

# INTRODUCTION

The Jasper aquifer system in Rapides and Vernon Parishes in west-central Louisiana has been extensively developed for public supply use and to a lesser extent for industrial use. In northern Beauregard Parish, water from this aquifer system is pumped for industrial uses. In 1985, an average of 43.8 Mgal/d was pumped from the Jasper aquifer system in west-central Louisiana (J.K. Lovelace, U.S. Geological Survey, written commun., 1989).

Additional knowledge about ground-water flow and the effects of withdrawals on the Jasper aquifer system is needed for assessment of ground-water development potential and protection of the resource. To meet this need, the potentiometric surfaces of aquifers in the Jasper aquifer system and changes in those surfaces are being monitored as part of the U.S. Geological Survey's cooperative program with the Louisiana Department of Transportation and Development.

This report presents data and maps that illustrate the potentiometric surface in the fall of 1989 and water-level changes from 1984 to 1989 for the Williamson Creek and Carnahan Bayou aquifers of the Jasper aquifer system. Hydrographs of water levels from selected wells also are presented for both aquifers. The water-level data are on file at the U.S. Geological Survey.

The Jasper aquifer system contains freshwater to depths as great as 2,000 to 3,000 ft (Smoot, 1988) in much of Rapides, Vernon, and Beauregard Parishes, and part of Allen Parish. Development of the aquifer system, however, has been limited primarily to the northern part of the area where the aquifer system contains freshwater. Water-level data are not available for much of the area where the aquifer system occurs at depths greater than about 1,500 ft.

The potentiometric surface maps in this report are useful for determining direction of ground-water flow, hydraulic gradients, and the effects of withdrawals on the ground-water system. The rate of ground-water movement can be estimated from the gradient when the hydraulic conductivity of the aquifer is known.

This map report is the fourth in a series that shows potentiometric surface and water-level changes of aquifers in Louisiana (Fendick and Wyman, 1987; Fendick, 1989; Smoot and Seanor, 1991). Reports prepared as part of previous studies in west-central Louisiana with emphasis on the Jasper aquifer system are included in the Selected References.

# GEOHYDROLOGY

The Jasper aquifer system of southwestern Louisiana and southeastern Texas was defined and named by Turcan and others (1966). The sediments that constitute the Jasper aquifer system are part of the Fleming Formation. These sediments were deposited as an off-lapping sequence of continental, deltaic, and marine sediments along the northern flank of the Gulf Coast geosyncline (Martin and others, 1980). The aquifer system consists of the Williamson Creek aquifer (upper part), Dough Hills confining unit, and Carnahan Bayou aquifer (lower part). The correlation of the Jasper aquifer system and the other geologic units in west-central Louisiana is given in table 1.

The Williamson Creek and Carnahan Bayou aquifers consist predominantly of alternating beds of sand and clay, whereas the Dough Hills confining unit consists primarily of calcareous clay. The natural flow of water in the Jasper aquifer system before development generally was southeasterly from the recharge area along the dip of the formation, except along the western part of the State, where the flow was southward and where the ground water discharged to the Sabine River. However, pumping in north-central Rapides Parish, central Vernon Parish, and northern Beauregard Parish has altered the direction of flow in the aquifer system. Both aquifers are under artesian conditions, except in the recharge area where they may be under water-table conditions.

The recharge area of the Williamson Creek aquifer is within Vernon and Rapides Parishes, as shown in figures 1 and 2. Freshwater (dissolved solids concentration of 1,000 milligrams per liter or less) in this aquifer extends downdip to Beauregard, Allen, Evangeline, and Avoyes Parishes. The downdip extent of freshwater, shown in figures 1 and 2, was determined from geophysical logs and water-quality data. The Williamson Creek aquifer ranges in thickness from about 400 ft near its recharge area to 900 ft in southern Vernon Parish (Rogers, 1965, p. 26).

The recharge area of the Carnahan Bayou aquifer is within Vernon, Sabine, Rapides, and Natchitoches Parishes, as shown in figures 6 and 7. Freshwater in this aquifer extends downdip to Beauregard, Allen, and Rapides Parishes (figs. 6 and 7). The Carnahan Bayou aquifer is about 540 ft thick near its recharge area in northwestern Vernon Parish and about 1,100 ft thick in southeastern Vernon Parish (Rogers, 1965, p. 21).

# POTENTIOMETRIC SURFACE

The potentiometric surface of the Williamson Creek aquifer in west-central Louisiana shown in figure 1 defines the altitude at which water levels in wells completed in this aquifer would have stood in the fall of 1989. The surface, for the most part, was interpreted from water-level measurements (table 2) made in wells completed in the lower part of the aquifer except outside of major pumping centers, where most wells are developed in the upper part of the aquifer.

The altitude of the potentiometric surface in the Williamson Creek aquifer ranged from 52 ft below sea level at a pumping center southwest of Alexandria in Rapides Parish to greater than 168 ft above sea level in the recharge area in northern Vernon Parish. Four cones of depression in the potentiometric surface have formed near major pumping centers. These centers are located near Leesville-Fort Polk in Vernon Parish, at a paper mill west of De Ridder in Beauregard Parish, at Alexandria in Rapides Parish, and southwest of Alexandria. The two cones of depression near Alexandria in Rapides Parish have coalesced to form an elongated depression.

# WATER-LEVEL CHANGES

Changes in water levels in the Williamson Creek aquifer from 1984 to 1989 are shown in figure 2. Water levels in most of the area recovered because of reduced pumping except near Fort Polk in Vernon Parish, where the water level declined 15 to 20 ft. The water-level recovery near De Ridder in Beauregard Parish during 1984-89 was 14 to 16 ft; in western Rapides Parish, the recovery was 20 to 34 ft; and in the Alexandria area in Rapides Parish, the water-level recovery generally was about 10 ft. However, the water level in one well in Alexandria recovered more than 40 ft.

The hydrograph of well Av-271 (fig. 3) shows very little water-level change during the past 20 years: the water-level declined less than 0.5 ft/yr from 1966 to 1982 and recovered less than 0.5 ft/yr from 1982 to 1989. The water-level trend in well Av-271 is representative of the water-level trend in areas of the aquifer away from major pumping centers. The hydrograph of well R-1085B (fig. 4) shows the water level in that well declined 7 ft from 1975 to 1979. Since 1983, however, the water level in well R-1085B has been rising about 0.4 ft/yr. With seasonal fluctuations taken into account, the hydrograph of well R-18 near Alexandria (fig. 5) indicates a water-level recovery trend averaging 4.5 ft/yr for the past 20 years.

Table 1.--Stratigraphic and geohydrologic units in west-central Louisiana

System	Series	Stratigraphic unit	Geohydrologic unit
Tertiary	Pliocene	Blounts Creek Member	Evangeline aquifer
		Castor Creek Member	Castor Creek confining unit
		Williamson Creek Member	Williamson Creek aquifer
		Dough Hills Member	Dough Hills confining unit
		Carnahan Bayou Member	Carnahan Bayou aquifer
	Miocene	Lena Member	Lena confining unit
		Catahoula Formation	Catahoula aquifer

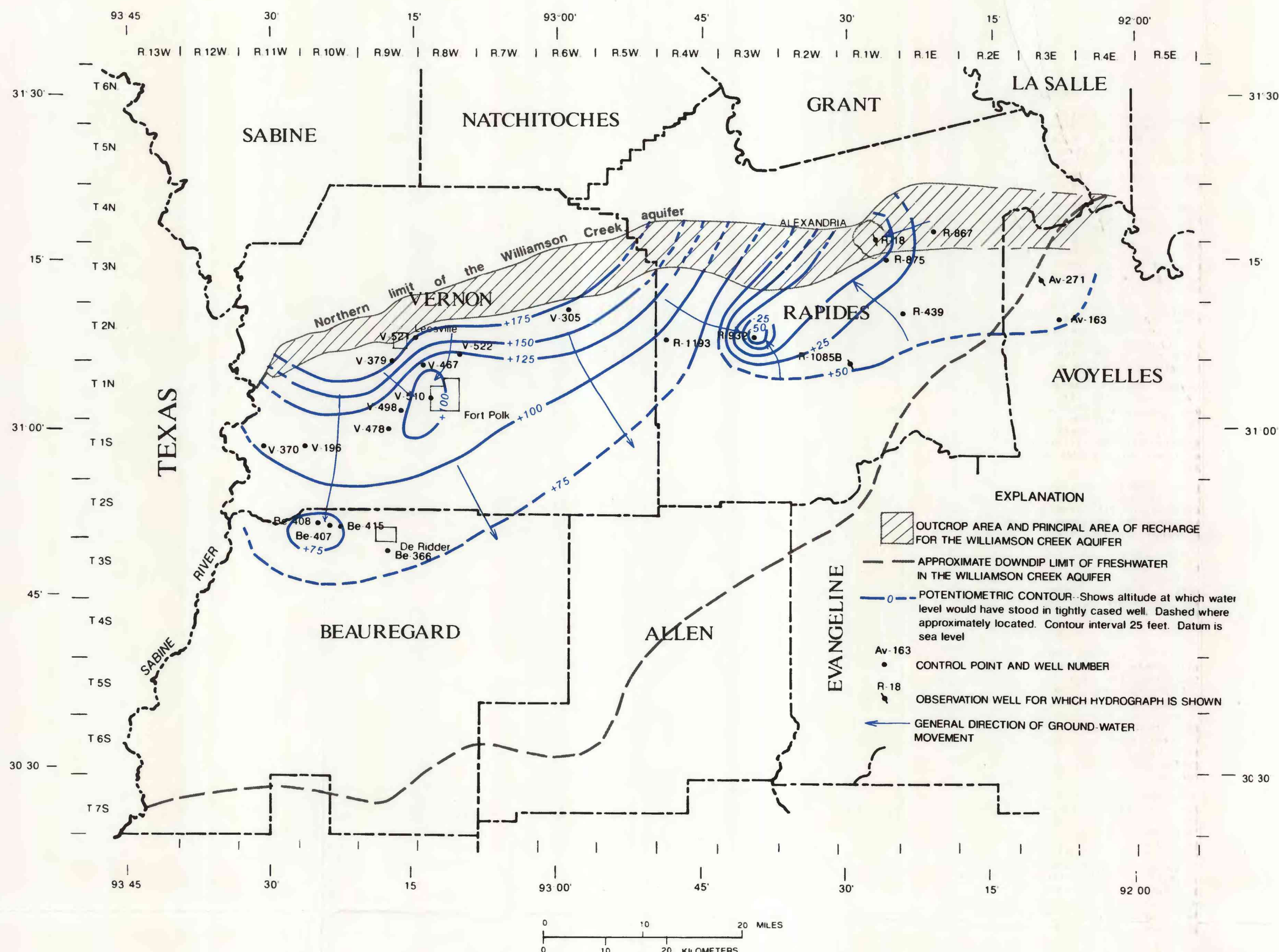


Figure 1.--Potentiometric surface of the Williamson Creek aquifer in west-central Louisiana, October-November 1989.

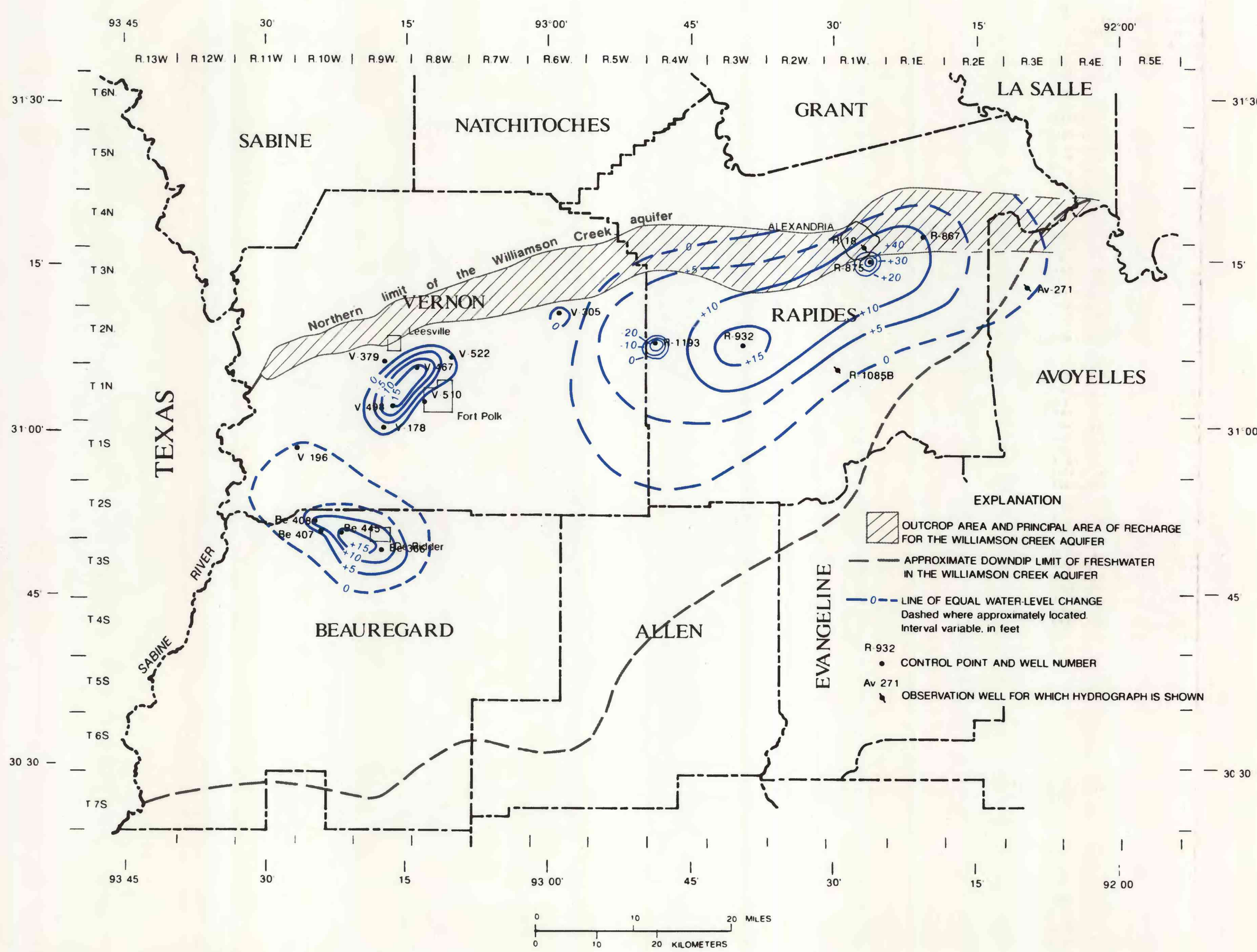


Figure 2.--Water-level changes in the Williamson Creek aquifer in west-central Louisiana, 1984-89.

## LOUISIANA GROUND-WATER MAP NO. 4: POTENTIOMETRIC SURFACE, 1989, AND WATER-LEVEL CHANGES, 1984-89, OF THE JASPER AQUIFER SYSTEM IN WEST-CENTRAL LOUISIANA

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Table 2.--Water-level data used to construct potentiometric surface of the Williamson Creek aquifer, October through November 1989, for parishes in west-central Louisiana

Well number	Well depth (feet)	Water level (feet below land surface)	Water level (feet above or below sea level)	Date measured
<b>Avoyes</b>				
Av-163	300	32.43	45.57	11-29
Av-271	370	63.57	31.43	11-22
<b>Beauregard</b>				
Be-366	1,207	94.20	85.80	11-20
Be-407	1,657	148.27	59.73	10-23
Be-408	1,686	138.10	63.90	10-23
Be-415	1,761	133.67	71.33	10-23
<b>Rapides</b>				
R-18	406	83.98	-4.98	11-13
R-439	460	35.45	40.55	11-28
R-465	364	130.80	-45.80	11-17
R-867	385	117.05	30.95	11-21
R-875	504	82.30	-0.30	11-13
R-932	466	237.45	-52.45	11-17
R-1085B	500	52.29	47.71	11-29
R-1193	571	116.20	90.80	11-28
<b>Vernon</b>				
V-196	503	126.43	116.57	11-15
V-305	350	116.99	168.01	11-20
V-370	342	18.20	102.80	11-15
V-379	274	49.15	180.85	11-16
V-467	560	216.05	103.95	11-20
V-478	1,010	211.70	108.30	11-16
V-498	1,008	110.96	109.04	11-16
V-510	900	208.60	96.40	11-16
V-521	350	111.80	168.20	11-16
V-522	588	205.74	119.26	11-16

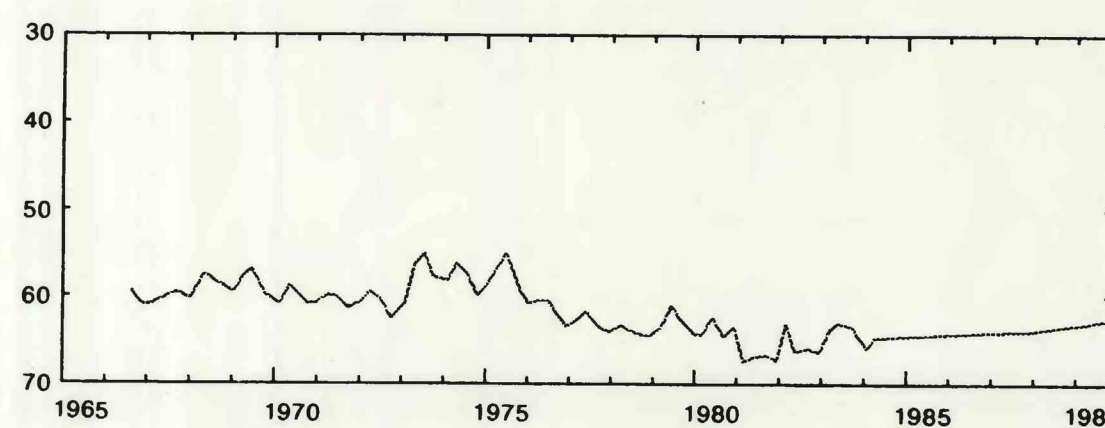


Figure 3.--Water level in well Av-271 (Avoyes Parish).

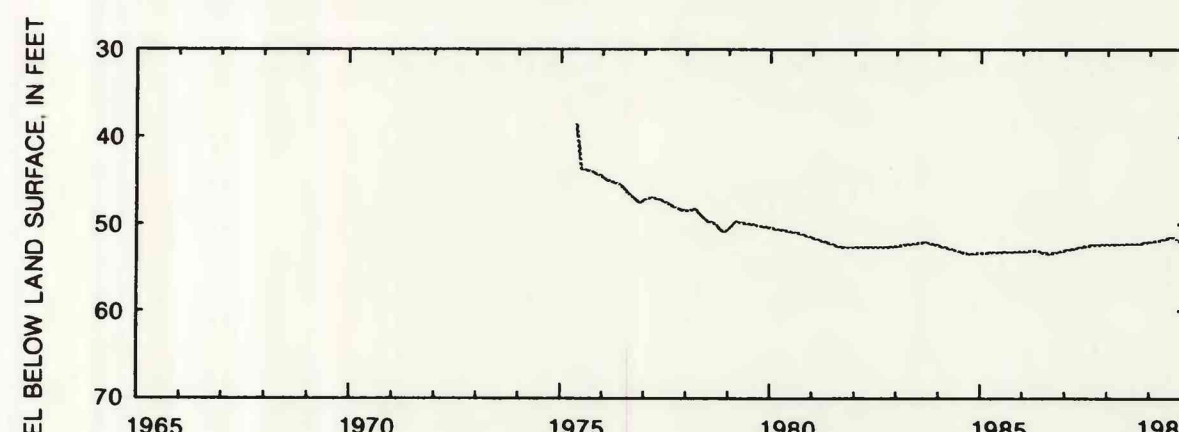


Figure 4.--Water level in well R-1085B (Rapides Parish).

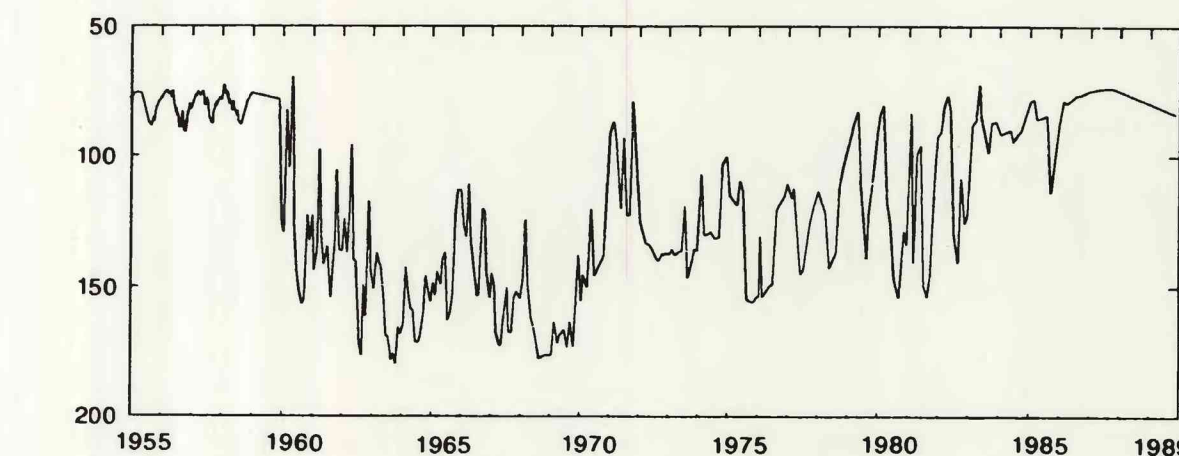
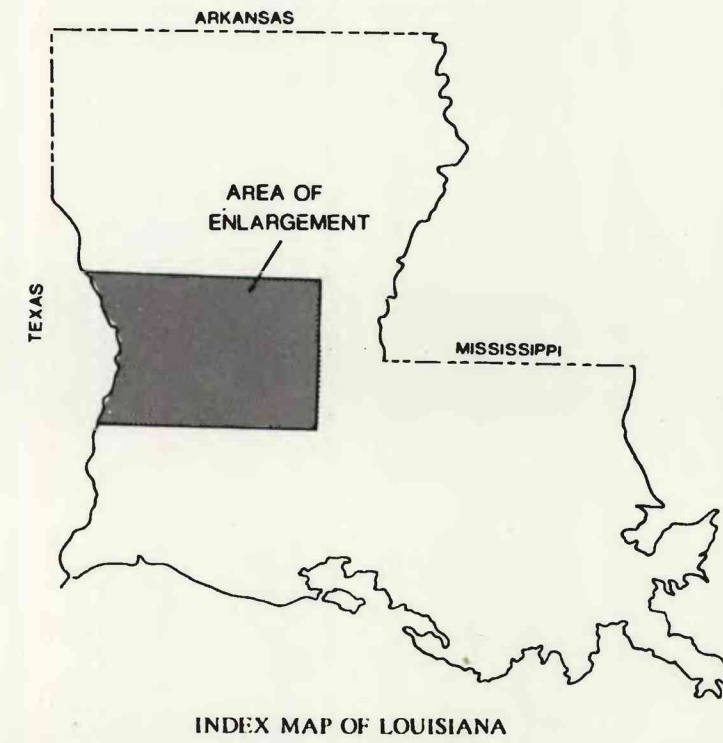


Figure 5.--Water level in well R-18 (Rapides Parish).



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