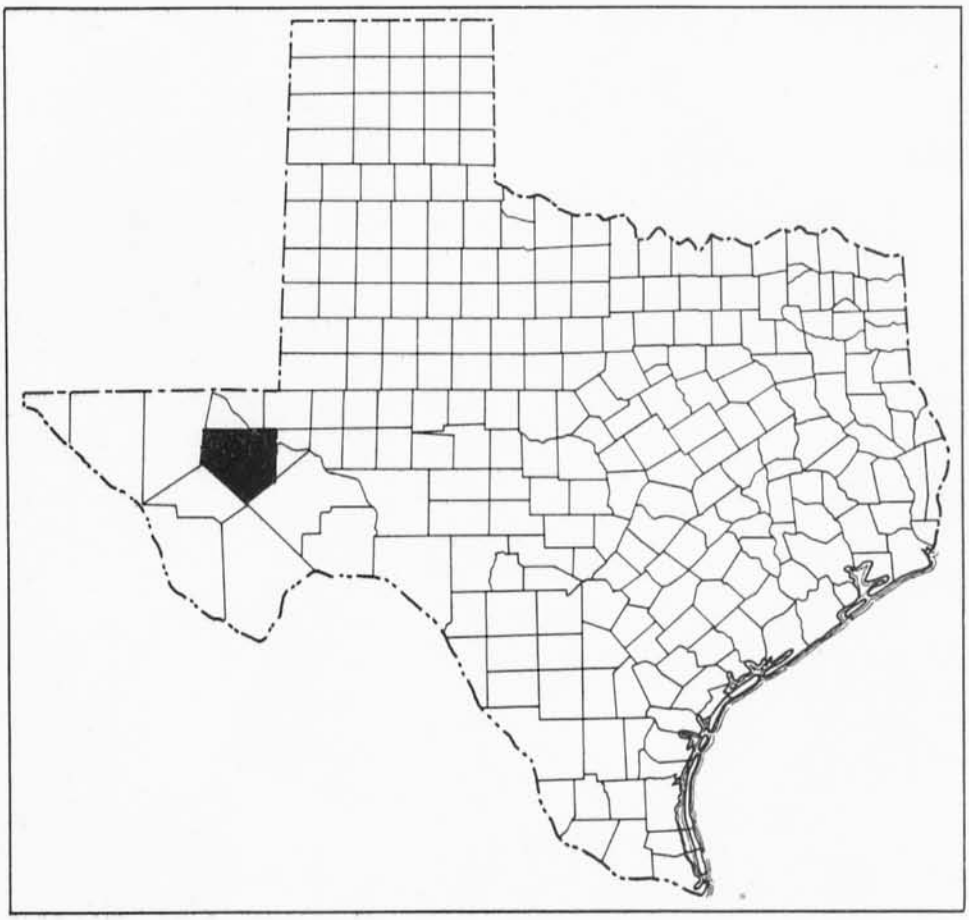

FIGURE 1.-Map of Texas showing area covered in Reeves and Ward Counties.

The field work upon which this report is based is part of a state-wide investigation of the ground-water resources of Texas, which is being made by the United States Geological Survey in cooperation with the Texas Board of Water Engineers. The purpose of the investigation is to determine the occurrence, movement, discharge, recharge, quality, and quantity of ground water available for beneficial uses. Progress reports are issued to present data of immediate use or interest.

Although several water-bearing formations in the Pecos area yield ground water suitable for irrigation, livestock, or human consumption, the aquifer of major economic importance for irrigation from wells in central Reeves County and western Ward County is alluvium of Quaternary age. Ground water in the alluvium is suitable for irrigation throughout most of the extent of the reservoir. Water levels in the alluvium range from slightly above the land surface to 200 feet below the land surface, depending upon the location.

Lava of Tertiary age in southern Reeves County yields water of excellent quality but, owing to the nature of the terrain, irrigation is not practical and water from the lava is used chiefly for domestic and livestock purposes.

Sandstone and limestone of Cretaceous age yield water of good quality to large springs in the Balmorhea area.

The Santa Rosa (?) sandstone of Triassic age, which occurs in the eastern part of Reeves County and the central part of Ward County east of Barstow, yields small quantities of potable water for municipal uses.

The Rustler formation of Permian age yields water suitable for irrigation but generally lies at depths so great as to preclude large-scale development.

The primary purpose of this report is to show the changes in the static water levels in wells that have been drilled into the alluvium in the vicinity of Pecos. The changes in water levels are primarily declines that have resulted from pumping large-capacity wells in the irrigated areas.

Static water levels are measured, in general, in February or March, near the end of the period of least pumping. Altitudes of wells were determined by instrumental leveling. The altitude of the water surface was determined by subtracting the measured depth to water in the well from the surface altitude of the well.

The estimate of the quantity of ground water pumped during an irrigation season is based upon measurement of the discharge of approximately 10 percent of the wells in use, on the number of acres irrigated by each well measured, on the amount of time each well was pumped, and on the total number of acres irrigated. The number of wells in use was determined by well inventory. The acreage irrigated each year was determined by acreage inventory, except the acreage for 1950 in Reeves County which was reported by the Pecos office of the Production and Marketing Administration of the United States Department of Agriculture.

USE OF GROUND WATER FOR IRRIGATION

Irrigation with water from wells was practiced in the Pecos area before 1900. The amount of land irrigated was small and the practice was limited to the immediate vicinity of Pecos, where flowing wells could be obtained. Irrigation with water from springs in the Balmorhea area has been practiced for many years. This report, however, is concerned only with the development of irrigation wells.

In 1940 approximately 50 wells were used in Reeves County and western Ward County. Of this number about 35 were in Reeves County 2 to 6 miles west and 11 to 17 miles southwest of Pecos, and the remainder were in Ward County near Barstow.

In 1946 a rapid land development began in Reeves County. The following table shows the estimated number of wells in use, the number of acres irrigated, the quantity of ground water pumped, and the quantity of water applied per acre irrigated in Reeves County.

Table 1.- Irrigation development in Reeves County

Year	Number of wells used	Number of acres irrigated	Pumpage in acre-feet	Acre-feet per acre
1940	35	2,460	11,000	4.4
1946	60	4,200	14,500	3.5
1947	82	5,800	16,000	2.8
1948	215	35,000	70,000	2.0
1949	380	50,000	100,000	2.0
1950	355	60,000	160,000	2.7

Although the number of wells in use in Reeves County during 1950 was less than in 1949, the pumpage increased by about 60,000 acre-feet. The increased withdrawal of water may be attributed to several factors, among which are the abandonment of a number of wells of low yield, the deepening of a number of existing wells, the drilling of new wells of high yield, and the partial replacement of cotton, which is the staple crop of the area, by crops requiring larger amounts of water.

In the Barstow area in Ward County much of the ground water has been used to supplement surface water from the Pecos River. As a result of deficiencies in surface-water supplies the number of irrigation wells in use increased from 15 in 1940 to 67 in 1950. The quantity of ground water pumped in the Barstow area was 20,000 acre-feet or more during each of the years 1948 and 1949. In 1950 the pumpage was reduced to approximately 10,000 acre-feet, owing to an increased amount of available surface water.

DECLINES OF WATER LEVELS IN WELLS

Declines of water levels in a water-bearing formation, which are caused by the withdrawal of large quantities of water, are of concern to the ground-water users. With reference to the Pecos area, Knowles and Lang (1947, pp. 26-27) stated:

> "Large-scale development of ground water for irrigation will necessarily result in concentration of wells in relatively small areas because much of the land of the alluvial basin is not suitable for irrigation. This condition precludes uniform distribution of wells throughout the regional extent of the aquifer. The amount of water that can be withdrawn economically at any one place depends not upon the quantity of water in storage but upon the transmission capacity of the aquifer, and eventually upon the rate of recharge at the areas of intake which lie along the western and southern boundaries of the basin. The transmission capacity of the aquifer is of immediate importance. If the wells are too closely spaced and the rate of withdrawal in any locality during the irrigation season exceeds the transmission capacity of the aquifer in that locality, the yield of the wells may begin to decline within a short time and the pumping lift will increase perhaps beyond the economic limit."

In the vicinity of Pecos the moderate increase in irrigation during the period 1940-47 was accompanied by only moderate declines in the ground-water levels; the maximum recorded decline in the irrigated areas was 4 feet. There was little or no change in water levels in the nonirrigated areas. Since 1947 the accelerated withdrawal of ground water has been accompanied by a greater decline in water levels and by a decrease in the yields of many wells during the pumping seasons. From 1947 to 1950 the effects of pumping spread to such an extent that declines were recorded over an area of about 900 square miles. The area in which the decline was 5 feet or more amounted to about 300 square miles by 1950 and more than 330 square miles by 1951. In the area most greatly affected, the maximum decline recorded from 1950 to 1951 was 21.7 feet, and the maximum decline recorded for the 4-year period 1947-51 was 49.8 feet.

In the Barstow area declines of water levels were negligible during the year 1950, and in most of the area small rises resulted from decreased pumping and from recharge by surface water flowing in the canals.

The declines or rises of water levels in 183 wells for 1949-50, in 147 wells for 1950-51, and in 56 wells for the period 1947-51 are shown in figures 2, 3, and 4, respectively.

DIRECTION OF GROUND-WATER MOVEMENT AND EXTENT OF THE ALLUVIAL RESERVOIR

The altitudes and measurements of water levels in 152 wells were used to prepare the map shown in figure 5. Contours were drawn connecting points of equal altitude of the water surface in wells. The contours indicate the slope of the water surface or artesian-pressure surface in the same manner as a topographic map shows the slope of the land surface. Ground water in the unconsolidated alluvial material moves at right angles to the contours of the water surface, indicating that recharge to the underground reservoir occurs in the southern, western, and northern parts of the reservoir.

The western and southern limits of the principal alluvial reservoir are shown by the abrupt change in slope of the water surface from about 15 feet per mile within the reservoir to about 125 feet per mile at the edge.

The relation of the parts of the ground-water reservoir on opposite sides of the Pecos River in the Pecos-Barstow area was investigated. Figure 6 shows the fluctuations of water levels in well E48, Reeves County, and well A74, Ward County. The hydrographs represent the daily high water levels as obtained from charts of recording gages. The large fluctuations are attributed to the pumping of well E235, Reeves County. No other large-capacity well was operated within a mile of the recorder sites throughout the 1950 pumping season. Although the magnitude of fluctuation in well A74 is small, the configuration of the two graphs is similar and indicates that the effect of pumping well E235 extended to both well E48 and well A74, even though they are separated by the river.

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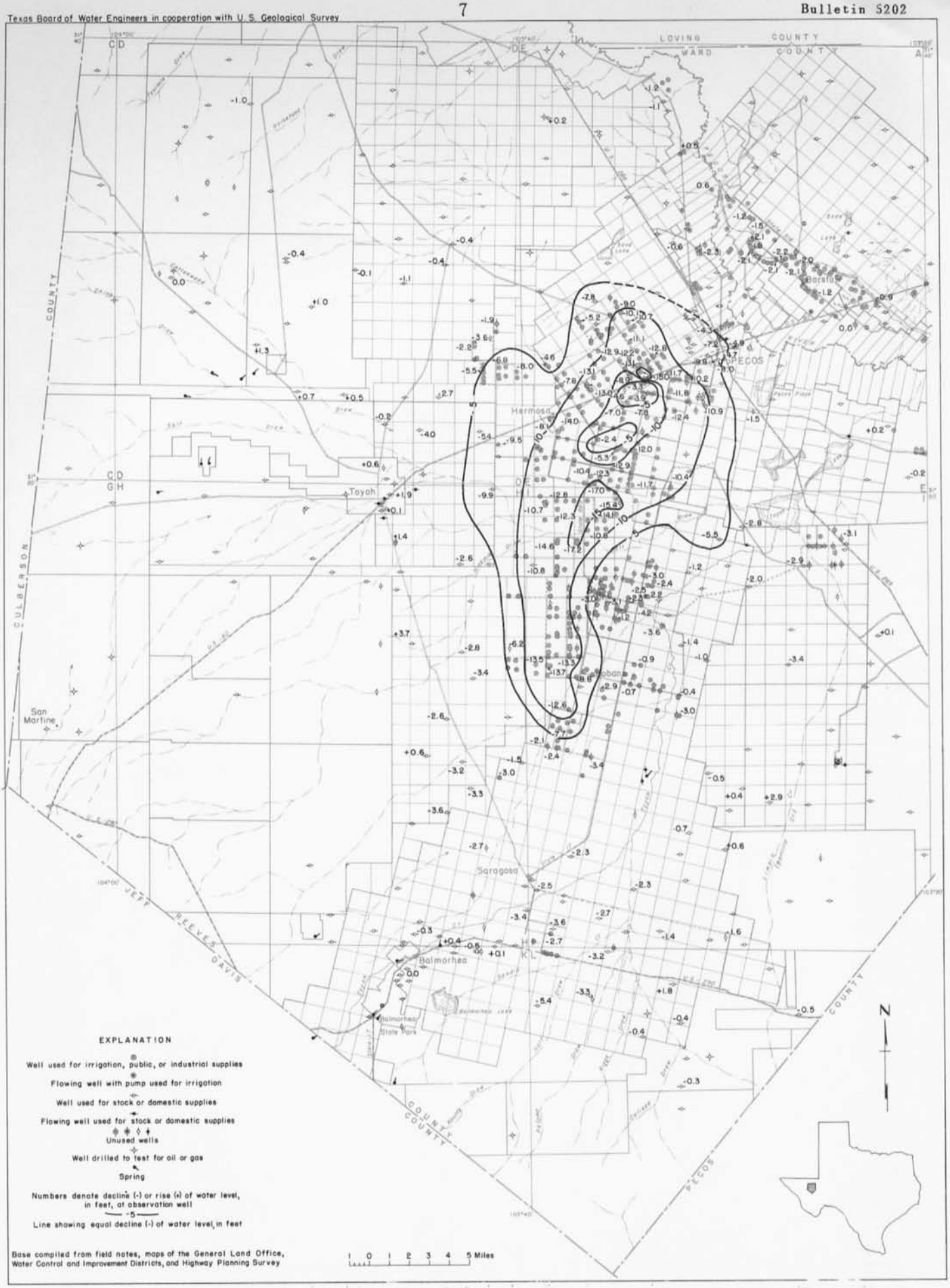

FIGURE 2.-Map of parts of Reeves and Ward Counties, Texas, showing irrigation wells, January 1950 and changes in water level from March 1949 to March 1950.

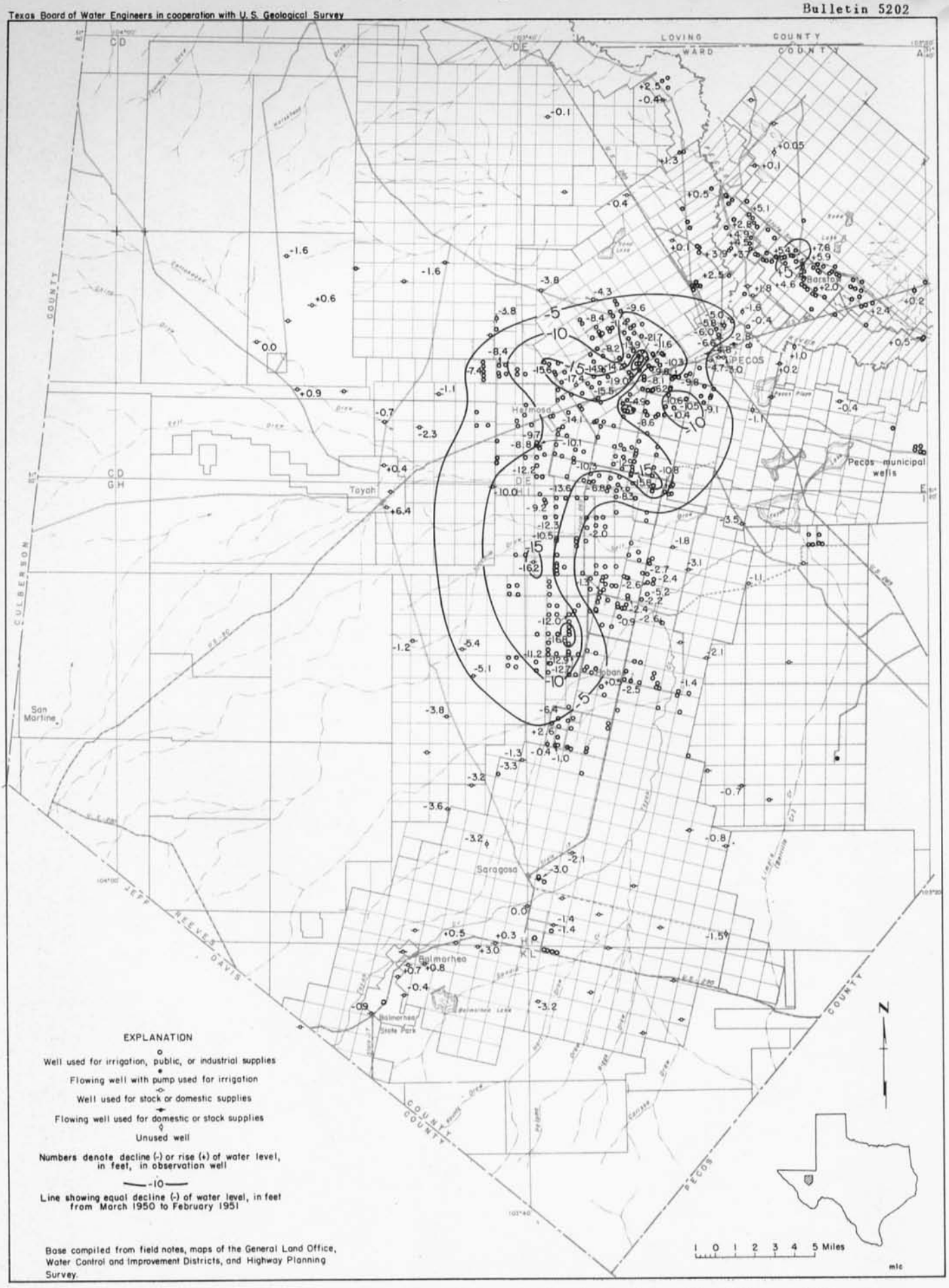

FIGURE 3.-Map of parts of Reeves and Ward Counties, Texas, showing irrigation wells, February 1951 and changes in water level from March 1950 to February 1951.

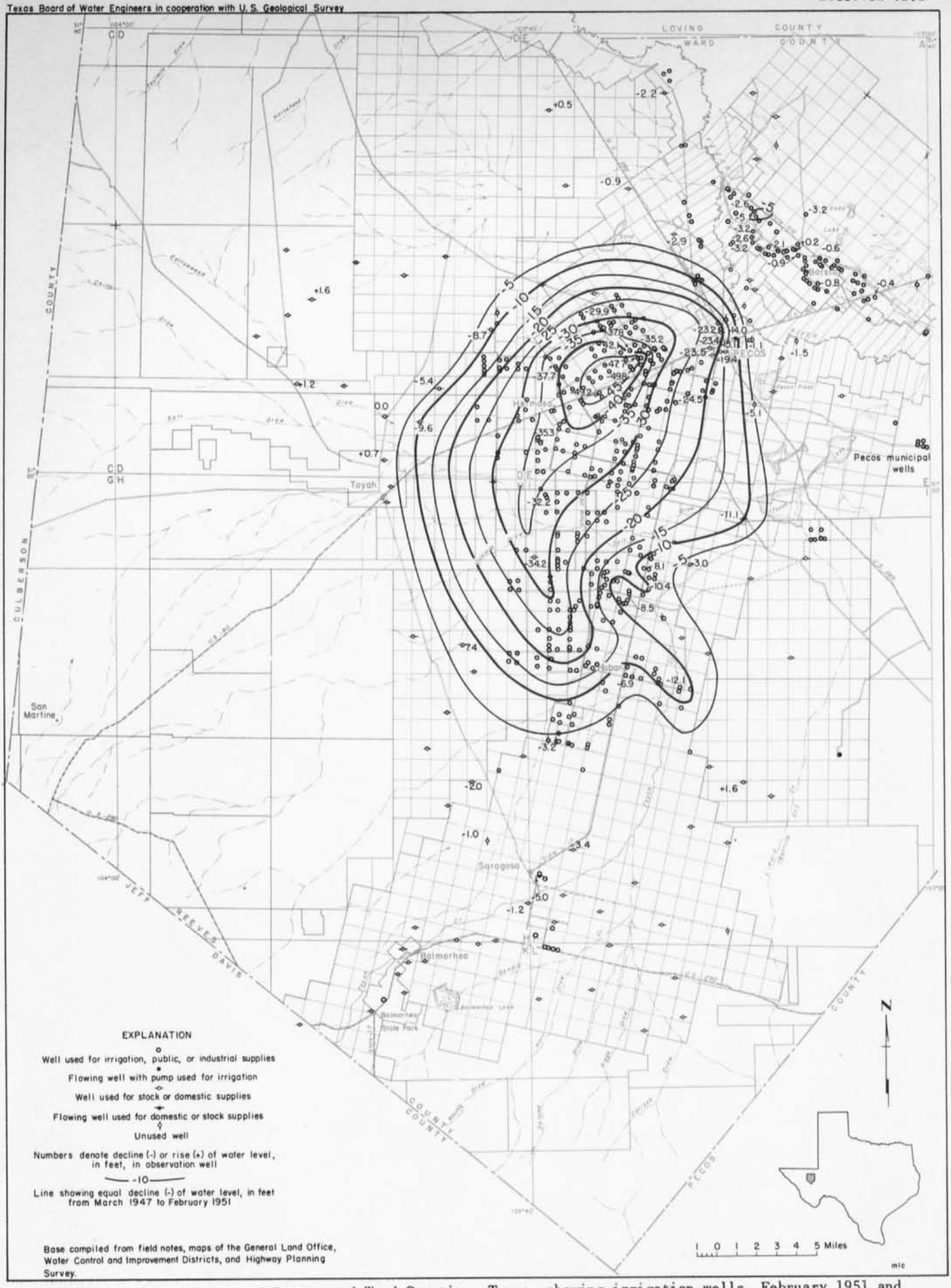

FIGURE 4.-Map of parts of Reeves and Ward Counties, Texas, showing irrigation wells, February 1951 and changes in water level from March 1947 to February 1951.

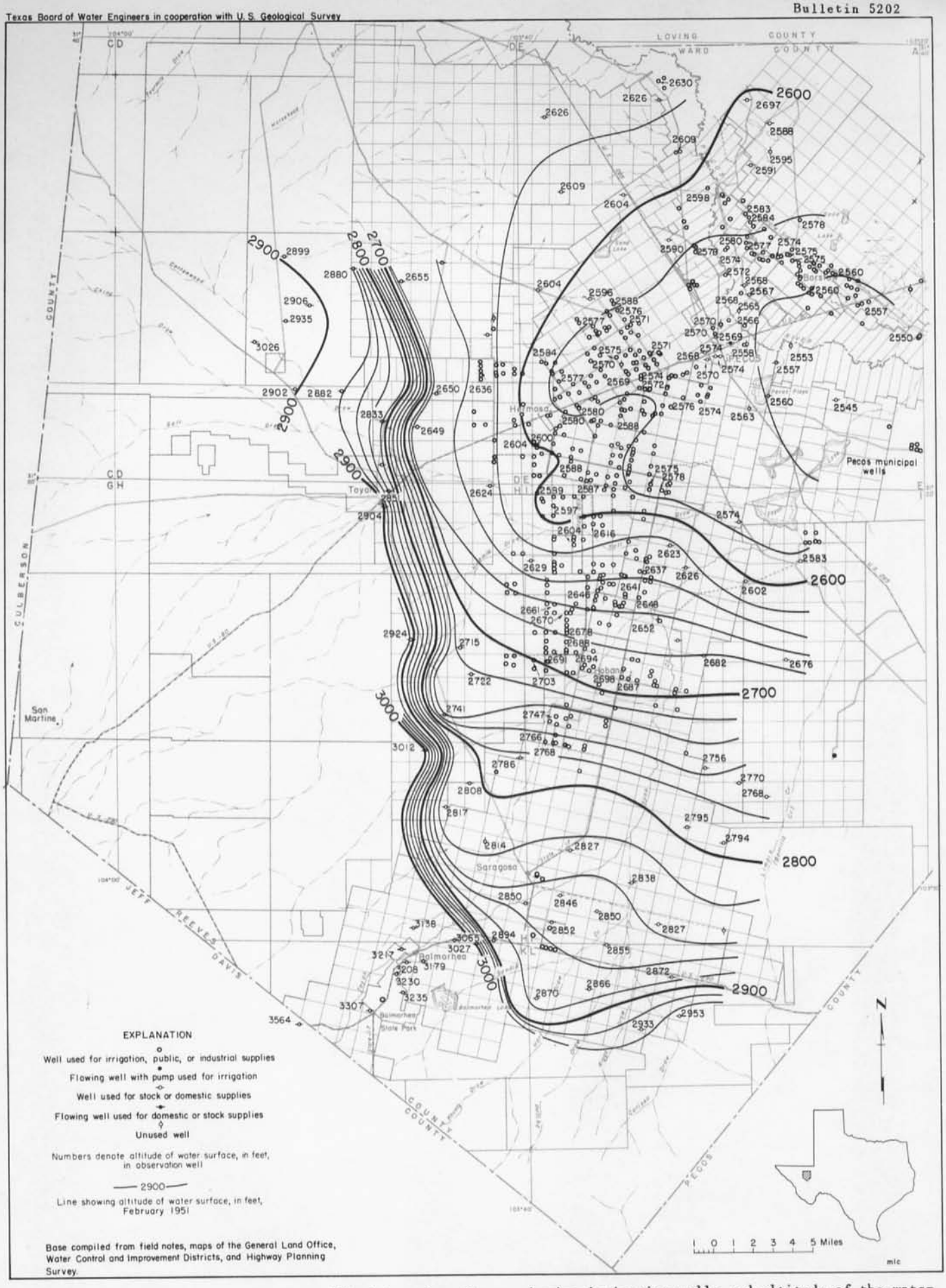

FIGURE 5.-Map of parts of Reeves and Ward Counties, Texas, showing irrigation wells and altitude of the water surface, February 1951.

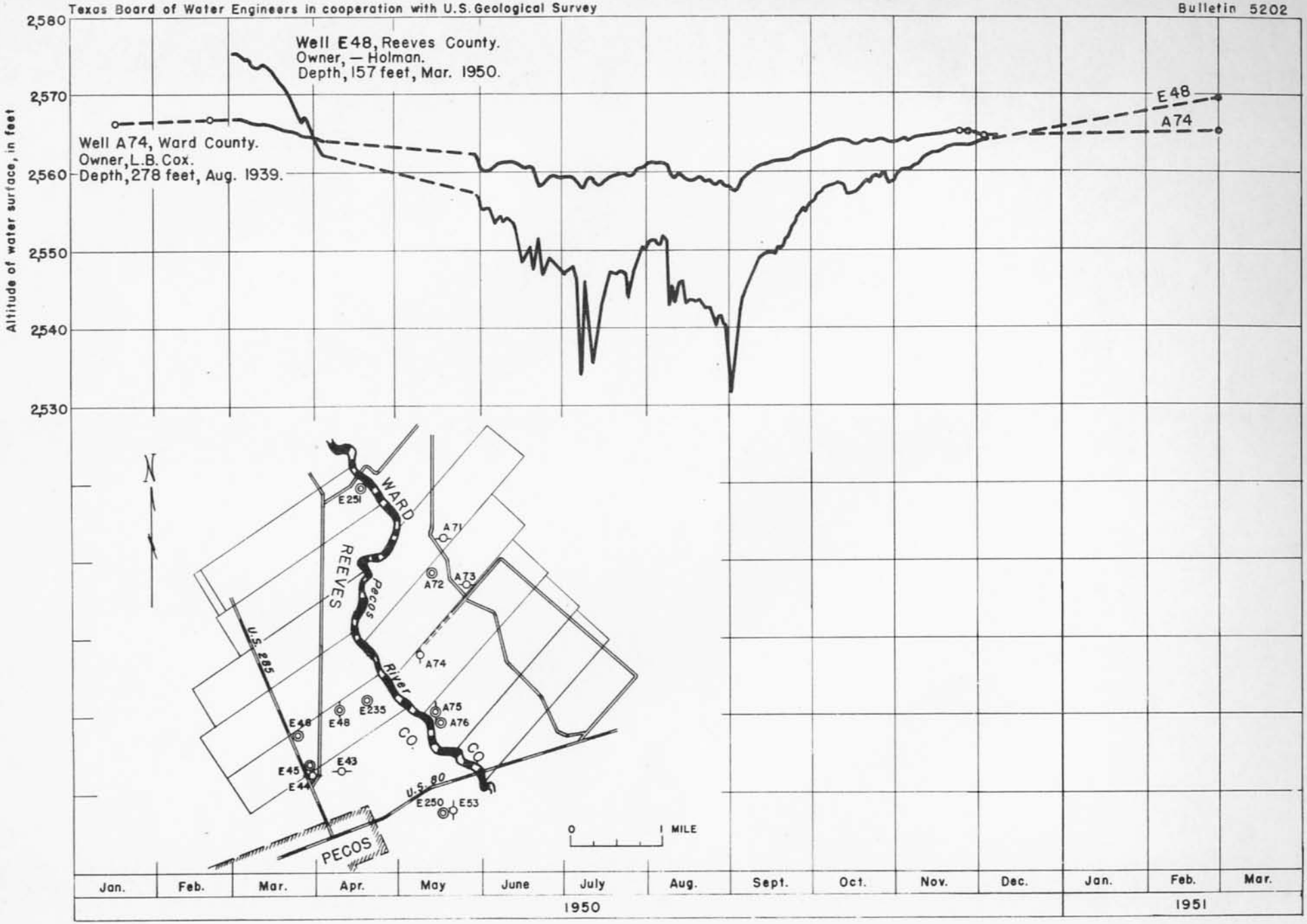

FIGURE 6.- Fluctuations of water levels in well E48, Reeves County, and well A74, Ward County, Tex.