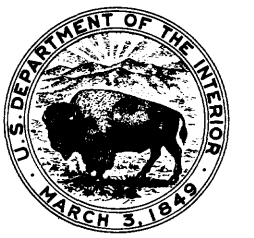
DEVELOPMENT OF GROUND-WATER RESOURCES IN THE ORANGE COUNTY AREA, TEXAS AND LOUISIANA, 1980-SPRING OF 1985

By C.W. Bonnet and James F. Williams III

U.S. GEOLOGICAL SURVEY
Water-Resources Investigations Report 87-4158



Prepared in cooperation with the
ORANGE COUNTY COMMISSIONER'S COURT

Austin, Texas
1987

DEPARTMENT OF THE INTERIOR

DONALD PAUL HODEL, Secretary

U.S. GEOLOGICAL SURVEY

Dallas L. Peck, Director

For additional information write to:

District Chief
U.S. Geological Survey
649 Federal Building
300 E. Eighth Street
Austin, TX 78701

For sale by:

U.S. Geological Survey
Books and Open-File Reports
Federal Center, Bldg. 810
Box 25425
Denver, CO 80225

CONTENTS

	Page
Abstract	1
Introduction	2
Purpose and scope	2
Previous investigations	2
Acknowledgments	5
Well-numbering system	5
Hydrogeology of the study area	6
Chicot aquifer	6
Areal extent and depth	6
Upper unit	6
Lower unit	6
Pumpage	6
Water levels	9
Water quality	16
Water-quality changes	16
Relation between specific conductance and chloride concentration	21
Evangeline aquifer	21
Ground-water issues and possible future studies	24
Summary	24
Selected references	25
Supplemental information	27

ILLUSTRATIONS

	Page
Figure 1. Index map showing location of the study area	3
2-6. Maps showing:	
2. Location of wells in the study area	4
3. Altitude of the bottom of the Chicot aquifer in Orange County	7
4. Approximate altitude of water levels in wells screened in the lower unit of the Chicot aquifer, spring 1985	10
5. Approximate change in water levels in wells screened in the lower unit of the Chicot aquifer, spring 1971 to spring 1985	11
6. Approximate change in water levels in wells screened in the lower unit of the Chicot aquifer, spring 1980 to spring 1985	12
7. Graphs of water levels in wells screened in the lower unit of the Chicot aquifer in Orange County, Texas, and Calcasieu Parish, Louisiana	17
8. Map showing range in chloride concentration in water contained in the lower unit of the Chicot aquifer in Orange County, 1984	18

ILLUSTRATIONS--Continued

		Page
Figure 9.	Profiles showing development of salinewater coning----------	19
10.	Map showing concentrations of chloride in water from wells screened in the lower unit of the Chicot aquifer at site A in southwestern Orange County----------	20
11.	Map showing concentrations of chloride in water from wells screened in the lower unit of the Chicot aquifer at site B in southeastern Orange County----------	22
12.	Graph showing relation between specific conductance and chloride concentration in water from the lower unit of the Chicot aquifer, Orange County, 1980-84----------	23

TABLES

Table 1.	Hydrogeologic correlations for eastern Texas and southwestern Louisiana----------	8
2.	Pumpage of ground water from the lower unit of the Chicot aquifer in Orange County, 1963-84----------	13
3.	Pumpage of ground water from the lower unit of the Chicot aquifer at major industrial sites in Orange County, 1963-84----------	14
4.	Reported pumpage of water from the lower unit of the Chicot aquifer for public supply in western Orange and eastern Hardin Counties, 1980-84----------	15
5.	Records of selected wells in the study area, 1979-84----------	28
6.	Drillers' logs of selected wells in the study area, 1979-84----------	30
7.	Water levels in observation wells in the study area, 1980-85----------	36
8.	Chemical analyses of water from wells in Orange County, 1980-84----------	43

CONVERSION FACTORS

Factors for converting inch-pound units to metric (International System) units are given in the following table:

Multiply inch-pound unit	By	To obtain metric units
foot (ft)	0.3048	meter
inch (in.)	25.40	millimeter
microsiemens per centimeter at 25°C (µS/cm)	1.000	micromho per centimeter at 25°C
mile (mi)	1.609	kilometer
million gallons per day (Mgal/d)	0.04381	cubic meter per second

National Geodetic Vertical Datum of 1929 (NGVD of 1929): A geodetic datum derived from a general adjustment of the first-order level nets of both the United States and Canada, formerly called "mean sea level."

GLOSSARY

Aquifer - A formation, group of formations, or part of a formation that contains sufficient saturated permeable material to yield substantial quantities of water to wells and springs.

Artesian well - A well in which the water level rises above the base of the bed confining the aquifer; an artesian well may be either flowing or nonflowing.

Base of freshwater - Top of the transition zone between freshwater and salinewater.

Cone of depression - The depression, approximately conical in shape, produced in a potentiometric suface by pumping (or artesian flow).

Confining bed - A body of markedly less permeable material stratigraphically adjacent to one or more aquifers that confine water in the aquifer so that the water level rises above the base of the confining bed.

Dip - The angle at which a stratum or any planar feature is inclined from the horizontal.

Freshwater - Variously defined as water containing less than 1,000 mg/L (milligrams per liter) dissolved solids or water containing 250 mg/L or less dissolved chloride. In this report, freshwater is defined as having 250 mg/L or less dissolved chloride.

Freshwater-salinewater interface - The boundary surface between two fluids of different density; the boundary is the sloping surface between freshwater and slightly salinewater in this report.

Milligrams per liter (mg/L) - For the purpose of converting to the metric system, the unit "milligrams per liter" replaces the unit "parts per million," formerly used by the U.S. Geological Survey. The two units are equivalent at dissolved-solids concentrations less than about 7,000 mg/L.

Salinewater - Water with a dissolved-solids concentration equal to or greater than 1,000 mg/L. Four classes of salinewater have been defined according to the concentrations of dissolved solids, in milligrams per liter: (1) slightly saline, 1,000 to 3,000; (2) moderately saline, 3,000 to 10,000; (3) very saline, 10,000 to 35,000; and (4) brine, greater than 35,000.

Salinewater coning (or vertical intrusion) - A phenomenon caused when two fluids of different density at dynamic equilibrium are made dynamically unstable because of pumping one of the fluids.

Salinewater encroachment (or intrusion) - The phenomenon occurring when a body of salinewater, because of its greater density or hydraulic head, encroaches (or intrudes) into a body of freshwater.

Salinewater wedge - In cross section, salinewater generally is wedge-shaped as it encroaches (or intrudes) into a body of freshwater. The leading edge of the wedge is at the base of the freshwater aquifer, the top of the wedge intersects the top of the freshwater aquifer in the coastal zone.

DEVELOPMENT OF GROUND-WATER RESOURCES IN THE ORANGE COUNTY AREA, TEXAS AND LOUISIANA, 1980-SPRING OF 1985

By
C. W. Bonnet and James F. Williams III

ABSTRACT

This report updates ground-water information pertaining to the lower unit of the Chicot aquifer in the Orange County area, Texas and Louisiana. The period of data collection was from 1980 to the spring of 1985. Some data collected prior to 1980 are presented to establish long-term trends and relations. The lower unit of the Chicot aquifer, which consists of sediments of Pleistocene age, is confined and underlies all of the study area. The base of the aquifer ranges from about 400 feet below National Geodetic Vertical Datum of 1929 in the northwestern part of the county to about 1,000 feet below National Geodetic Vertical Datum of 1929 in the southeastern part.

The lower unit of the Chicot aquifer is the main source of freshwater for several cities, communities, industries, housing subdivisions, and individual homeowners in Orange County. The total pumpage from the lower unit of the Chicot aquifer in Orange County decreased from a historical maximum of 23.1 million gallons per day during 1972 to an estimated 15.2 million gallons per day during 1984. The average industrial pumpage during 1980-84, 10.5 million gallons per day, decreased substantially when compared to 1963-79, when an average of 15.6 million gallons per day was withdrawn. This is in contrast to municipal pumpage that increased from an average withdrawal of 5.3 million gallons per day during 1963-79 to 7.3 million gallons per day during 1980-84. The use of surface water decreased from a peak withdrawal of 58.1 million gallons per day during 1981 to 41.4 million gallons per day during 1984.

From the spring of 1980 to the spring of 1985, water levels in the lower unit of the Chicot aquifer in the Orange County area ranged from rises of as much as 14 feet to declines of as much as about 3 feet. Water levels rose throughout most of the area. The greatest rise in water levels occurred in and near the city of Orange, whereas the greatest decline occurred northwest of Vidor.

Most of the water in the lower unit of the Chicot aquifer is fresh, but the water quality can vary greatly within short distances. Chloride concentrations determined during 1980-84 ranged from 10 to 1,700 milligrams per liter. The larger chloride concentrations were measured where salinewater coning and updip migration are occurring. In general, chloride concentrations remained constant during 1980-84.

A relation exists between chloride concentrations and specific conductance. It was determined that chloride concentrations (milligrams per liter) generally can be estimated by multiplying specific-conductance values (microsiemens per centimeter at 25 °Celsius) by 0.29 when the specific conductance is between 500 and 5,600 microsiemens per centimeter at 25 °Celsius.

INTRODUCTION

A program of continuing ground-water studies in Orange County, Texas, and adjacent areas in Texas and Louisiana (fig. 1) in cooperation with the Texas Department of Water Resources (currently the Texas Water Development Board) and the Sabine River Authority of Texas began in March 1967 due to the need for systematic monitoring and appraisal of the changing ground-water conditions. Water levels were declining, and salinewater encroachment was suspected along with the possibility of land-surface subsidence. In 1979, local cooperation was assumed by the Orange County Commissioner's Court. The continuing program includes the following items of work:

1. An inventory of all new large-capacity wells and the compilation of drillers' logs.
2. The establishment and maintenance of a network of observation wells for monitoring changes in water levels and changes in chemical quality, especially dissolved-chloride concentration.
3. An annual inventory of pumpage for municipal supply and industrial use.
4. The comparison of current data with previously collected data.

Purpose and Scope

This report presents data collected from 1980 to the spring of 1985, an analysis of the data, and limited inferences about future water quality based on synthesis of part of the historical hydrogeologic data. The location of wells for which data are included is shown in figure 2. The lower unit of the Chicot aquifer is the principal source of ground water in Orange County and, therefore, the focus of this study. A brief discussion of the hydrogeology also is presented. Although not specifically a purpose for this report, a relation was determined between specific conductance and chloride concentration in water from the lower unit of the Chicot aquifer in Orange County. Because this relation may be helpful in estimating chloride concentration, it is included in this report. For more detailed information, the reader is referred to the "Selected References."

The principal part of the area of data collection and study, as described in this report, is Orange County, Texas. When necessary to provide a better interpretation of ground water in Orange County, data also were collected from adjacent Jasper, Newton, Jefferson, and Hardin Counties, Texas, and Calcasieu and Cameron Parishes, Louisiana (fig. 1).

Previous Investigations

The geology and ground-water resources of Orange County and adjacent areas are described in reports by Baker (1964) on the ground-water resources of Hardin County, Texas; Bonnet (1975) on ground-water data for Orange County and vicinity; Bonnet and Gabrysch (1982) on the development of ground-water resources in Orange County and adjacent areas in Texas and Louisiana, 1971-80; Gabrysch and McAdoo (1972) on development of ground-water resources in the Orange County area, Texas and Louisiana, 1963-71; Harder (1960) on the geology and ground-water resources of Calcasieu Parish, Louisiana; Jones and others (1954, 1956) on the geology of ground-water resources of southwestern Louisiana; McAdoo

87-4158

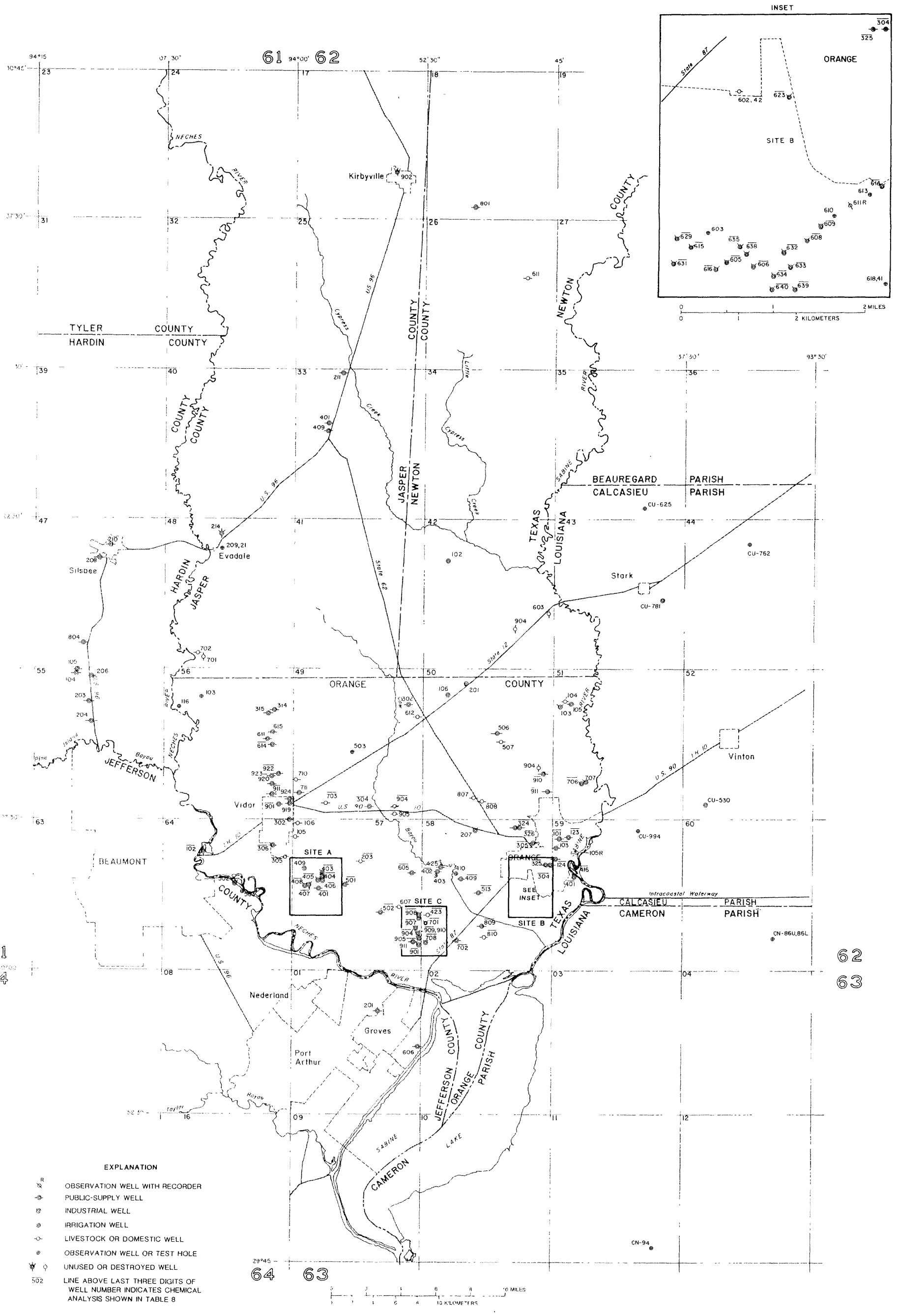


Figure 2.--Location of wells in the study area.

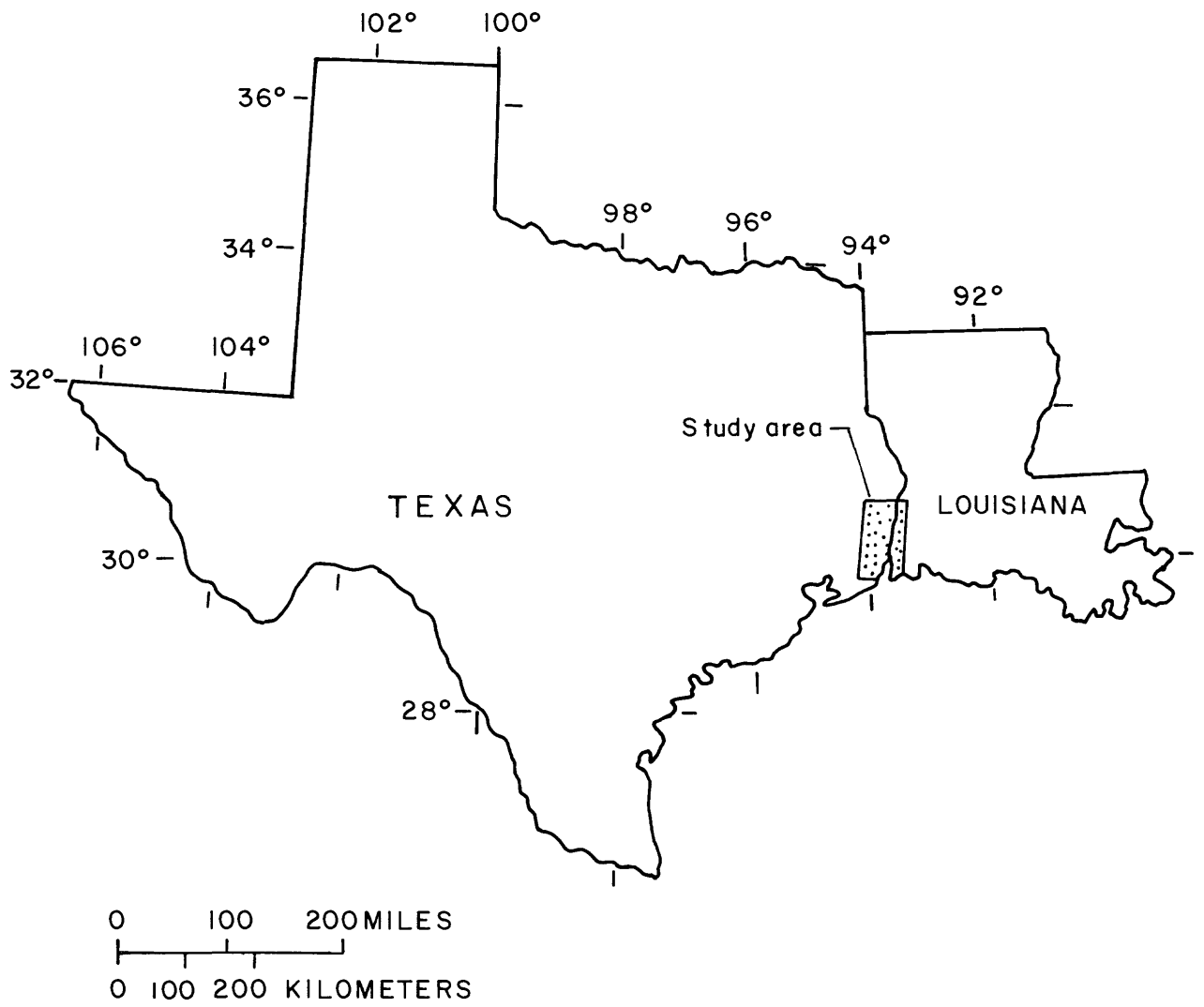


Figure 1.-Location of the study area.

(1968, 1969, 1970) on ground-water data for Orange County and vicinity; Nyman (1984) on abnormally large chloride concentrations in the Chicot aquifer in southwestern Louisiana; Wesselman, on ground-water resources of Orange County (1965), Jasper and Newton Counties (1967), and Chambers and Jefferson Counties, Texas (1971); and Zack (1971) on an update of hydrologic studies in southwestern Louisiana.

Acknowledgments

The authors gratefully acknowledge the cooperation of the many land owners and industry and city officials who provided data and granted access to water wells. The assistance of Albert Gray, Sabine River Authority of Texas, also is gratefully acknowledged. Others who contributed data to this report were: Philip Williams, Gulf Oil Products; R.A. Ogden, Firestone Petrochemical Center; G.D. McWright, E.I. DuPont, Inc.; Clark Shupp, Polysar Gulf Coast Inc.; Clarence Kite, Phillips Chemical Co.; and Charles Petry and Terrance Swan, Gulf States Utilities, Sabine Station.

Well-Numbering System

The well-numbering system in Texas was developed by the Texas Department of Water Resources for use throughout the State. Under this system, each 1-degree quadrangle is given a number consisting of two digits. These are the first two digits in the well number. Each 1-degree quadrangle is divided into 7-1/2-minute quadrangles which are given a two-digit number from 01 to 64. These are the third and fourth digits of the well number. Each 7-1/2-minute quadrangle is divided into 2-1/2-minute quadrangles which are given a single-digit number from 1 to 9. This is the fifth digit of the well number. Finally each well within a 2-1/2-minute quadrangle is given a two-digit number in the order in which it was inventoried, starting with 01. These are the last two digits of the well number.

Only the last three digits of the well number are shown at each well location (fig. 2). The second two digits are shown in the northwest corner of each 7-1/2-minute quadrangle, and the first two digits are shown by the large block numerals in each 1-degree quadrangle.

In addition to the seven-digit well number, a two-letter prefix is used to identify the county. The prefixes for Orange County and adjacent counties are as follows: Orange, UJ; Jasper, PR; Jefferson, PT; Hardin, LH; and Newton, TZ.

Wells inventoried in Louisiana by the U.S. Geological Survey are assigned a number consisting of two parts, an abbreviation of the name of the parish in which the well is located and a consecutive well number. The number assigned does not indicate a specific location because the number generally is assigned in the order in which the well was inventoried. The prefix for Calcasieu Parish is CU; the prefix for Cameron Parish is CN. In addition, some well numbers have a third part which consists of a letter abbreviation referring to wells that have a dual completion--usually a 2-in.-diameter well inside a 4-in.-diameter well with the 4-in.-diameter well screened in an upper aquifer designated "U" or a 2-in.-diameter well screened in a lower aquifer, or lower part of an aquifer, designated "L."

HYDROGEOLOGY OF THE STUDY AREA

Descriptions of the hydrologic and geologic units in Orange County have been documented by Gabrysch and McAdoo (1972, p. 7-10) and Wesselman (1965, p. 12-19). In southwestern Louisiana, Harder and others (1967) defined the hydrologic units. This report uses the classification of Harder and others (1967) but with a slight modification in wording. The Chicot aquifer is the uppermost principal aquifer and occurs in the subsurface as two or more sand layers. The relation between aquifer names used in Texas and Louisiana is given in table 1.

A deeper aquifer, the Evangeline, underlies the Chicot aquifer, but due to its greater depth and more mineralized water, the Evangeline is not used in Orange County. Only in the extreme northwestern part of the county, is the Evangeline aquifer likely to contain freshwater.

CHICOT AQUIFER

Areal Extent and Depth

The Chicot aquifer of Pleistocene age is divided into two units by clay beds that, although not areally continuous, do separate an upper sand section from a lower sand section in most of the area. Jones and others (1954, p. 7) named their Chicot aquifer system for a deltaic sequence consisting of sand, gravel, and clay deposits that crops out in west-central Louisiana. The Chicot aquifer system underlies a large area bordering the Gulf of Mexico, extending from Louisiana to south Texas. The Chicot aquifer as used in this report underlies all of Orange County. The base of the aquifer ranges from about 400 ft below NGVD of 1929 in northwestern Orange County to about 1,000 ft below NGVD of 1929 in southeastern Orange County as shown in figure 3.

The depth below land surface of the base of the Chicot aquifer can be determined by adding the altitude of the land surface to the data presented in figure 3.

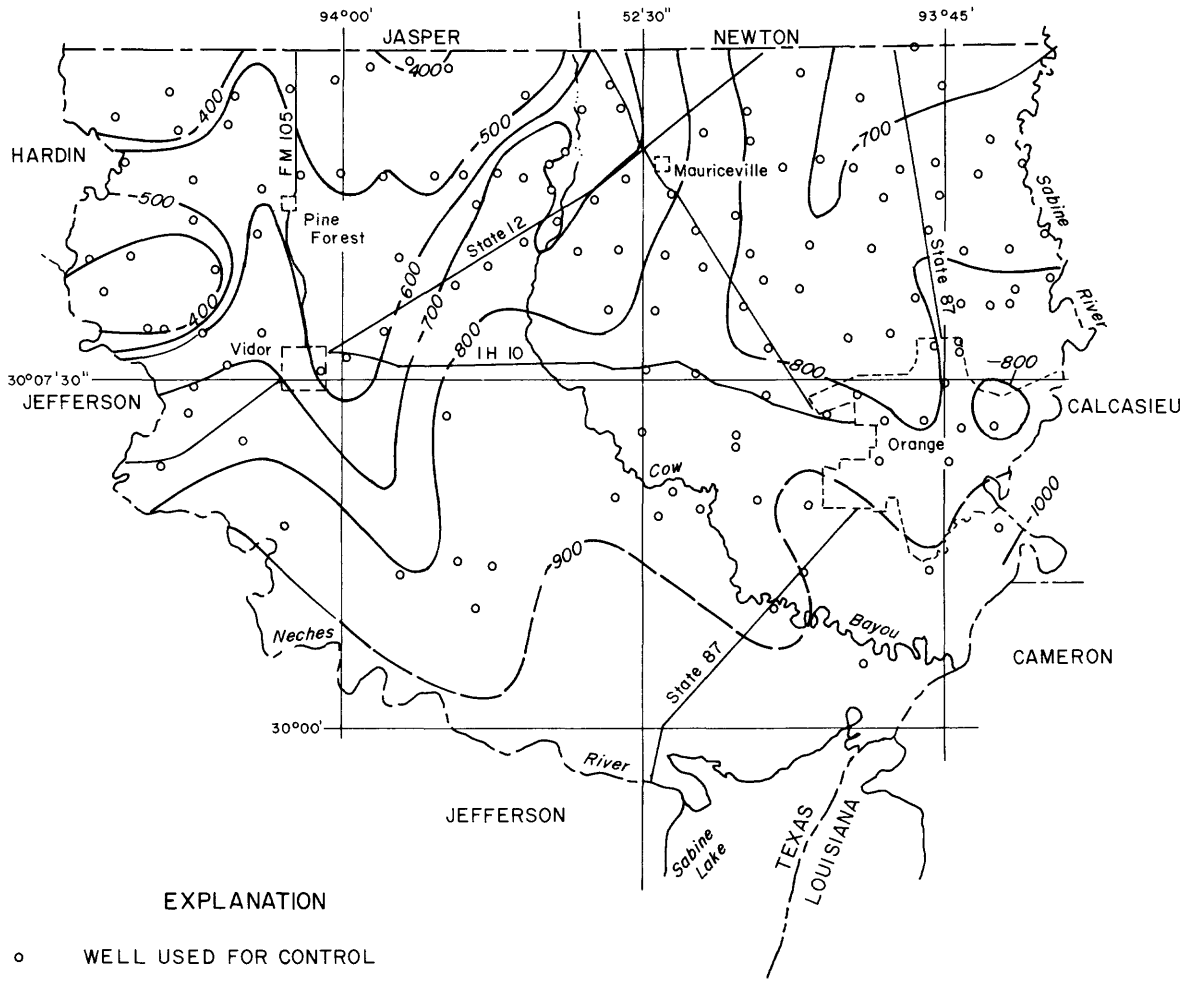
Upper Unit

An inventory of pumpage from the upper unit of the Chicot aquifer in 1965 indicated that this unit was not a principal source of water in the study area. No update to the inventory of pumpage from the upper unit of the Chicot aquifer was made because an examination of records of wells drilled in the study area since 1965 indicated that the upper unit still (1984) is not a principal source of water. Water levels were measured in 10 wells completed in the upper unit, and 3 water samples were collected for chemical analysis. These data are included with similar data for the lower unit in tables at the back of the report.

Lower Unit

Pumpage

The pumpage inventory for 1980-84 consists of pumpage data reported by major water users to the Texas Department of Water Resources and estimates by the authors. Estimates of pumpage before 1980 were based on the same methods



Modified from Gabrysch and McAdoo, 1972

Figure 3.--Altitude of the bottom of the Chicot aquifer, in Orange County.

Table 1.--Hydrogeologic correlations for eastern Texas and southwestern Louisiana

System	Series	Wesselman (1965)	Wesselman (1971)	Harder (1960)	Harder and others (1967)	This report
		Hydrologic unit				
Quaternary	Holocene	Upper aquifer	Upper aquifer	Chicot shallow	Shallow sand	Shallow sand
	Pleistocene			"200-foot" sand	"Upper sand unit"	Upper unit of the Chicot aquifer
		Middle aquifer	Lower aquifer	"500-foot" sand	Undifferentiated "lower sand unit"	Lower unit of the Chicot aquifer
				"700-foot" sand		
Tertiary	Pliocene and Miocene	Lower aquifer	Evangeline aquifer	Evangeline aquifer	Evangeline aquifer	Evangeline aquifer

Modified from Nyman (1984, table 1).

87-4158

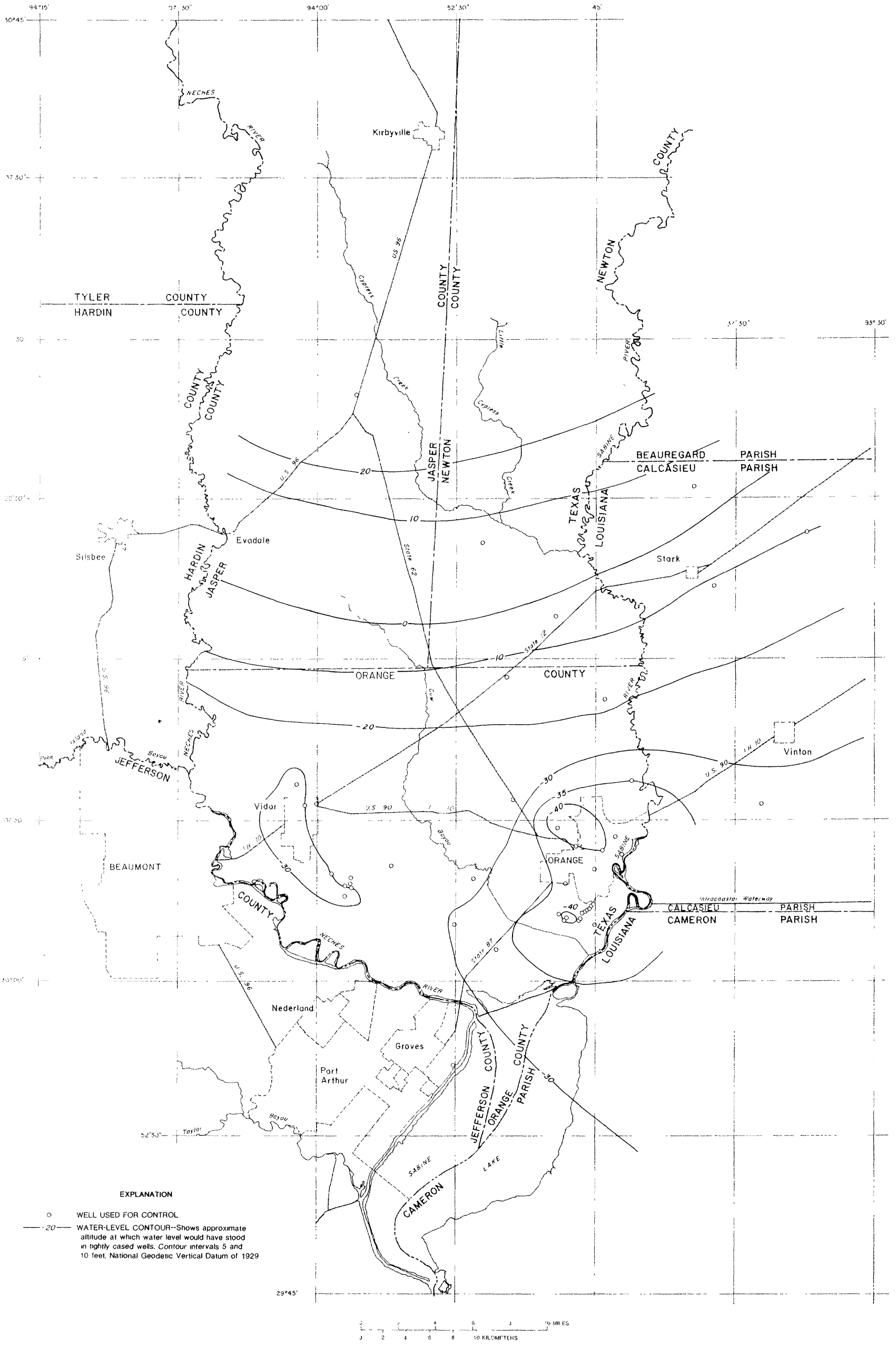


Figure 4.--Approximate altitude of water levels in wells screened in the lower unit of the Chicot aquifer, spring 1985.

87-4158

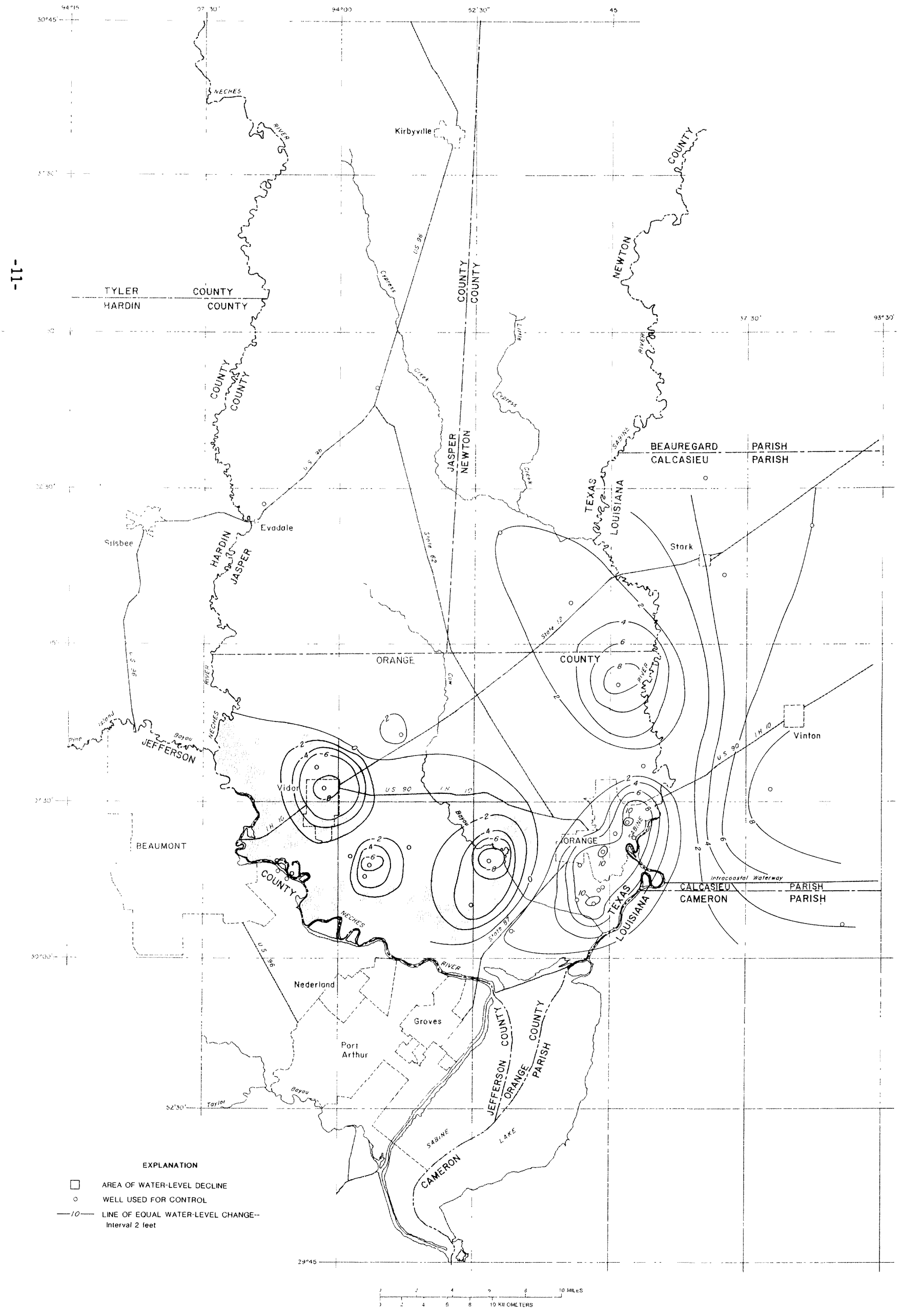


Figure 5.---Approximate change in water levels in wells screened in the lower unit of the Chicot aquifer, spring 1971 to spring 1985.

87-4158

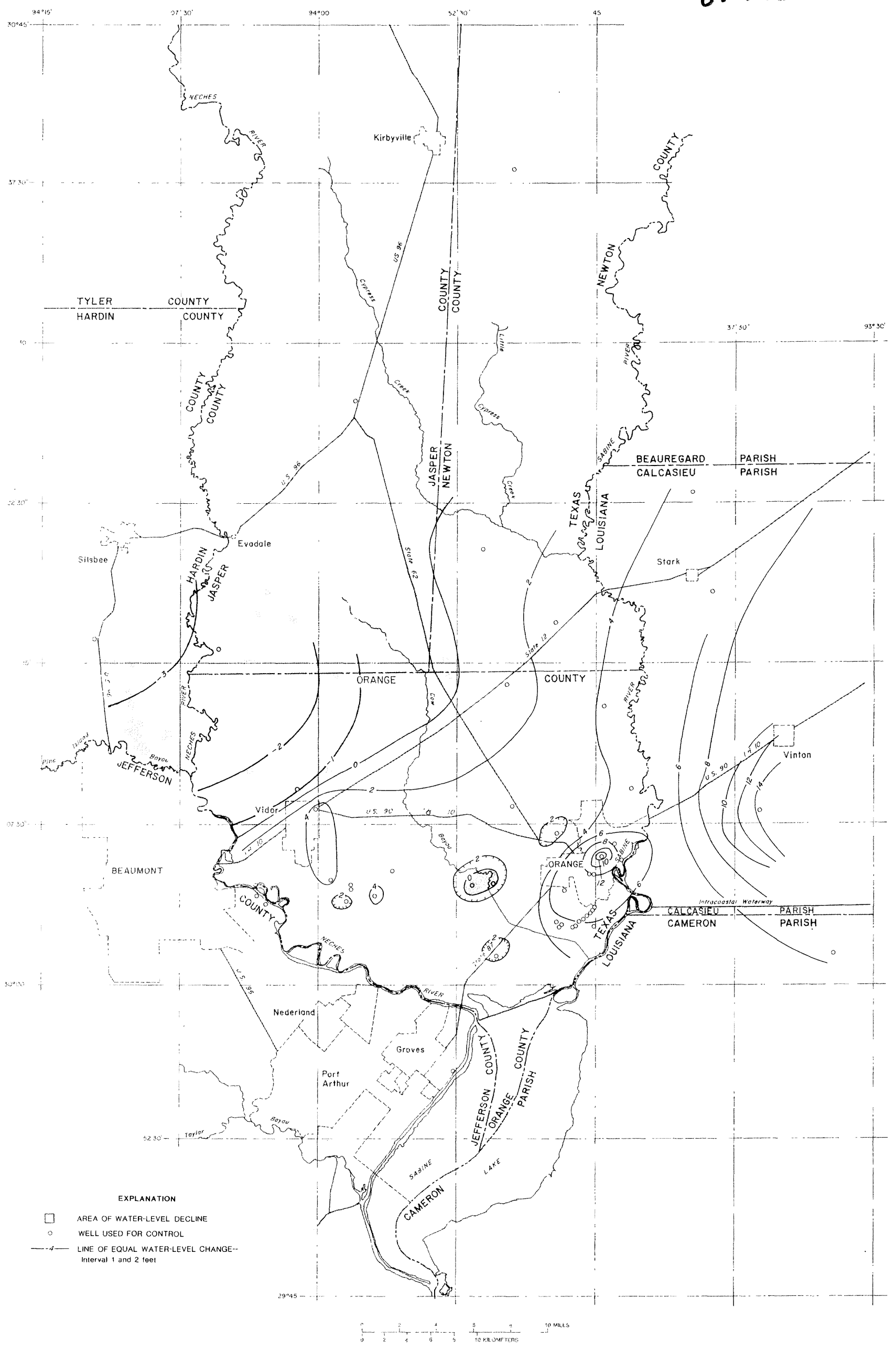


Figure 6.--Approximate change in water levels in wells screened in the lower unit of the Chicot aquifer, spring 1980 to spring 1985.

and reported in previous publications. Estimated and reported pumpage of water from the lower unit of the Chicot aquifer in Orange County during 1963-84 are given in table 2. Total ground-water pumpage ranged from 18.5 to 23.1 Mgal/d during 1963-81. Beginning in 1982, total pumpage began to decrease; during 1984, total ground-water pumpage was 15.2 Mgal/d. Municipal use during 1980-84 decreased slightly from 7.5 to 7.0 Mgal/d. However, large decreases in industrial use began in 1982. Most ground water used for industrial purposes is obtained from three sites (A, B, and C) in southern Orange County (fig. 2). The estimated and reported ground-water pumpage at these three sites for 1963-84 are given in table 3. Ground-water pumpage decreased substantially at sites A and B between 1980 and 1984. Pumpage at site C remained relatively constant. Conversely, ground-water use for public supply in western Orange County and in eastern Hardin County has increased. The pumpage of the major users in western Orange and eastern Hardin Counties for 1980-84 are given in table 4. The records and drillers' logs of selected wells during 1979-84 are given in tables 5 and 6 (Supplemental Information).

Listed below is the estimated surface-water use in Orange County during 1980-84. The decrease in ground-water pumpage during the same period was not due to increased use of surface water. Surface-water use during 1984 was substantially less than that during 1981:

	Million gallons per day				
	1980	1981	1982	1983	1984
Surface-water use	48.6	58.1	38.0	36.5	41.4

Water Levels

Measurements of water levels on which regional maps are based were made in the early part of the year when pumpage was minimal. Measurements made during 1980-85 are presented in table 7 (Supplemental Information); measurements for 1971-74 were given in Bonnet (1975) and for 1975-79 in Bonnet and Gabrysch (1982). The approximate altitudes of water levels (spring 1985) in wells screened in the lower unit of the Chicot aquifer are shown in figure 4.

Water levels in 1985 ranged from about 20 ft above NGVD of 1929 in the southern part of Jasper and Newton Counties, to about 40 ft below NGVD of 1929 in the vicinity of the city of Orange and about 30 ft below NGVD of 1929 in southwestern Orange County. The altitudes of water levels in 1971 and 1980 were presented by Gabrysch and McAdoo (1972) and Bonnet and Gabrysch (1982). Long-term net changes in the altitudes of water levels for 1971-85 are presented in figure 5 and for 1980-85 in figure 6.

The water-level change maps show differences between measurements made during the spring in the beginning and ending years. Water-level rises of as much as about 10 ft in and near the city of Orange, rises of as much as about 8 ft in northeastern Orange County, and rises of as much as about 9 ft in Calcasieu Parish, Louisiana, during 1971-85 are shown in figure 5. Meanwhile, water levels declined as much as about 8 ft in central and western Orange County. The rise in water levels in eastern Orange County and western Calcasieu Parish, Louisiana, is related directly to the decreases in withdrawal (tables 2 and 3)

Table 2.--Pumpage of ground water from the lower unit of the Chicot aquifer in Orange County, 1963-84

[million gallons per day]

Year	Municipal supply	Industrial use	Total
1963	3.8	14.7	18.5
1964	4.1	16.2	20.3
1965	4.5	16.3	20.8
1966	4.7	16.3	21.0
1967	5.8	14.7	20.5
1968	4.6	16.6	21.2
1969	4.8	16.0	20.8
1970	5.1	15.9	21.0
1971	5.4	17.6	23.0
1972	5.4	17.7	23.1
1973	5.3	15.8	21.1
1974	5.5	15.0	20.5
1975	5.7	12.8	18.5
1976	5.9	15.7	21.6
1977	6.1	16.2	22.3
1978	6.4	13.6	20.0
1979	7.0	13.3	20.3
1980	7.5	12.2	19.7
1981	7.3	12.8	20.1
1982	7.4	10.3	17.7
1983	7.2	8.9	16.1
1984	7.0	8.2	15.2

Table 3.--Pumpage of ground water from the lower unit of the Chicot aquifer at major industrial sites in Orange County, 1963-84

[million gallons per day]

Year	Site A	Site B	Site C	Total
1963	3.3	10.2	1.2	14.7
1964	3.9	11.1	1.2	16.2
1965	3.7	11.2	1.4	16.3
1966	1.5	11.1	3.7	16.3
1967	2.4	10.8	1.5	14.7
1968	4.3	10.8	1.5	16.6
1969	2.8	11.7	1.5	16.0
1970	2.8	11.5	1.6	15.9
1971	3.3	12.5	1.8	17.6
1972	3.2	12.7	1.8	17.7
1973	3.0	11.0	1.8	15.8
1974	2.9	10.4	1.7	15.0
1975	2.6	8.4	1.8	12.8
1976	3.1	10.7	1.9	15.7
1977	3.3	10.7	2.2	16.2
1978	3.5	7.8	2.3	13.6
1979	3.9	7.5	1.9	13.3
1980	3.9	6.4	1.9	12.2
1981	4.2	6.4	2.2	12.8
1982	3.4	4.7	2.2	10.3
1983	2.2	4.5	2.2	8.9
1984	1.4	4.9	1.9	8.2

Table 4.--Reported pumpage of water from the lower unit of the Chicot aquifer for public supply in western Orange and eastern Hardin Counties, 1980-84

User/source	Million gallons per day				
	1980	1981	1982	1983	1984
City of Vidor, Orange County	0.65	0.77	0.84	0.89	0.94
Lumberton Municipal Utility District, Hardin County	.66	.69	.78	.81	.87
City of Beaumont, Hardin County	7.17	8.96	10.26	10.79	10.46
TOTAL	8.48	10.42	11.88	12.49	12.27

in these areas. When comparing the long-term water-level change map (fig. 5) to the more recent water-level change map (fig. 6), both similarities and differences are found. Water-level rises of as much as about 12 ft in the city of Orange and as much as about 14 ft in southwestern Calcasieu Parish, Louisiana, occurred during 1980-85 (fig. 6), while water-level rises of as much as about 6 ft occurred at an industrial area southwest of the city of Orange (fig. 6). Water levels also rose by about 4 ft in Vidor and in northeastern Orange County. In northwestern Orange County, water levels declined as much as about 2 ft.

Trends in water levels in wells throughout the study area have fluctuated because of changes in pumping patterns. Long-term fluctuations are shown by hydrographs of four wells in the area (fig. 7)--well UJ-62-59-105 in eastern Orange County, well CU-530 in western Calcasieu Parish, Louisiana, well UJ-61-56-901 in western Orange County, and well UJ-62-57-401 in southwestern Orange County. Well UJ-62-59-105 is located in an area where water levels rose about 7.5 ft from spring 1980 to spring 1985. The hydrograph of well CU-530 shows a steady water-level decline from spring 1957 to spring 1973. Between spring 1973 and spring 1979, practically no change in the water level occurred; from spring 1979 to spring 1985, the water level rose about 14 ft.

The hydrograph of well UJ-61-56-901 in Vidor shows a long-term downward trend from spring 1963 to spring 1981. From spring 1981 to spring 1985, depths to water in this well have remained at about 51 ft below land surface, reflecting an approximately constant pumpage in Vidor during 1981-84 (table 4). The trend of the water levels in well UJ-62-57-401, located about 5 mi southeast of Vidor, was slightly downward from spring 1963 to spring 1976. Since spring 1976, the water level has stabilized at about 48 ft below land surface, reflecting the pumpage decrease (table 3, site A) in this part of Orange County.

Water Quality

The approximate chloride concentration most likely to occur in water from the lower unit of the Chicot aquifer in Orange County is shown in figure 8. Chloride concentrations determined during 1980-84 ranged from 10 to 1,700 mg/L. The chemical analyses of water samples collected during 1980-84 are given in table 8 (Supplemental Information).

Water-quality changes

In coastal areas, many aquifers have contained both freshwater and saline-water, with the lighter freshwater floating on top of the salinewater since before ground-water development began. When these two fluids are disturbed because of pumping of the freshwater, the salinewater will rise and the water pumped will increase in chloride concentration. How salinewater coning occurs in a pumped well is shown in figure 9. The pattern of wells producing water with abnormally large chloride concentrations surrounded by wells producing water with much smaller chloride concentrations in some areas of Orange County indicates salinewater coning.

A good example of salinewater coning is illustrated by chloride concentrations in water from wells at an industrial site located southeast of Vidor (fig. 10). Chloride concentrations have been measured in water from several

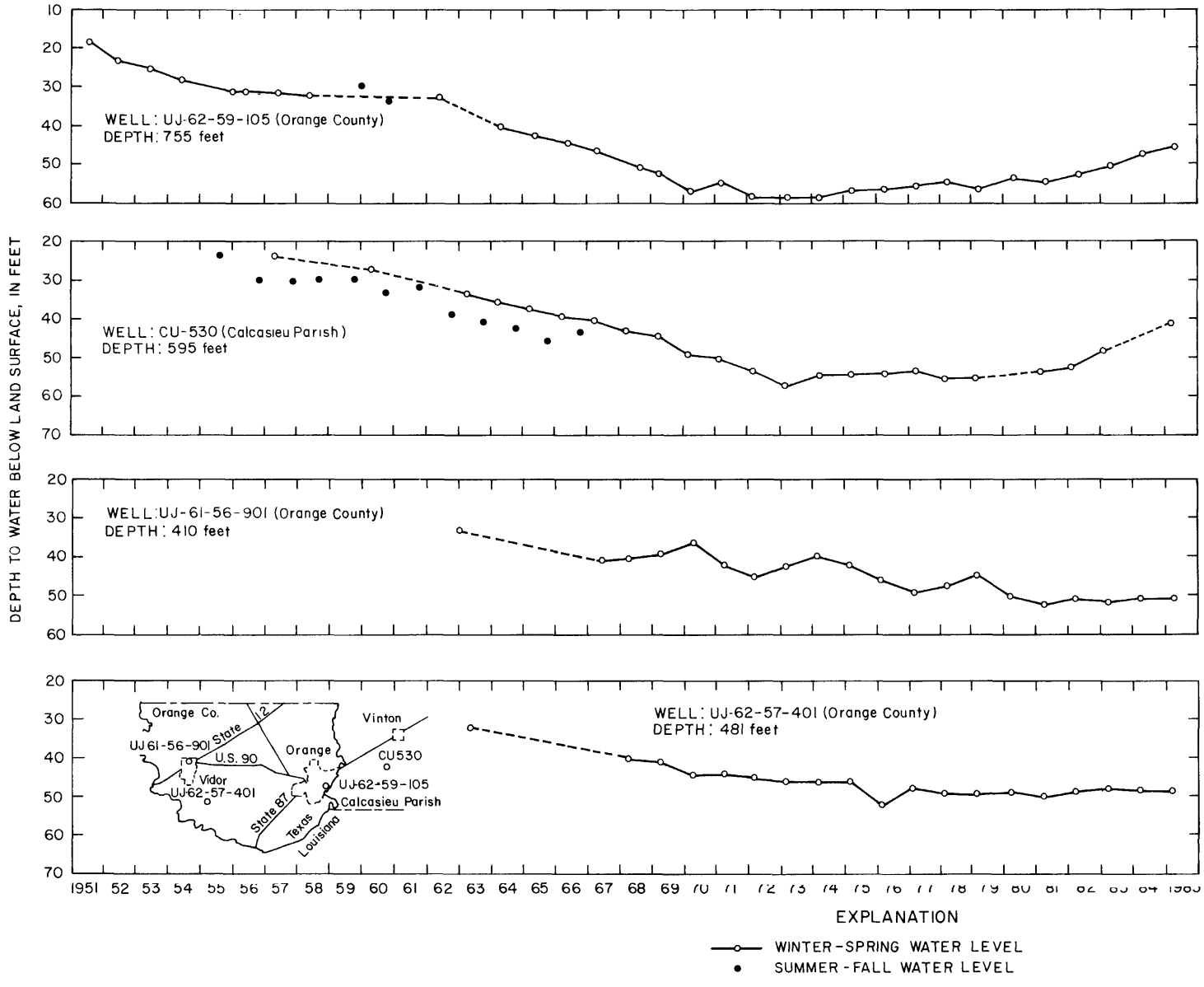


Figure 7.--Water levels in wells screened in the lower unit of the Chicot aquifer in Orange County, Texas, and Calcasieu Parish, Louisiana.

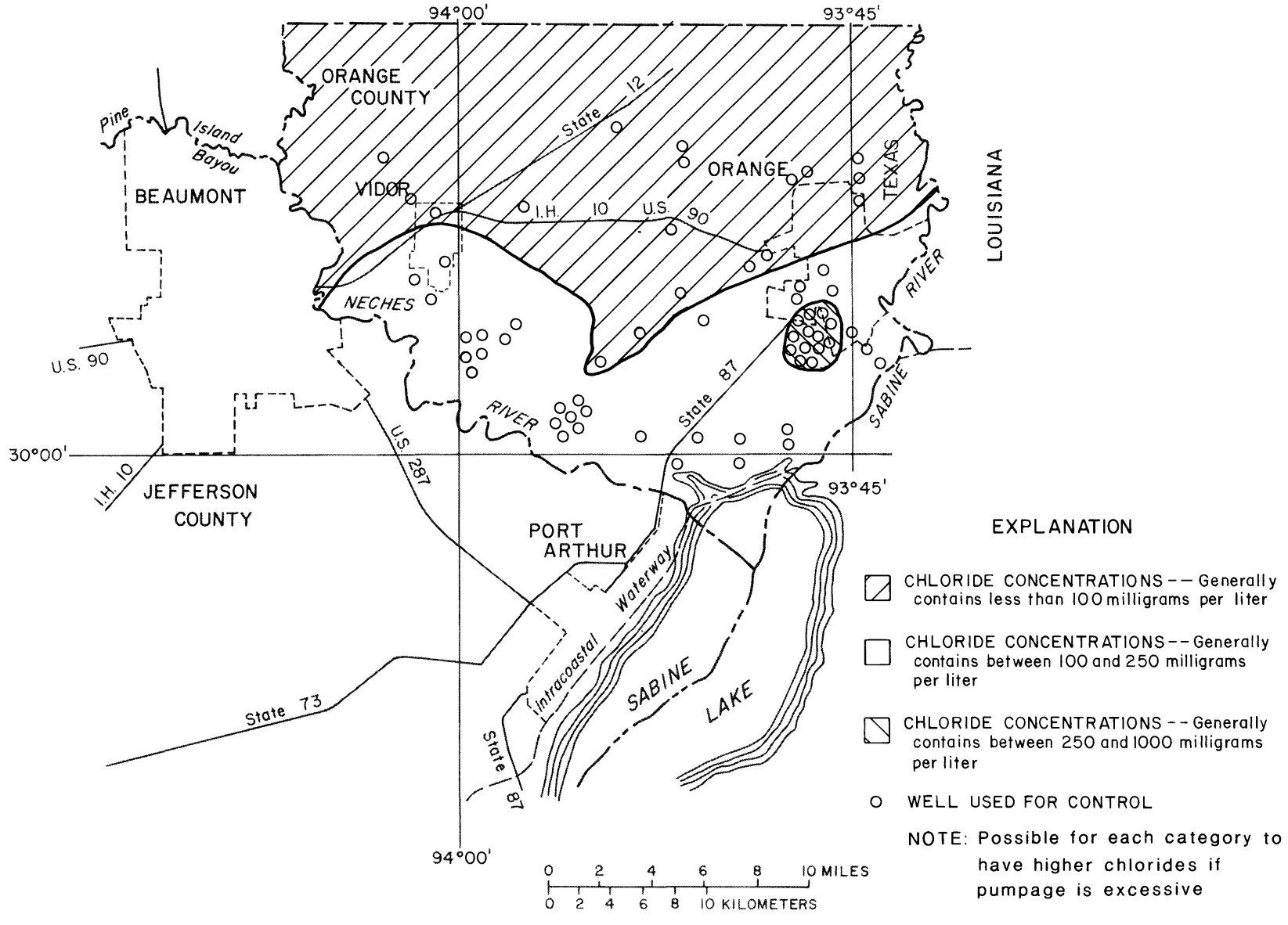
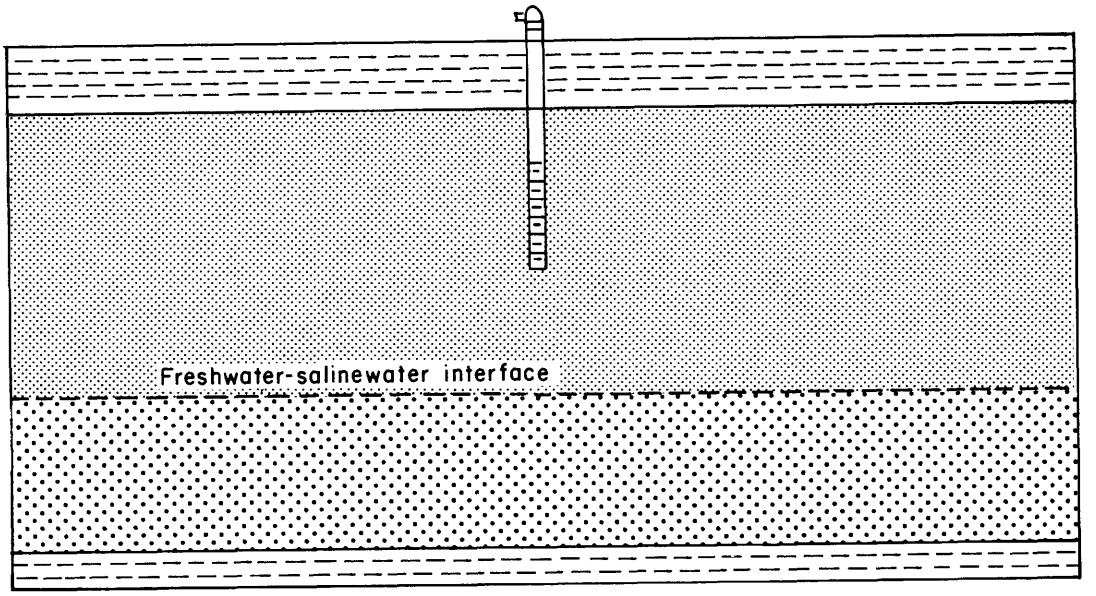
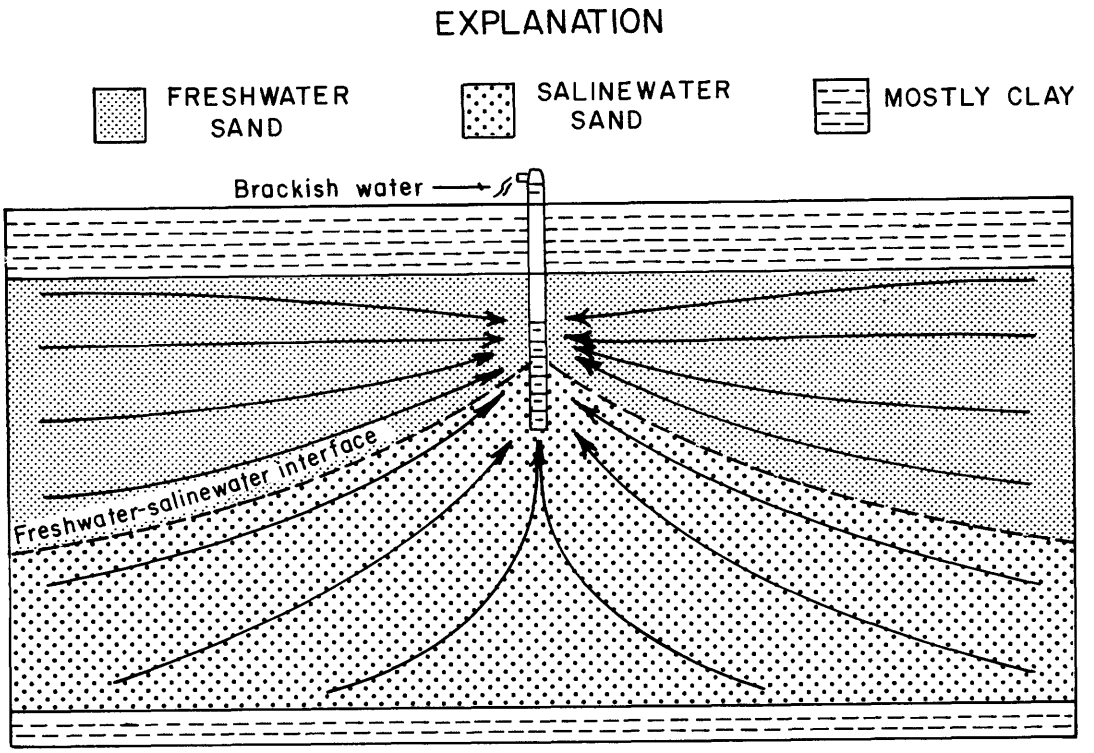


Figure 8.--Range in chloride concentration in water contained in the lower unit of the Chicot aquifer in Orange County, 1984.



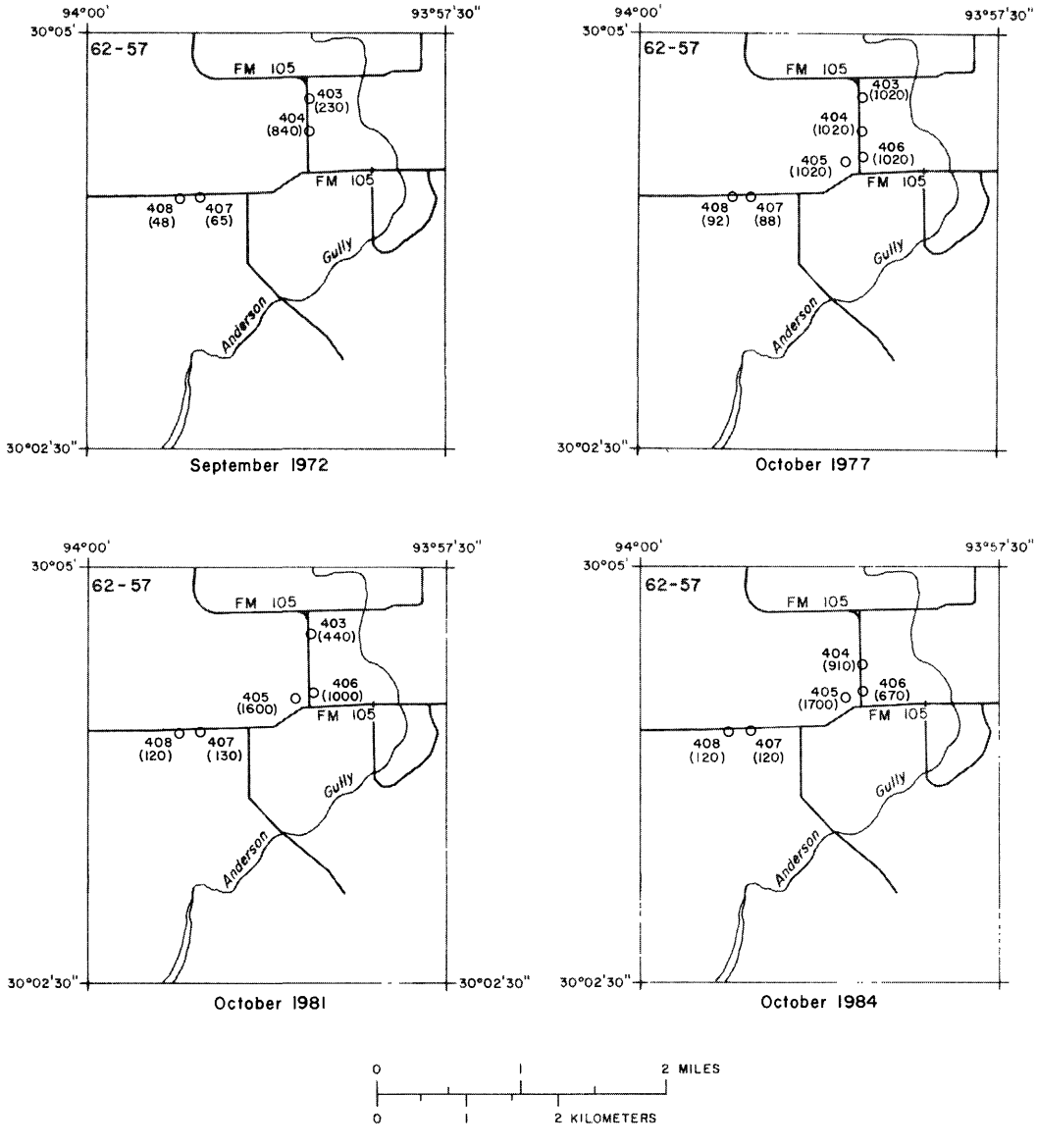
a. Relationship between freshwater and salinewater before pumping begins



b. The development of a salinewater cone during pumping

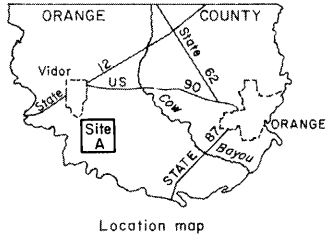
Modified from Nyman, 1984

Figure 9.--Development of salinewater coning.



EXPLANATION

408 (48) OBSERVATION WELL AND WELL NUMBER-- Number in parentheses is chloride concentration, in milligrams per liter



Location map

Figure 10.--Concentrations of chloride in water from wells screened in the lower unit of the Chicot aquifer at site A in southwestern Orange County.

wells at this site since 1972. The chloride concentration is directly related to pumping, which is responsible for causing the salinewater coning effect. Between 1977 and 1984, chloride concentrations decreased in water from wells UJ-62-57-404 and UJ-62-57-406, yet increased in water from well UJ-62-57-405. If there was a general updip migration of the freshwater-salinewater interface, the pumpage from well UJ-62-57-405 would have caused an increase in chloride concentrations in water from well UJ-62-57-406. Instead, the chloride concentration in water from this well was substantially less in 1984 compared to 1977.

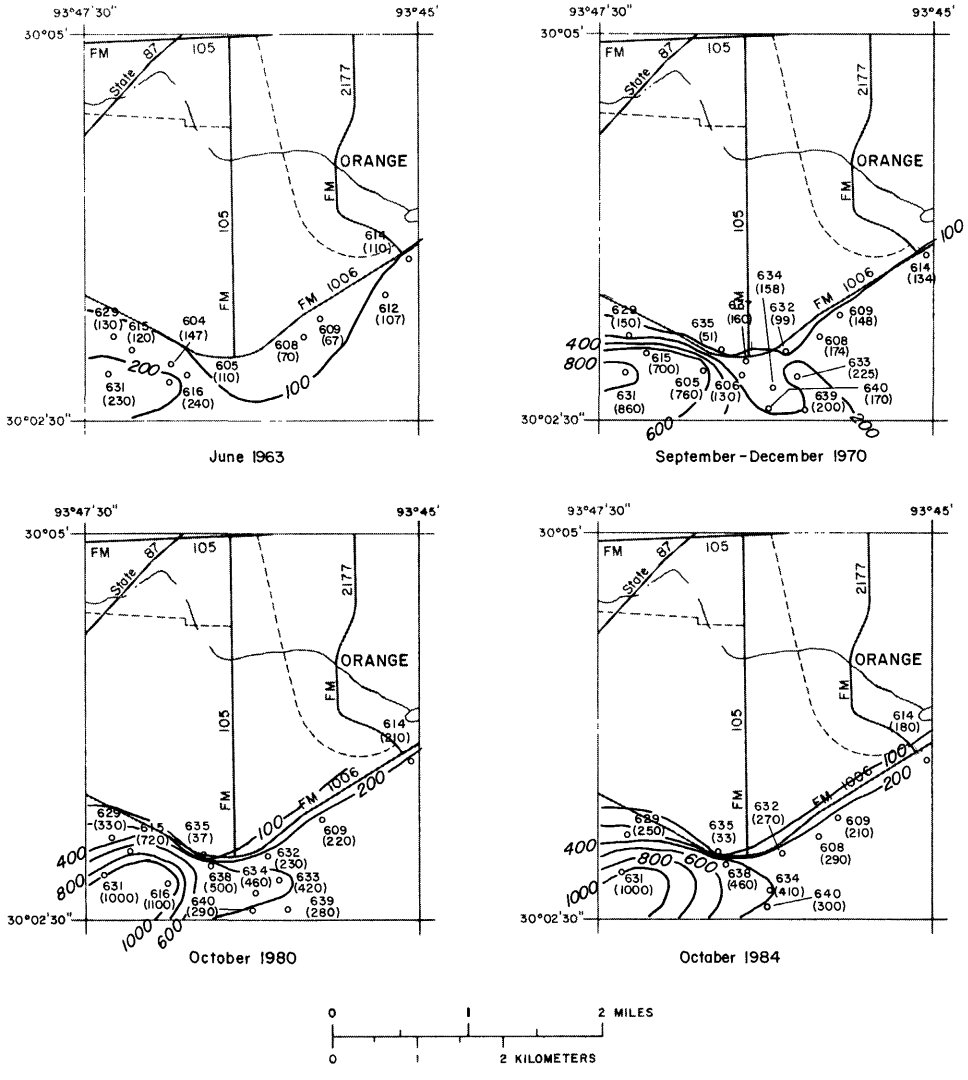
A good example of updip migration of salinewater is shown by the trend of increasing chloride concentrations at site B (fig. 11), an industrial area near the city of Orange. At site B, chloride concentrations and ground-water withdrawals (table 3) increased from 1963 until 1980. Thereafter, until 1984, chloride concentrations decreased slightly due to decreased ground-water withdrawals. The 100-mg/L chloride-concentration line remained stationary between 1980 and 1984. No significant changes in chloride concentrations have occurred north or south of the line. The steepness of the freshwater-salinewater interface is demonstrated by the chloride concentrations in water from two wells (UJ-62-58-635 and UJ-62-58-638) located within 0.33 mi of each other. In 1980, the concentrations were 37 and 500 mg/L; in 1984, they were 33 and 460 mg/L.

Relation between specific conductance and chloride concentration

The relation between specific conductance and the chloride concentration in water from all wells completed in the lower unit of the Chicot aquifer in Orange County that were sampled during 1980-84 is shown in figure 12. The relation between specific conductance and chloride concentrations is not a straight line when the chloride concentration is small (less than 75 mg/L). However, as the chloride concentration increases to more than 75 mg/L, the curve begins to approximate a straight line. From the part of the curve that approximates a straight line, the chloride concentration in water from the lower unit of the Chicot aquifer in Orange County can be estimated by multiplying the specific conductance, in microsiemens per centimeter at 25 °Celsius, by 0.29. This relation is applicable only to Orange County where the samples were collected. Because specific-conductance measurements can be made quickly, easily, and inexpensively at the well site, the relation may be conveniently used to estimate chloride concentrations.

EVANGELINE AQUIFER

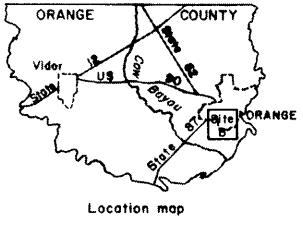
Water from the Evangeline aquifer, consisting of Pliocene and Miocene sediments, is used at Evadale in Jasper County and at Silsbee in Hardin County. During 1979, an average of 25 Mgal/d of water was pumped from the Evangeline aquifer at Evadale. During 1980-84, the quantity of water pumped had increased by 66 percent to 41.6 Mgal/d. Pumpage data are not available at this time from Silsbee.



EXPLANATION

614° (110) OBSERVATION WELL AND WELL NUMBER-- Number in parentheses is chloride concentration, in milligrams per liter

—200— LINE OF EQUAL CHLORIDE CONCENTRATION-- Interval 100 and 200 milligrams per liter



Location map

Figure 11.--Concentrations of chloride in water from wells screened in the lower unit of the Chicot aquifer at site B in southeastern Orange County.

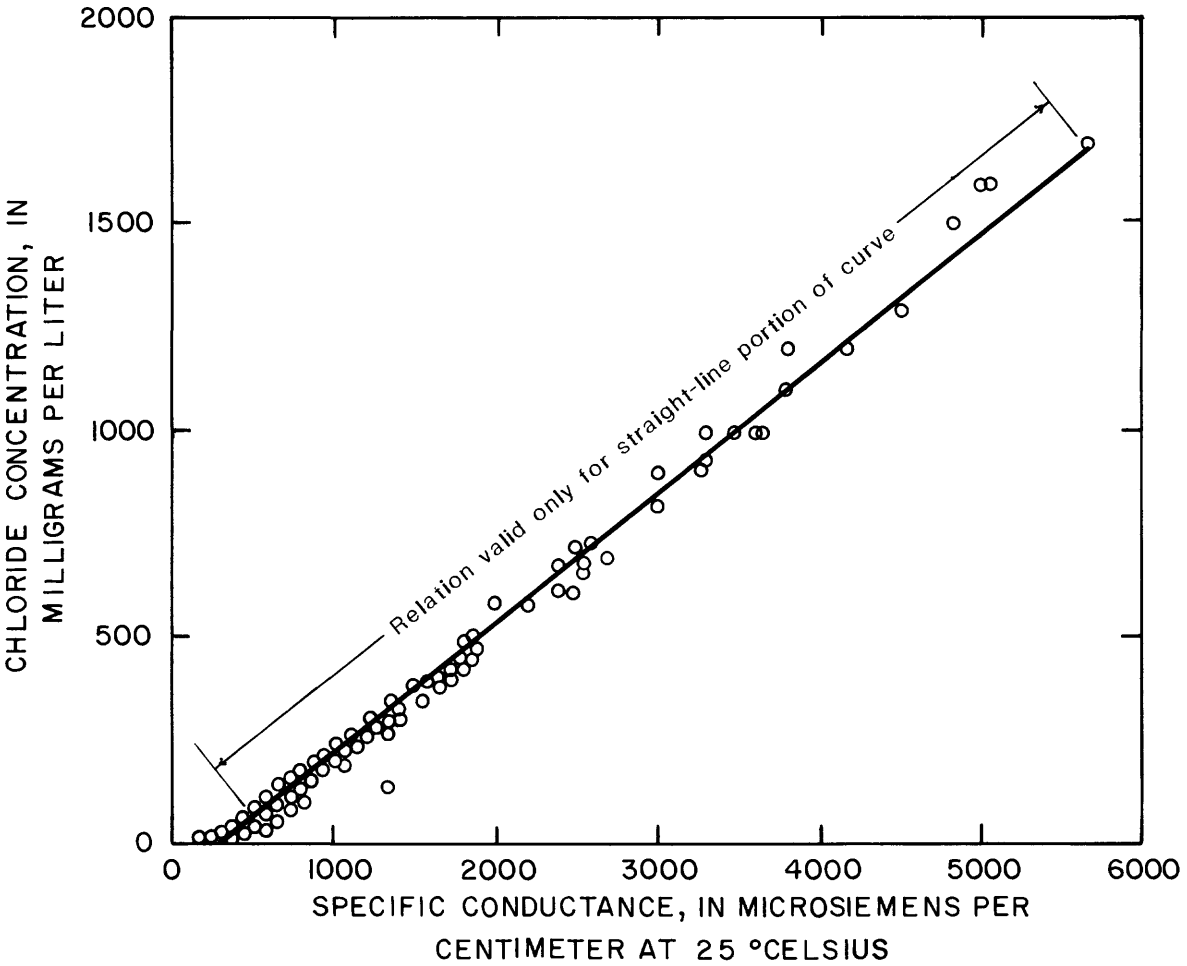


Figure 12.--Relation between specific conductance and chloride concentration in water from the lower unit of the Chicot aquifer, Orange County, 1980-84.

GROUND-WATER ISSUES AND POSSIBLE FUTURE STUDIES

In most locations in Orange County, the chloride concentrations in water from the lower unit of the Chicot aquifer stablized during 1980-84 due to decreases in withdrawals. However, the potential for encroachment and coning of salinewater exists, and chloride concentrations will increase if pumpage is increased in those areas where wells are concentrated. Because the lower unit of the Chicot aquifer is a principal source of water in Orange County, pumpage from the aquifer needs to be managed to assure long-term yields of freshwater. Proper well location, spacing, and pumping patterns would allow a greater rate of production without serious consequences.

Digital-computer-modeling programs that provide approximate solutions to transient-flow problems would facilitate more detailed studies of the relations between pumpage, changes in water levels, and salinewater encroachment. Observation wells at various depths could be installed away from the pumping centers along the southern boundary and part of the western and eastern boundaries of Orange County to monitor changes in water levels and water quality. Water samples from these observation wells could be analyzed for synthetic organic contaminants in addition to being analyzed for the usual inorganic elements and compounds. Ground-water contamination from synthetic organic compounds in Orange County is possible. Currently (1985), two U.S. Environmental Protection Agency Superfund sites are located in Orange County (Bailey Waste Disposal and Triangle Chemical Company). Determining the concentration of synthetic organic compounds present in ground water at points throughout the county may prove to be useful in detecting possible future changes in ground-water quality.

The suitability of the Evangeline aquifer as a water source in northern Orange County could be investigated should the need arise for a different or additional water supply.

SUMMARY

The lower unit of the Chicot aquifer produces most of the ground water in Orange County. Total water pumpage from the unit during 1980-84 decreased substantially. Surface-water use also decreased. The quantity of ground water used during 1984, 15.2 Mgal/d, was the smallest compared to the previous 22 years. Municipal use of ground water increased slightly during 1980-84.

Water levels in most of the study area rose between spring 1980 and spring 1985 because of the decreased pumpage. In and near the city of Orange, water levels rose as much as about 14 ft. Water levels in a small area to the north and northwest of Vidor declined between spring 1980 and spring 1985 mainly due to increased pumpage in Hardin County. The maximum decline was about 3 ft.

Chemical analyses indicate that the chloride concentration of the ground water remained approximately constant during 1980-84. Chloride concentrations determined during 1980-84 ranged from 10 to 1,700 mg/L.

Chemical analyses of water from wells in the lower unit of the Chicot aquifer indicate a relation between specific conductance and chloride concentration that is approximately linear when specific conductance ranges from about 500 to 5,600 µS/cm. From a plot of the data, the chloride concentration can be estimated by multiplying specific conductance by 0.29.

SELECTED REFERENCES

Baker, E.T., Jr., 1964, Geology and ground-water resources of Hardin County, Texas: Texas Water Commission Bulletin 6406, 179 p.

Bonnet, C.W., 1975, Ground-water data for Orange County and vicinity, Texas and Louisiana, 1971-74: Texas Water Development Board Report 197, 26 p.

Bonnet, C.W., and Gabrysch, R.K., 1982, Development of ground-water resources in Orange County, Texas, and adjacent areas, 1971-80: Texas Department of Water Resources Report 283, 51 p.

Gabrysch, R.K., and McAdoo, G.D., 1972, Development of ground-water resources in the Orange County area, Texas and Louisiana, 1963-71: Texas Water Development Board Report 156, 47 p.

Harder, A.H., 1960, The geology and ground-water resources of Calcasieu Parish, Louisiana: U.S. Geological Survey Water-Supply Paper 1488, 102 p.

Harder, A.H., Kilbum, C., Whitman, H.M., and Rogers, S.M., 1967, Effects of ground-water withdrawals on water levels and saltwater encroachment in Southwestern Louisiana: Louisiana Department of Conservation and Louisiana Department of Public Works, Water Resources Bulletin 10, 56 p.

Hem, J.D., 1970, Study and interpretation of the chemical characteristics of natural water (2d ed.): U.S. Geological Survey Water-Supply Paper 1473, 363 p.

Jones, P.H., Hendricks, E.L., Irelan, Burdge, and others, 1956, Water resources of southwestern Louisiana: U.S. Geological Survey Water-Supply Paper 1364, 460 p.

Jones, P.H., Turcan, A.N., Jr., and Skibitzke, H.E., 1954, Geology and groundwater resources of southwestern Louisiana: Louisiana Geological Survey, Geological Bulletin 30, 285 p.

McAdoo, G.D., 1968, Ground-water data for Orange County and vicinity, Texas and Louisiana, 1968: U.S. Geological Survey open-file report, 20 p.

------ 1969, Ground-water data for Orange County and vicinity, Texas and Louisiana, 1969: U.S. Geological Survey open-file report, 22 p.

------ 1970, Ground-water data for Orange County and vicinity, Texas and Louisiana, 1970: U.S. Geological Survey open-file report, 19 p.

Nyman, D.J., 1984, The occurrence of high concentrations of chloride in the Chicot aquifer system of southwestern Louisiana: Louisiana Department of Transportation and Development, Water Resources Technical Report No. 33, 75 p.

Ratzlaff, K.W., 1980, Land-surface subsidence in the Texas coastal region: U.S. Geological Survey Open-File Report 80-969, 19 p.

Turcan, A.N., Jr., Wesselman, J.B., and Chabot, Kilburn, 1966, Interstate correlation of aquifers, southwestern Louisiana and southeastern Texas: U.S. Geological Survey Professional Paper 550-D, p. D231-236.

Wesselman, J.B., 1965, Geology and ground-water resources of Orange County, Texas: Texas Water Commission Bulletin 6516, 112 p.

------ 1967, Ground-water resources of Jasper and Newton Counties, Texas: Texas Water Development Board Report 59, 177 p.

------ 1971, Ground-water resources of Chambers and Jefferson Counties, Texas, with a section on Quaternary geology, by Saul Aronow: Texas Water Development Board 133, 183 p.

Winslow, A.G., and Kister, L.R. 1956, Saline-water resources of Texas: U.S. Geological Survey Water-Supply Paper 1365, 105 p.

Winslow, A.G., and Wood, L.A., 1959, Relation of land subsidence to ground-water withdrawals in the upper Gulf Coast region, Texas: Mining Engineering, v. 11, no. 10, p. 1030-1034.

Wood, L.A., and Gabrysch, R.K., 1965, Analog model study of ground water in the Houston district, Texas, with a section on Design, construction, and use of electric analog models, by E. P. Patton, Jr.: Texas Water Commission Bulletin 6508, 103 p.

Zack, A.L., 1971, Ground-water pumpage and related effects, southwestern Louisiana, 1970, with a section on Surface-water withdrawals: Louisiana Department of Conservation and Louisiana Department of Public Works, Water Resources Pamphlet No. 27, 35 p.

SUPPLEMENTAL INFORMATION

Table 5.--Records of selected wells in the study area, 1979-84

Screen : DH, open hole.
Principal aquifer : CHCTL, lower unit of Chicot aquifer; EVGL, Evangeline aquifer.
Altitude : Datum is sea level.
Water level : Reported water levels given in feet; measured water levels given in feet and tenths.
Use of water : D, domestic; N, industrial; P, public supply.
Type of data available: D, drillers' logs (see table 7); E, electric logs; Q, chemical analysis (see table 8); W, water-level measurements (see table 5).

Well number	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Screen		Principal aquifer	Altitude of land surface (feet)	Water level		Use of water	Discharge (gallons per minute)	Drawdown (feet)	Types of data available
						Length (feet)	Depth interval (feet)			Below land surface (feet)	Date of measurement				
					Orange County, Texas										
UJ-61-56-615	Don Lightfoot	Baison Water Well Drilling Co.	1979	420	4,2	OH	390-420	CHCTL	25	40	05/ /1979	P	55	--	D
UJ-61-56-923	Tiger Lake Utility Dist.	Baison Water Well Drilling Co.	1981	460	6,4	30	430-460	CHCTL	16	50	02/16/1981	P	120	--	D
UJ-61-56-924	Vidor ISD	Baison Water Well Drilling Co.	1983	410	4,3	30	380-410	CHCTL	20	50	02/11/1983	P	60	20	D
UJ-62-49-302	Mauriceville Water Supply Corp.	Baison Water Well Drilling Co.	1983	350	6	30	320-350	CHCTL	25	47.48	04/27/1984	P	450	30	D
UJ-62-49-612	James Linscomb	Baison Water Well Drilling Co.	1980	580	4,2	40	540-580	CHCTL	26	25	07/16/1980	D	18	--	D
UJ-62-49-710	Leon Broom	Richardson Water Well Co.	1983	360	4,2	30	330-360	CHCTL	22	54	10/22/1983	D	--	--	D
UJ-62-49-711	James Manchac	Paskell Water Well Co.	1983	480	4,2	60	420-480	CHCTL	22	55	07/14/1983	P	--	--	D
UJ-62-49-804	Parkview Subdivision	Baison Water Well Drilling Co.	1979	490	6,4	20	470-490	CHCTL	14	44.46	04/12/1983	P	--	--	D,Q
UJ-62-50-106	Mauriceville Water Supply Corp.	Baison Water Well Drilling Co.	1983	480	10,6	35	445-480	CHCTL	26	50	09/27/1983	P	400	10	D
UJ-62-50-506	Karl Fragstein	Paskell Water Well Co.	1979	400	4	OH	400-460	CHCTL	23	55	03/15/1979	P	--	--	D
UJ-62-50-507	Harold Mills	Deep Water Red Drilling Co.	1979	374	2	10	364-374	CHCTL	21	69	06/26/1979	D	12	--	D
UJ-62-50-911	City of Orange, well no. 9	Franks Engine Service Inc.	1982	629	18,10	164	454-618	CHCTL	12	45.65	04/19/1983	P	--	--	D,E,Q,W
UJ-62-51-105	Sanderfer, Inc.	B & L Water Well Service	1981	466	4	20	446-466	CHCTL	25	21	05/17/1981	N	100	--	D
UJ-62-57-105	Paul Stelly	Richardson Water Well Co.	1983	455	4,2	30	425-455	CHCTL	17	56	10/18/1983	D	--	--	D
UJ-62-57-106	Don Lightfoot	Baison Water Well Drilling Co.	1979	560	4,2	30	530-560	CHCTL	20	50	03/ /1979	P	55	--	D
UJ-62-57-607	Frank Hatton	Paskell Water Well Co.	1979	560	4,2	40	520-560	CHCTL	9	45	01/18/1979	D	--	--	D
UJ-62-57-909	Gulf States Utilities Co., Sabine, well no. 9	Baison Water Well Drilling Co.	1982	460	12,6	50	410-460	CHCTL	10	107.80	04/21/1983	N	--	--	Q
UJ-62-57-910	Gulf States Utilities Co. Sabine, test well no. 1	Baison Water Well Drilling Co.	1982	280	2	20	260-280	CHCTL	10	114	10/23/1982	N	--	--	D

Table 5.--Records of selected wells in the study area, 1979-84--Continued

Well number	Owner	Driller	Date completed	Depth of well (feet)	Diameter of well (inches)	Screen		Principal aquifer	Altitude of land surface (feet)	Water level		Use of water	Discharge (gallons per minute)	Drawdown (feet)	Types of data available
						Length (feet)	Depth interval (feet)			Below land surface (feet)	Date of measurement				
UJ-62-57-911	Gulf States Utilities Co., Sabine, well no. 3-A	Baison Water Well Drilling Co.	1984	470	6,2	30	440-470	CHCTL	8	97	05/22/1984	P	95	--	D,Q
UJ-62-58-207	Love Truck Stop	Paskell Water Well Co.	1982	630	4,2	70	560-630	CHCTL	12	60	10/25/1982	P	--	--	D
UJ-62-58-326	City of Pinehurst, well no. 2	Franks Engine Service Inc.	1981	600	16,10	70	530-600	CHCTL	14	55.80	11/05/1981	P	1,530	29	D,Q
UJ-62-58-425	Drangefield ISD	Paskell Water Well Co.	1979	630	4	30	600-630	CHCTL	15	55	09/01/1979	P	100	--	D
						Hardin County, Texas									
LH-61-55-104	City of Beaumont, Lumberton, well no. 3	Layne-Texas Co.	1980	780	26,20,14	290	290-765	EVGL	40	54	02/04/1980	P	--	--	D,E,Q
LH-61-55-105	Lumberton M.U.D., well no. 3	Alsay-Texas Corp.	1983	796	24,18,14	257	343-770	EVGL	43	--	--	P	--	--	D,Q

Table 6.--Drillers' logs of selected wells in the study area, 1979-84

Orange County, Texas

Well UJ-61-56-615
Owner: Don Lightfoot
Driller: Baison Water Well Drilling Co.

	Thickness (feet)	Depth (feet)
Clay, brown and gray	22	22
Sand, tan	16	38
Clay, brown and gray	28	66
Sand, tan	29	95
Clay, brown and gray	35	130
Sand, tan	14	144
Clay, brown	28	172
Sand, tan	48	220
Clay, brown	35	255
Sand, tan	30	285
Clay, gray and brown	45	330
Mixed	15	345
Clay, gray and brown	15	360
Sand, tan	25	385
Clay, brown	10	395
Sand, coarse	25	420

Well UJ-61-56-923
Owner: Tiger Lake Utility District
Driller: Baison Water Well Drilling Co.

	Thickness (feet)	Depth (feet)
Clay, red	40	40
Sand, white, coarse	30	70
Clay, blue	15	85
Sand, white	70	155
Clay, blue	10	165
Sand, tan, medium	20	185
Clay, blue	160	345
Sand, medium, tan and white	10	355
Clay, blue	25	380
Sand, coarse	80	460

Well UJ-61-56-924
Owner: Vidor Independent School District
Driller: Baison Water Well Drilling Co.

	Thickness (feet)	Depth (feet)
Clay, gray	20	20
Clay, brown and gray	20	40
Clay, gray	18	58
Sand, tan	2	60
Sand, tan and brown	20	80
Sand, brown	20	100
Sand, tan	20	120
Clay, gray and blue	20	140
Clay, blue	4	144
Sand, tan	5	149
Clay, gray	21	170
Clay, gray and blue	20	190
Clay, gray and tan	20	210
Clay, tan	20	230
Clay, blue	20	250
Clay, gray and blue	40	290
Sand, tan	10	300
Clay, gray	10	310
Clay, gray and blue	4	314
Sand, tan	7	321
Sand, tan and brown	20	341
Sand, brown	19	360
Sand, brown and tan, coarse	50	410

Well UJ-62-49-302
Owner: Mauriceville Water Supply Corp.
Driller: Baison Water Well Drilling Co.

	Thickness (feet)	Depth (feet)
Clay, blue and gray	80	80
Sand, tan	10	90
Clay, blue and gray	50	140
Sand, tan	20	160
Clay, blue	80	240
Sand, tan	40	280

Table 6.--Drillers' logs of selected wells in the study area, 1979-84--Continued

	Thickness (feet)	Depth (feet)
Well UJ-62-49-302--Continued		
Clay, blue and gray	20	300
Sand, tan, coarse	60	360
Clay, blue	20	380
Sand, tan	80	460
Clay, blue and gray	40	500
Sand, tan, fine	40	540
Clay, blue	10	550
Sand, tan, fine and medium	100	650
Well UJ-62-49-612 **Owner: James Linscomb** **Driller: Baison Water Well Drilling Co.**		
Clay, gray	40	40
Sand, tan	5	45
Clay, gray and blue	10	55
Sand, tan	85	140
Clay, gray	160	300
Sand, tan	60	360
Clay, gray	5	365
Sand, tan	5	370
Clay, gray	2	372
Sand, tan	8	380
Clay, gray	5	385
Sand, tan	5	390
Clay, gray	5	395
Sand, tan	5	400
Sand, tan and white	60	460
Clay, gray and blue	10	470
Sand, tan	10	480
Clay, gray	10	490
Sand, tan	2	492
Clay, gray	3	495
Sand, brown, coarse	85	580
Well UJ-62-49-711 **Owner: James Manchac** **Driller: Paskell Water Well Co.**		
Clay	40	40
Sand	40	80
Clay	40	120
Sand	67	187
Clay	23	210
Sand	42	252
Clay	53	305
Sand, light	73	378
Clay	42	420
Sand	60	480
Well UJ-62-49-804 **Owner: Parkview Subdivision** **Driller: Baison Water Well Drilling Co.**		
Clay, brown	15	15
Sand, tan	10	25
Clay, brown	15	40
Sand, tan	120	160
Clay, blue	190	350
Sand, blue	140	490
Well UJ-62-50-106 **Owner: Mauriceville Water Supply Corp.** **Driller: Baison Water Well Drilling Co.**		
Clay, gray	40	40
Sand, fine, tan	10	50
Sand, tan	10	60
Sand, coarse, tan	75	135
Clay, blue and gray	15	150
Sand, tan	15	165
Clay, blue and gray	10	175
Sand, tan	10	185
Clay, blue and gray	125	310
Sand, coarse, tan	40	350
Clay, blue and gray	10	360
Sand, tan	20	380

Table 6.--Drillers' logs of selected wells in the study area, 1979-84--Continued

	Thickness (feet)	Depth (feet)
Well UJ-62-50-106--Continued		
Sand, fine, tan	30	410
Clay, blue and gray	15	425
Sand, fine	10	435
Sand, coarse, tan	215	650
Well UJ-62-50-506 Owner: Karl Fragstein Driller: Paskell Water Well Co.		
Clay	40	40
Sand	80	120
Clay	130	250
Sand, blue	23	273
Clay	63	336
Sand, light	42	378
Sand, medium	42	420
Sand, production, coarse	40	460
Well UJ-62-50-507 Owner: Harold Mills Driller: Deep Water Red Drilling Co.		
Clay	17	17
Quicksand	5	22
Clay	21	43
Sand, white	83	126
Clay	184	310
Sand and lignite	64	374
Well UJ-62-50-911 Owner: City of Orange, well no. 9 Driller: Franks Engine Service Inc.		
Topsoil	1	1
Shale, sticky	7	8
Quicksand, fine	18	26
Shale, sandy	14	40
Sand	36	76
Shale	2	78
Wood	1	79
Shale, sandy	24	103
Well UJ-62-50-911--Continued		
Shale	23	126
Sand, fine	4	130
Shale, sandy	170	300
Wood	3	303
Sand, coarse	42	345
Shale	35	380
Sand, fine	25	405
Shale, sandy	7	412
Sand, fine, packed	30	442
Shale	8	450
Sand, fine and medium	200	650
Well UJ-62-51-105 Owner: Sanderfer, Inc. Driller: B and L Water Well Service		
Clay, red	16	16
Sand, brown	65	81
Clay, blue	330	411
Sand, coarse	55	466
Well UJ-62-57-105 Owner: Paul Stelley Driller: Richardson Water Well Co.		
Topsoil and blue clay	20	20
Clay, blue	200	220
Sand, fine, white	20	240
Clay, blue	120	360
Sand, medium	60	420
Sand, coarse	35	455
Well UJ-62-57-106 Owner: Don Lightfoot Driller: Baison Water Well Drilling Co.		
Clay, brown	20	20
Sand, tan	5	25
Clay, brown	5	30
Sand, tan	10	40
Clay, brown	20	60

Table 6.--Drillers' logs of selected wells in the study area, 1979-84--Continued

	Thickness (feet)	Depth (feet)
Well UJ-62-57-106--Continued		
Sand, tan	20	80
Clay, brown and gray	20	100
Sand, tannish	50	150
Clay, gray	80	230
Sand, tan and brown	20	250
Clay, brown	70	320
Mixed	5	325
Clay, brown	5	330
Sand, tan	50	380
Clay, gray and brown	15	395
Sand, tan	5	400
Mixed	15	415
Clay, gray	20	435
Sand, coarse, tan	45	480
Clay, gray and brown	20	500
Sand, coarse	60	560
Well UJ-62-57-607 Owner: Frank Hatton Driller: Paskell Water Well Co.		
Clay, red and sand	63	63
Sand, white	63	126
Clay, blue	84	210
Sand, light	42	252
Clay	142	394
Sand, light	26	420
Sand, medium	40	460
Clay	20	480
Sand, medium	80	560
Well UJ-62-57-910 Owner: Gulf States Utilities, Sabine, test well no. 1 Driller: Baison Water Well Drilling Co.		
Clay, blue	10	10
Sand, tan	30	40
Clay, blue and gray	20	60
Well UJ-62-57-910--Continued		
Sand, coarse, tan	40	100
Clay, gray	10	110
Sand, tan	10	120
Clay, gray and blue	60	180
Sand, medium, beady	9	189
Sand, medium and coarse	26	215
Clay, blue	10	225
Sand, tan	35	260
Sand, beady, tan	20	280
Clay, blue and gray	20	300
Sand, tan	20	320
Clay, blue	20	340
Clay, blue and gray	40	380
Sand, tan, fine	4	384
Clay, blue and gray	76	460
Sand, beady	20	480
Well UJ-62-57-911 Owner: Gulf States Utilities, Sabine, well no. 3-A Driller: Baison Water Well Drilling Co.		
Clay, blue and gray	5	5
Sand, tan	3	8
Clay, blue and gray	12	20
Sand, tan	30	50
Clay, blue	6	56
Sand, tan	24	80
Clay, blue	70	150
Sand, tan	50	200
Clay, blue and gray	220	420
Sand, tan, salt and pepper	60	480
Well UJ-62-58-207 Owner: Love Truck Stop Driller: Paskell Water Well Co.		
Clay	10	10
Sand, red, fine	10	20

Table 6.--Drillers' logs of selected wells in the study area, 1979-84--Continued

	Thickness (feet)	Depth (feet)
Well UJ-62-58-207--Continued		
Clay	60	80
Sand	20	100
Clay	80	180
Sand	40	220
Clay	137	357
Sand, light blue	63	420
Clay	80	500
Sand, light	60	560
Sand, coarse	70	630
Well UJ-62-58-326 Owner: City of Pinehurst, well no. 2 Driller: Franks Engine Service, Inc.		
Topsoil	2	2
Clay	16	18
Sand, fine, red	8	26
Shale	43	69
Sand, fine	20	89
Sand, coarse	37	126
Shale, sandy	64	190
Shale, sandy	30	220
Shale, hard	130	350
Well UJ-62-58-326--Continued		
Shale, sandy	20	370
Sand, fine	50	420
Shale, sandy	30	450
Shale, hard	50	500
Shale, sandy	20	520
Sand, loose, fine	110	630
Well UJ-62-58-425 Owner: Orangefield Independent School District Driller: Paskell Water Well Co.		
Clay	63	63
Sand	63	126
Clay	84	210
Sand, light	22	232
Clay, blue	83	315
Sand, light	65	380
Clay	80	460
Sand, white, light	40	500
Mixed, light, medium	65	565
Clay, light	10	575
Sand, light, medium	25	600
Sand, coarse, white	30	630

Hardin County, Texas

	Thickness (feet)	Depth (feet)
Well LH-61-55-104 Owner: City of Beaumont, Lumberton, well no. 3 Driller: Layne-Texas Co.		
Topsoil	2	2
Clay	66	68
Sand	12	80
Clay	10	90
Sand	10	100
Clay	12	112
Clay, sandy	7	119
Sand	25	144
Clay	29	173
Shale	5	178
Well LH-61-55-104--Continued		
Sand	33	211
Shale	19	230
Shale, sandy	22	252
Sand and shale streaks	23	275
Shale	9	284
Sand	31	315
Shale	8	323
Sand and shale streaks	10	333
Shale	45	378
Sand	6	384
Sand and shale	6	390

Table 6.--Drillers' logs of selected wells in the study area, 1979-84--Continued

	Thickness (feet)	Depth (feet)
Well LH-61-55-104--Continued		
Sand	37	427
Shale and sand streaks	11	438
Sand	21	459
Shale, sandy	15	474
Sand	25	499
Shale and sand streaks	54	553
Clay and sand streaks	16	569
Sand	19	588
Clay	16	604
Sand	10	614
Sand and clay	10	624
Sand and clay streaks	20	644
Shale	12	656
Sand and clay streaks	51	707
Clay	3	710
Wood and shale	23	733
Sand	12	745
Sand and shale streaks	18	763
Wood and shale	22	785
Shale	20	805
Well LH-61-55-105 Owner: Lumberton Municipal Utility District, well no. 3 Driller: Alsay-Texas Corp.		
Sand, tan	20	20
Clay, brown-to-red	22	42
Clay, gray and brown	27	69
Clay, brown	20	89
Well LH-61-55-105--Continued		
Sand	34	123
Clay, gray	44	167
Clay, gray-to-red	13	180
Clay, gray, sandy	20	200
Sand	33	233
Sand and red clay	47	280
Sand and gravel	25	305
Sand, fine	13	318
Clay, gray	24	342
Clay, blue and sand	31	373
Sand and clay traces	12	385
Sand	16	401
Sand and clay	10	411
Sand with red and blue clay	10	421
Sand and gray clay	10	431
Sand and gray clay	19	450
Clay, blue	22	472
Sand and blue clay	11	483
Clay, blue and sand	11	494
Sand and blue clay	20	514
Clay and sand	12	526
Sand and blue clay	69	595
Sand and gray clay	118	713
Clay, brown-to-gray	29	742
Sand and blue clay	54	796
Clay, blue	10	806

Table 7.--Water levels in observation wells in the study area, 1980-85

[Datum for depth, screen, and water levels is land surface; datum for altitude is sea level]

Orange County, Texas

Well UJ-61-56-103
Owner: B.H. Thibodeau
Depth: 76 feet
Altitude: 23 feet

Date	Water level
03/31/1980	7.31
04/23/1981	13.19
04/26/1982	11.85
04/13/1983	10.19
04/19/1984	11.52
04/15/1985	11.09

Well UJ-61-56-116
Owner: H.H. Houseman
Depth: 800 feet
Altitude: 21 feet

Date	Water level
03/31/1980	41.28
04/23/1981	43.39
04/26/1982	42.41

Well UJ-61-56-314
Owner: L.B. Williamson
Screen: 375-385 feet
Altitude: 27 feet

Date	Water level
03/31/1980	41.33
04/27/1981	43.40
04/19/1982	43.83
04/15/1983	43.48
04/19/1984	43.62
04/15/1985	44.20

Well UJ-61-56-315
Owner: Iwanda Trailer Park
Screen: 356-380 feet
Altitude: 29 feet

Date	Water level
03/31/1980	41.63
04/27/1981	43.97
04/19/1982	44.40
04/15/1983	43.62
04/19/1984	43.83
04/15/1985	44.37

Well UJ-61-56-611
Owner: B & B Water System
Screen: 441-457 feet
Altitude: 22 feet

Date	Water level
04/23/1981	55.22
04/20/1982	55.99
04/13/1983	56.34
04/19/1984	54.97

Well UJ-61-56-901
Owner: Orange County WCID 1, well no. 2
Screen: 350-400 feet
Altitude: 21 feet

Date	Water level
04/08/1980	50.02
04/27/1981	52.13
04/23/1982	50.55
04/15/1983	51.92
04/23/1984	50.11
04/09/1985	50.65

Well UJ-61-56-919
Owner: Orange County WCID 1, well no. 3
Screen: 385-420 feet
Altitude: 21 feet

Date	Water level
04/08/1980	54.34
04/27/1981	54.87
04/23/1982	52.50
04/15/1983	52.42
04/09/1985	49.84

Well UJ-61-56-920
Owner: B & B Water System
Depth: 380 feet
Altitude: 11 feet

Date	Water level
04/01/1980	46.53
04/21/1981	50.18
04/19/1982	50.09
04/12/1983	51.25
04/19/1984	46.74
04/15/1985	47.54

Well UJ-61-56-922
Owner: Orange County WCID 1
Screen: 284-490 feet
Altitude: 26 feet

Date	Water level
04/08/1980	50.65
04/27/1981	52.28
04/15/1983	57.92
04/23/1984	50.85
04/09/1985	58.24

Well UJ-62-49-503
Owner: G.L. Linscomb
Depth: 117 feet
Altitude: 26 feet

Date	Water level
04/01/1980	7.83
04/24/1981	11.45
04/26/1982	9.23
04/12/1983	9.45
04/17/1984	8.68
04/08/1985	8.74

Well UJ-62-49-904
Owner: Texas Dept. of Highways & Public Transportation
Screen: 399-415 feet
Altitude: 16 feet

Date	Water level
04/03/1980	43.90
04/24/1981	44.78
04/23/1982	44.06
04/12/1983	43.72
04/18/1984	41.60

Well UJ-62-50-201
Owner: Boyce Ward
Screen: 476-586 feet
Altitude: 26 feet

Date	Water level
04/01/1980	44.50
04/24/1981	46.55
04/26/1982	45.09
04/12/1983	43.99
04/17/1984	42.04
04/08/1985	44.12

Well UJ-62-50-807
Owner: Frank Michell
Screen: 442-454 feet
Altitude: 20 feet

Date	Water level
04/03/1980	50.02
04/27/1981	51.29
04/30/1982	51.52
04/19/1983	50.82
04/23/1984	46.14
04/09/1985	46.60

Well UJ-62-50-808
Owner: H.D. Womack
Depth: 643-655 feet
Altitude: 21 feet

Date	Water level
04/03/1980	51.90
04/27/1981	52.92
04/30/1982	51.90
04/19/1983	50.65
04/23/1984	48.85
04/09/1985	48.15

Well UJ-62-50-904
Owner: George Glidden
Depth: 566 feet
Altitude: 12 feet

Date	Water level
04/01/1980	5.65
04/28/1981	7.87
04/21/1982	6.53
04/12/1983	5.72
04/16/1984	6.89

Table 7.--Water levels in observation wells in the study area, 1980-85--Continued

Well UJ-62-50-911
Owner: City of Orange, well no. 9
Screen: 454-618 feet
Altitude: 12 feet

Date	Water level
04/19/1983	45.65
04/18/1984	45.44
04/10/1985	44.10

Well UJ-62-51-103
Owner: Owens Illinois, Inc.
Screen: 445-515 feet
Altitude: 25 feet

Date	Water level
04/03/1980	45.05
04/24/1981	48.61
04/21/1982	45.71
04/22/1983	47.22
04/26/1984	41.61
04/09/1985	40.71

Well UJ-62-51-104
Owner: Owens Illinois, Inc.
Screen: 460-470 feet
Altitude: 25 feet

Date	Water level
04/03/1980	47.60
04/24/1981	50.28
04/21/1982	48.36
04/22/1983	49.72

Well UJ-62-51-707
Owner: Phillips Chemical Co.
Screen: 428-488 feet
Altitude: 12 feet

Date	Water level
04/03/1980	50.96
04/24/1981	52.38
04/21/1982	49.01
04/22/1983	48.40
04/26/1984	45.81
04/09/1985	46.52

Well UJ-62-57-203
Owner: Paul Comier
Depth: 740 feet
Altitude: 18 feet

Date	Water level
04/09/1980	48.90
04/21/1981	49.92
04/20/1982	48.75
04/14/1983	49.12
04/20/1984	46.96
04/09/1985	45.31

Well UJ-62-57-401
Owner: Texas Eastern Trans. Co.
Screen: 448-468 feet
Altitude: 16 feet

Date	Water level
04/02/1980	48.91
04/20/1981	50.26
04/20/1982	48.98
04/19/1983	48.00
04/26/1984	48.27
04/11/1985	48.84

Well UJ-62-57-403
Owner: Gulf States Util. Co., Vidor, well no. 1
Screen: 433-483 feet
Altitude: 15 feet

Date	Water level
04/11/1980	45.30
04/30/1981	48.83
04/15/1983	43.85
04/09/1985	42.89

Well UJ-62-57-404
Owner: Gulf States Util. Co., Vidor, well no. 2
Screen: 430-481 feet
Altitude: 16 feet

Date	Water level
04/20/1981	46.93
04/20/1982	49.72
04/16/1984	47.97
04/09/1985	44.90

Well UJ-62-57-405
Owner: Gulf States Util. Co., Vidor, well no. 3
Screen: 430-480 feet
Altitude: 18 feet

Date	Water level
04/02/1980	41.76
04/20/1981	54.19
04/09/1985	46.20

Well UJ-62-57-406
Owner: Gulf States Util. Co., Vidor, well no. 6
Screen: 430-480 feet
Altitude: 15 feet

Date	Water level
04/20/1982	47.83
04/09/1985	44.82

Well UJ-62-57-407
Owner: Gulf States Util. Co., Vidor, well no. 4
Screen: 320-370 feet
Altitude: 6 feet

Date	Water level
04/11/1980	40.35
04/30/1981	44.16
04/30/1982	41.02
04/15/1983	41.92
04/09/1985	30.60

Well UJ-62-57-408
Owner: Gulf States Util. Co., Vidor, well no. 5
Screen: 343-383 feet
Altitude: 6 feet

Date	Water level
04/16/1984	40.38
04/09/1985	31.36

Well UJ-62-57-409
Owner: L.N. Michael
Screen: 550-640 feet
Altitude: 13 feet

Date	Water level
04/02/1980	47.72
04/21/1981	48.92
04/20/1982	49.33
04/14/1983	48.26
04/20/1984	46.10
04/09/1985	43.05

Well UJ-62-57-501
Owner: Florida Gas Co.
Screen: 405-435 feet
Altitude: 16 feet

Date	Water level
04/02/1980	46.40
04/20/1981	47.30
04/20/1982	45.96
04/14/1983	46.69
04/16/1984	44.92
04/09/1985	41.60

Well UJ-62-57-904
Owner: Gulf States Util. Co., Sabine, well no. 4
Screen: 432-455 feet
Altitude: 10 feet

Date	Water level
04/08/1980	101.23
04/30/1981	101.95
04/27/1982	99.36
04/21/1983	96.44
04/26/1984	103.96

Well UJ-62-57-907
Owner: Gulf States Util. Co., Sabine, well no. 7
Screen: 604-654 feet
Altitude: 10 feet

Date	Water level
04/09/1980	45.59
04/30/1981	46.32
12/08/1982	45.55

Table 7.--Water levels in observation wells in the study area, 1980-85--Continued

Well UJ-62-57-908
Owner: Gulf States Util. Co., Sabine, well no. 8
Screen: 573-623 feet
Altitude: 10 feet

Date	Water level
04/27/1982	44.35
04/21/1983	44.80
04/26/1984	43.52
04/16/1985	41.25

Well UJ-62-58-304
Owner: Orange County WCID 2, well no. 1
Screen: 626-706 feet
Altitude: 10 feet

Date	Water level
04/10/1980	54.31
04/22/1981	53.55
04/20/1982	51.38
04/14/1983	50.56
04/23/1984	45.10
04/10/1985	47.70

Well UJ-62-58-305
Owner: City of Orange, well no. 8
Screen: 520-610 feet
Altitude: 11 feet

Date	Water level
04/04/1980	51.80
04/21/1981	52.82
04/22/1982	51.40
04/19/1983	49.68
04/18/1984	48.47
04/10/1985	51.36

Well UJ-62-58-324
Owner: City of Pinehurst, well no. 1
Screen: 365-445 feet
Altitude: 14 feet

Date	Water level
04/09/1980	55.31
04/22/1981	58.66
04/29/1982	50.20
04/18/1983	54.84
04/18/1984	47.25
04/10/1985	56.73

Well UJ-62-58-325
Owner: Orange County WCID 2, well no. 2
Screen: 620-670 feet
Altitude: 12 feet

Date	Water level
04/09/1980	53.21
04/22/1981	54.07
04/20/1982	53.61
04/14/1983	50.54
04/23/1984	46.97
04/10/1985	44.97

Well UJ-62-58-403
Owner: Orangefield Ind. School Dist.
Screen: 460-480 feet
Altitude: 15 feet

Date	Water level
04/03/1980	42.45
04/21/1981	42.75
04/14/1983	43.50
04/16/1984	43.68
04/09/1985	43.03

Well UJ-62-58-410
Owner: Orangefield Rec. Park
Screen: 110-120 feet
Altitude: 5 feet

Date	Water level
04/03/1980	6.89
04/21/1981	8.43
04/20/1982	7.37
04/14/1983	7.72
04/16/1984	7.78
04/09/1985	7.70

Well UJ-62-58-602
Owner: Ernie Willey
Depth: 711 feet
Altitude: 14 feet

Date	Water level
04/03/1980	57.12
04/27/1981	56.62
04/29/1982	54.86
04/18/1983	52.84
04/26/1984	50.94
04/10/1985	50.10

Well UJ-62-58-603
Owner: W.H. Stark Est.
Depth: 204 feet
Altitude: 8 feet

Date	Water level
04/04/1980	8.28
04/21/1981	8.36
04/19/1982	8.44
04/11/1983	8.29
04/17/1984	9.18
04/10/1985	10.53

Well UJ-62-58-605
Owner: Gulf Oil Products, well no. 4
Screen: 604-717 feet
Altitude: 7 feet

Date	Water level
04/10/1980	55.04
04/30/1981	57.49
04/26/1982	56.61
04/19/1983	50.12
04/11/1985	51.88

Well UJ-62-58-608
Owner: Allied Chemical Co.
Screen: 620-735 feet
Altitude: 8 feet

Date	Water level
04/04/1980	54.43
04/21/1981	51.82
04/20/1982	49.77
04/14/1983	47.61
04/17/1984	49.30
04/10/1985	47.00

Well UJ-62-58-609
Owner: E.I. DuPont Co., well no. 103-3
Screen: 634-723 feet
Altitude: 5 feet

Date	Water level
04/11/1980	51.90
04/28/1981	53.80
04/27/1982	50.99
04/24/1984	47.54
04/12/1985	47.35

Well UJ-62-58-610
Owner: E.I. DuPont Co., well no. 103-3.1
Depth: 715 feet
Altitude: 7 feet

Date	Water level
04/11/1980	51.85
04/28/1981	53.72
04/27/1982	50.93
04/21/1983	48.48
04/24/1984	49.70
04/12/1985	48.02

Well UJ-62-58-611
Owner: E.I. DuPont Co., well no. 103-2
Depth: 715 feet
Altitude: 8 feet

Date	Water level
01/10/1980	53.70
04/01/1980	53.18
08/27/1980	54.89
10/28/1980	54.96
01/07/1981	53.43
04/21/1981	53.44
06/30/1981	54.62
10/19/1981	55.12
02/10/1982	53.75
04/19/1982	51.45
07/14/1982	52.47
10/19/1982	52.98
01/14/1983	50.70
04/11/1983	50.13
08/03/1983	50.70
10/17/1983	48.89
02/14/1984	48.15
10/15/1984	47.72
04/08/1985	47.22

Table 7.--Water levels in observation wells in the study area, 1980-85--Continued

Well UJ-62-58-613
Owner: E.I. DuPont Co., well no. 103-1.1
Depth: 723 feet
Altitude: 10 feet

Date	Water level
04/11/1980	52.39
04/28/1981	53.88
04/27/1982	52.62
04/21/1983	48.16
04/24/1984	47.80
04/12/1985	47.17

Well UJ-62-58-614
Owner: E.I. DuPont Co., well no. 103.1
Depth: 726 feet
Altitude: 11 feet

Date	Water level
04/11/1980	55.17
04/28/1981	56.58
04/27/1982	54.40
04/21/1983	51.92
04/24/1984	50.48
04/12/1985	49.39

Well UJ-62-58-615
Owner: Firestone Petrochemical Center, well no. P-817
Depth: 700 feet
Altitude: 7 feet

Date	Water level
04/10/1980	50.76
04/28/1981	52.19
04/23/1982	49.64
04/21/1983	46.30
04/24/1984	46.27
04/10/1985	45.63

Well UJ-62-58-616
Owner: Gulf Oil Products, well no. 2
Depth: 718 feet
Altitude: 7 feet

Date	Water level
04/10/1980	53.75
04/30/1981	58.38
04/26/1982	53.08
04/19/1983	50.81
04/24/1984	47.54
04/11/1985	48.42

Well UJ-62-58-618
Owner: E.I. DuPont Co., well no. 103.6
Screen: 637-682 feet
Altitude: 5 feet

Date	Water level
04/11/1980	48.57
04/28/1981	50.17
04/27/1982	47.53
04/21/1983	45.40
04/24/1984	44.30
04/12/1985	43.48

Well UJ-62-58-631
Owner: Firestone Petrochemical Center, well no. P-826
Screen: 585-680 feet
Altitude: 6 feet

Date	Water level
04/10/1980	52.39
04/28/1981	53.90
04/23/1982	51.43
04/21/1983	50.35
04/24/1984	47.95

Well UJ-62-58-633
Owner: Polysar Gulf Coast Inc., well no. 2
Screen: 625-725 feet
Altitude: 5 feet

Date	Water level
04/09/1980	43.90
04/28/1981	45.19
04/23/1982	41.45
04/18/1983	39.18
04/24/1984	38.62
04/10/1985	38.39

Well UJ-62-58-634
Owner: Polysar Gulf Coast Inc., well no. 3
Screen: 614-715 feet
Altitude: 5 feet

Date	Water level
04/09/1980	49.35
04/28/1981	50.05
04/23/1982	46.61
04/18/1983	43.81
04/24/1984	43.77
04/10/1985	43.93

Well UJ-62-58-639
Owner: Polysar Gulf Coast Inc., well no. 4
Screen: 620-725 feet
Altitude: 5 feet

Date	Water level
04/28/1981	50.19
04/23/1982	44.32
04/18/1983	42.10
04/24/1984	41.51
04/10/1985	41.11

Well UJ-62-58-640
Owner: Polysar Gulf Coast Inc., well no. 5
Screen: 612-718 feet
Altitude: 5 feet

Date	Water level
04/09/1980	55.81

Well UJ-62-58-641
Owner: E.I. DuPont Co., well no. 103-6
Screen: 697-702 feet
Altitude: 5 feet

Date	Water level
04/11/1980	49.08
04/28/1981	50.66
04/27/1982	48.35
04/21/1983	46.01
04/24/1984	44.17
04/12/1985	44.19

Well UJ-62-58-702
Owner: Orange County WCID 3, well no. 2
Screen: 600-672 feet
Altitude: 10 feet

Date	Water level
04/03/1980	45.67
04/29/1982	45.34
04/14/1983	45.05
04/18/1984	45.20
04/10/1985	44.20

Well UJ-62-58-708
Owner: Gulf States Util. Co., Sabine, well no. 6
Depth: 465 feet
Altitude: 10 feet

Date	Water level
04/16/1985	111.74

Well UJ-62-58-809
Owner: Orange County WCID 3, well no. 3
Screen: 570-650 feet
Altitude: 7 feet

Date	Water level
04/22/1981	47.91

Well UJ-62-58-810
Owner: H.H. Silkwood
Screen: 160-170 feet
Altitude: 5 feet

Date	Water level
04/09/1980	9.02
04/22/1981	10.93
04/10/1985	8.99

Well UJ-62-59-101
Owner: City of Orange, well no. 7
Screen: 555-666 feet
Altitude: 10 feet

Date	Water level
04/10/1980	61.36
04/21/1981	58.71
04/19/1983	53.00
04/18/1984	47.87

Table 7.--Water levels in observation wells in the study area, 1980-85--Continued

Well UJ-62-59-103
Owner: City of Orange, well no. 2
Screen: 565-685 feet
Altitude: 9 feet

Date	Water level
04/04/1980	62.63
04/21/1981	59.09
04/22/1982	59.45
04/19/1983	54.31
04/18/1984	51.12
04/10/1985	48.65

Well UJ-62-59-105
Owner: Levingston Shipyard
Screen: 672-737 feet
Altitude: 9 feet

Date	Water level
04/01/1980	53.24
08/27/1980	57.91
10/28/1980	57.48
01/07/1981	54.94
04/21/1981	54.59
06/30/1981	56.04
10/19/1981	56.38
02/10/1982	54.92
04/19/1982	52.95
07/14/1982	53.88
10/19/1982	53.75
01/14/1983	51.56
04/11/1983	50.32
08/03/1983	50.50
10/17/1983	48.75
02/14/1984	47.45
04/17/1984	47.10
02/20/1985	45.80
04/08/1985	45.76

Well UJ-62-59-123
Owner: City of Orange, well no. 9
Screen: 529-643 feet
Altitude: 10 feet

Date	Water level
04/10/1980	50.45
04/21/1981	53.22
04/22/1982	51.89
04/19/1983	42.10
04/18/1984	33.07
04/10/1985	43.86

Hardin County, Texas

Well LH-61-47-208
Owner: City of Silsbee, well no. 3
Screen: 442-842 feet
Altitude: 80 feet

Date	Water level
04/07/1980	97.90
04/29/1981	102.05
04/28/1982	104.62
04/20/1983	95.71
04/25/1984	103.97
04/11/1985	101.83

Well LH-61-47-210
Owner: City of Silsbee, well no. 4
Depth: 900 feet
Altitude: 87 feet

Date	Water level
04/07/1980	114.03
04/29/1981	109.67
04/28/1982	112.34
04/20/1983	114.30
04/25/1984	111.88
04/11/1985	112.31

Well LH-61-47-804
Owner: Lumberton MUD, well no. 2
Screen: 395-458 feet
Altitude: 55 feet

Date	Water level
04/07/1980	58.10
05/01/1981	62.25
04/28/1982	68.31
04/20/1983	65.18
04/10/1985	61.80

Well LH-61-55-203
Owner: City of Beaumont
Screen: 301-775 feet
Altitude: 27 feet

Date	Water level
04/07/1980	58.32
05/01/1981	60.81
04/23/1982	73.33

Well LH-61-55-204
Owner: City of Beaumont
Screen: 311-780 feet
Altitude: 25 feet

Date	Water level
05/01/1981	50.24
04/15/1983	65.32

Well LH-61-55-206
Owner: Lumberton MUD, well no. 1
Screen: 380-443 feet
Altitude: 35 feet

Date	Water level
04/07/1980	59.21
05/01/1981	66.80
04/28/1982	77.10
04/20/1983	83.70
04/10/1985	73.10

Jasper County, Texas

Well PR-61-48-209
Owner: East Texas Pulp and Paper Co.
Screen: 213-594 feet
Altitude: 45 feet

Date	Water level
06/17/1980	33.30
03/11/1981	38.40
12/08/1981	39.20
12/08/1982	39.38
12/06/1983	37.59
12/05/1984	39.33

Well PR-61-48-214
Owner: Southern Pine Co.
Depth: 226 feet
Altitude: 42 feet

Date	Water level
04/08/1980	35.60
04/29/1981	38.39
04/28/1982	36.12
04/20/1983	35.54
04/25/1984	36.88
04/11/1985	35.65

Well PR-61-48-221
Owner: East Texas Pulp and Paper Co.
Screen: 723-1,264 feet
Altitude: 45 feet

Date	Water level
06/17/1980	180.10
03/11/1981	190.95
12/08/1981	203.87
12/08/1982	190.30
12/06/1983	199.41
12/05/1984	190.40

Table 7.--Water levels in observation wells in the study area, 1980-85--Continued

Date	Water level
Well PR-61-48-701	
Owner: Larkin Franklin	
Screen: 1,210-1,250 feet	
Altitude: 35 feet	
03/31/1980	100.85
Well PR-61-48-702	
Owner: J.C. Chance	
Screen: 448-468 feet	
Altitude: 30 feet	
03/31/1980	43.21
04/23/1981	45.62
04/26/1982	48.19
04/13/1983	46.56
04/19/1984	46.81
04/15/1985	45.97
Well PR-62-17-902	
Owner: W.S. Gillespie	
Screen: 300-325 feet	
Altitude: 119 feet	
06/17/1980	25.24
12/08/1981	32.25
12/08/1982	32.81
12/06/1983	30.48
12/05/1984	30.38
Well PR-62-33-211	
Owner: Cougar Country Subdiv.	
Screen: 495-535 feet	
Altitude: 68 feet	
04/08/1980	70.14
04/25/1984	74.33
04/12/1985	72.38
Well PR-62-33-401	
Owner: City of Buna	
Screen: 230-275 feet	
Altitude: 72 feet	
04/08/1980	30.52
04/28/1982	33.11
04/20/1983	31.51
04/25/1984	29.86
04/12/1985	30.91
Well PR-62-33-409	
Owner: City of Buna	
Depth: 803 feet	
Altitude: 70 feet	
04/08/1980	86.30
04/29/1981	87.60
04/28/1982	90.20
04/20/1983	90.76
04/25/1984	91.47
04/12/1985	89.86

Jefferson County, Texas

Date	Water level
Well PT-61-64-502	
Owner: Gulf States Util. Co.	
Screen: 306-435 feet	
Altitude: 10 feet	
04/09/1980	36.18
04/22/1981	39.52
04/21/1982	37.61
04/21/1983	35.91
04/20/1984	35.04
04/12/1985	32.98
Well PT-61-64-509	
Owner: Gulf States Util. Co.	
Screen: 380-542 feet	
Altitude: 8 feet	
04/09/1980	34.90
04/22/1981	37.36
04/21/1982	35.64
04/20/1983	36.02
04/20/1984	35.58
04/12/1985	32.79
Well PT-63-01-201	
Owner: City of Groves	
Screen: 520-540 feet	
Altitude: 9 feet	
04/04/1980	41.60
04/22/1981	42.44
Well PT-63-01-201--Cont.	
04/21/1982	41.65
04/18/1983	41.71
Well PT-63-01-606	
Owner: City of Groves	
Depth: 814 feet	
Altitude: 5 feet	
04/04/1980	35.79
04/22/1981	36.34
04/21/1982	36.31
04/18/1983	34.86
04/20/1984	36.87
04/11/1985	32.76

Newton County, Texas

Date	Water level
Well TZ-62-18-801	
Owner: Texas Forest Service	
Screen: 186-210 feet	
Altitude: 115 feet	
04/08/1980	39.49
04/29/1981	44.90
04/28/1982	40.92
04/20/1983	41.19
04/25/1984	40.85
04/11/1985	40.72
Well TZ-62-26-611	
Owner: Cecil Lazanbee	
Screen: 637-647 feet	
Altitude: 62 feet	
04/08/1980	6.62
04/29/1981	7.64
04/28/1982	7.46
04/20/1983	7.17
04/25/1984	7.84
Well TZ-62-42-102	
Owner: Joe Heinen	
Screen: 179-429 feet	
Altitude: 37 feet	
04/01/1980	31.94
04/12/1983	31.70
04/17/1984	29.68
04/08/1985	30.94

Table 7.--Water levels in observation wells in the study area, 1980-85--Continued

Well TZ-62-42-603
Owner: L.S. Arrendell
Screen: 184-190 feet
Altitude: 22 feet

Date	Water level
04/01/1980	4.80
04/24/1981	9.52
04/21/1982	7.74
04/12/1983	5.75
04/17/1984	6.24
04/08/1985	5.96

Well TZ-62-42-904
Owner: L.A. Whidden
Depth: 270 feet
Altitude: 34 feet

Date	Water level
04/01/1980	38.75
04/24/1981	40.92
04/21/1982	39.90
04/12/1983	38.09
04/17/1984	36.28
04/08/1985	35.81

Calcasieu Parish, Louisiana

Well CU-530
Owner: M. Gray
Depth: 595 feet
Altitude: 9.3 feet

Date	Water level
02/20/1981	53.89
02/22/1982	52.89
02/23/1983	48.13
03/06/1985	41.23

Well CU-625
Owner: Stine and Kinney
Depth: 460 feet
Altitude: 48.6 feet

Date	Water level
03/03/1981	48.50
02/24/1983	45.00
03/05/1985	42.32

Well CU-781
Owner: Edgerly Rice Dryer
Depth: 460 feet
Altitude: 35 feet

Date	Water level
02/19/1981	52.87
02/24/1983	53.08
03/05/1985	45.82

Well CU-762
Owner: Raymond Royer
Screen: 372-431 feet
Altitude: 42.23 feet

Date	Water level
03/05/1985	52.60

Cameron Parish, Louisiana

Well CN-86-U
Owner: U.S. Geological Survey
Screen: 525-535 feet
Altitude: 3.66 feet

Date	Water level
02/12/1980	47.66
02/19/1981	48.15
02/23/1983	44.87
03/06/1985	40.89

Well CN-86-L
Owner: U.S. Geological Survey
Screen: 631-641 feet
Altitude: 3.66 feet

Date	Water level
02/12/1980	47.79
02/19/1981	48.85
02/23/1983	45.01
03/06/1985	41.01

Well CN-94
Owner: U.S. Geological Survey
Screen: 1,112-1,118 feet
Altitude: 6.2 feet

Date	Water level
02/20/1981	41.82
02/23/1983	40.90
02/27/1985	39.47

Table 8.--Chemical analyses of water from selected wells in the study area, 1980-84

Water-bearing-unit: CHCTU, upper unit of Chicot aquifer; CHCTL, lower unit of Chicot aquifer.

[mg/L, milligrams per liter; µg/L, micrograms per liter; microsiemens, microsiemens per centimeter at 25 °Celsius; deg C = degree Celsius]

Well	Owner	Depth or producing interval (feet)	Water-bearing unit	Date of sample	Silica, dissolved (mg/L as SiO2)	Iron, dissolved (µg/L as Fe)	Manganese, dissolved (µg/L as Mn)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Bicarbonate (mg/L as HCO3)	Carbonate (mg/L as CO3)	Sulfate, dissolved (mg/L as SO4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Dissolved solids, sum of constituents (mg/L)	Hardness (mg/L as CaCO3)	Specific conductance (microsiemens)	pH (standard units)	Temperature (deg C)
									Orange County, Texas											
1/ UJ-61-56-614	Pine Forest School District	453 - 483	CHCTL	80-10-27	--	--	--	--	--	--	--	--	0.6	59	--	--	--	600	8.1	--
				81-10-20	--	--	--	--	--	--	--	--	<5.0	65	--	--	--	620	8.1	--
				82-10-19	--	--	--	--	--	--	--	--	--	56	--	--	--	610	7.9	--
				83-10-19	--	--	--	--	--	--	--	--	--	47	--	--	--	610	8.0	--
				84-10-16	--	--	--	--	--	--	--	--	--	84	--	--	--	739	8.0	--
UJ-61-56-901	Orange County WCID 1, well no. 2	350 - 400	CHCTL	80-10-20	--	--	--	--	--	--	--	--	.8	350	--	--	--	1560	7.5	20.0
1/ UJ-61-56-911	B and B Water System	468 - 486	CHCTL	80-10-27	--	--	--	--	--	--	--	--	.5	88	--	--	--	680	8.1	--
				81-10-20	--	--	--	--	--	--	--	--	<5.0	100	--	--	--	700	8.2	--
				82-10-18	--	--	--	--	--	--	--	--	--	89	--	--	--	700	8.0	--
				83-11-19	--	--	--	--	--	--	--	--	--	85	--	--	--	700	8.1	--
				84-10-16	--	--	--	--	--	--	--	--	--	92	--	--	--	720	7.8	--
UJ-61-56-919	Orange County WCID 1, well no. 3	385 - 420	CHCTL	80-10-20	--	--	--	--	--	--	--	--	.7	210	--	--	--	1020	7.5	20.0
				81-10-23	--	--	--	--	--	--	--	--	<5.0	55	--	--	--	500	7.9	24.0
				82-12-09	--	--	--	--	--	--	--	--	--	60	--	--	--	490	7.6	21.0
				83-10-21	--	--	--	--	--	--	--	--	--	50	--	--	--	490	7.9	24.0
				84-10-22	--	--	--	--	--	--	--	--	--	48	--	--	--	487	7.4	24.0
UJ-61-56-922	Orange County WCID 1	284 - 490	CHCTL	81-10-23	--	--	--	--	--	--	--	--	<5.0	58	--	--	--	490	8.2	22.5
				82-12-09	--	--	--	--	--	--	--	--	--	53	--	--	--	490	7.9	22.0
				83-10-21	--	--	--	--	--	--	--	--	--	48	--	--	--	480	8.3	22.5
				84-10-22	--	--	--	--	--	--	--	--	--	43	--	--	--	481	7.8	22.0
1/ UJ-61-64-105	G and W Marine	54 - 60	CHCTU	80-10-20	--	--	--	--	--	--	--	--	1.8	1000	--	--	--	3600	6.1	20.0
1/ UJ-61-64-302	Vidor Independent School District	521	CHCTL	80-10-27	--	--	--	--	--	--	--	--	1.7	430	--	--	--	1820	8.1	--
				81-10-30	--	--	--	--	--	--	--	--	<5.0	440	--	--	--	1820	8.0	--
				82-10-19	--	--	--	--	--	--	--	--	--	430	--	--	--	1750	7.9	--
				83-10-19	--	--	--	--	--	--	--	--	--	390	--	--	--	1700	7.9	--
				84-10-16	--	--	--	--	--	--	--	--	--	450	--	--	--	1910	8.0	--
UJ-61-64-305	David Wilkerson	462 - 472	CHCTL	80-10-24	--	--	--	--	--	--	--	--	1.3	150	--	--	--	800	8.2	19.0
				81-10-20	--	--	--	--	--	--	--	--	<5.0	150	--	--	--	840	8.2	--
				82-10-19	--	--	--	--	--	--	--	--	--	150	--	--	--	820	8.1	22.5
				83-10-19	--	--	--	--	--	--	--	--	--	140	--	--	--	810	8.1	23.0
				84-10-16	--	--	--	--	--	--	--	--	--	140	--	--	--	830	7.8	23.5
1/ UJ-61-64-306	B and B Water System	525 - 545	CHCTL	80-10-27	--	--	--	--	--	--	--	--	1.7	320	--	--	--	1440	8.2	--
				81-10-20	--	--	--	--	--	--	--	--	7.0	290	--	--	--	1360	8.4	--
				82-10-19	--	--	--	--	--	--	--	--	--	290	--	--	--	1300	8.1	--
				83-10-19	--	--	--	--	--	--	--	--	--	140	--	--	--	1340	8.2	--
				84-10-16	--	--	--	--	--	--	--	--	--	280	--	--	--	1350	8.0	--

See footnotes at end of table.

Table 8.--Chemical analyses of water from selected wells in the study area, 1980-84--Continued

Well	Owner	Depth or producing interval (feet)	Water-bearing unit	Date of sample	Silica, dissolved (mg/L as SiO2)	Iron, dissolved (µg/L as Fe)	Manganese, dissolved (µg/L as Mn)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Bicarbonate (mg/L as HCO3)	Carbonate (mg/L as CO3)	Sulfate, dissolved (mg/L as SO4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Dissolved solids, sum of constituents (mg/L)	Hardness (mg/L as CaCO3)	Specific conductance (microsiemens)	pH (standard units)	Temperature (deg C)
1/ UJ-62-49-703	James P. Wilson	693 - 703	CHCTL	80-10-20	--	--	--	--	--	--	--	--	0.5	680	--	--	--	2400	7.7	--
				81-10-30	--	--	--	--	--	--	--	--	<5.0	660	--	--	--	2400	8.0	--
				82-12-09	--	--	--	--	--	--	--	--	--	670	--	--	--	2400	8.2	--
				83-10-28	--	--	--	--	--	--	--	--	--	620	--	--	--	2400	8.1	--
				84-10-22	--	--	--	--	--	--	--	--	--	610	--	--	--	2480	7.9	--
1/ UJ-62-49-804	Parkview Subdivision	470 - 490	CHCTL	83-10-28	--	--	--	--	--	--	--	--	--	12	--	--	--	220	7.9	--
1/ UJ-62-49-904	Texas Department of Highways and Public Transportation	399 - 415	CHCTL	80-10-27	--	--	--	--	--	--	--	--	.7	21	--	--	--	230	7.5	--
				81-10-19	--	--	--	--	--	--	--	--	<5.0	24	--	--	--	230	7.7	--
				82-12-06	--	--	--	--	--	--	--	--	--	17	--	--	--	230	7.4	--
				83-10-18	--	--	--	--	--	--	--	--	--	14	--	--	--	230	7.5	--
				84-10-16	--	--	--	--	--	--	--	--	--	14	--	--	--	232	7.6	--
1/ UJ-62-49-905	Texas Department of Highways and Public Transportation	378 - 394	CHCTL	81-10-23	--	--	--	--	--	--	--	--	<5.0	17	--	--	--	240	7.6	--
				83-10-19	--	--	--	--	--	--	--	--	--	13	--	--	--	240	7.8	--
1/ UJ-62-50-808	H.D. Womack	643 - 655	CHCTL	80-10-31	--	--	--	--	--	--	--	--	2.3	150	--	--	--	700	7.2	--
				81-10-30	--	--	--	--	--	--	--	--	<5.0	150	--	--	--	680	7.2	--
				82-12-09	--	--	--	--	--	--	--	--	--	140	--	--	--	650	7.0	--
				84-10-19	--	--	--	--	--	--	--	--	--	120	--	--	--	620	6.9	--
UJ-62-50-910	Little Cypress-Mauriceville Consolidated School District	450 - 500	CHCTL	80-10-23	--	--	--	--	--	--	--	--	1.2	30	--	--	--	320	7.1	--
				81-10-27	--	--	--	--	--	--	--	--	<5.0	31	--	--	--	320	7.2	--
				82-12-06	--	--	--	--	--	--	--	--	--	35	--	--	--	320	7.2	23.0
				83-10-26	--	--	--	--	--	--	--	--	--	30	--	--	--	320	7.2	--
				84-10-19	--	--	--	--	--	--	--	--	--	29	--	--	--	304	6.9	--
UJ-62-50-911	City of Orange, well no. 9	455 - 618	CHCTL	83-10-18	--	--	--	--	--	--	--	--	--	47	--	--	--	430	7.4	--
				84-10-18	--	--	--	--	--	--	--	--	--	58	--	--	--	486	7.0	24.0
UJ-62-51-706	Phillips Chemical Co.	428 - 488	CHCTL	80-10-23	--	--	--	--	--	--	--	--	2.9	27	--	--	--	360	7.7	--
				81-10-27	--	--	--	--	--	--	--	--	<5.0	29	--	--	--	360	7.5	--
				82-12-06	--	--	--	--	--	--	--	--	--	26	--	--	--	350	7.5	--
				83-10-26	--	--	--	--	--	--	--	--	--	23	--	--	--	340	7.4	--
				84-10-19	--	--	--	--	--	--	--	--	--	22	--	--	--	342	7.4	24.0
1/ UJ-62-57-203	Paul Comier	740	CHCTL	80-10-24	--	--	--	--	--	--	--	--	3.5	52	--	--	--	440	7.8	--
UJ-62-57-401	Texas Eastern Transmission Co.	448 - 468	CHCTL	81-10-20	--	--	--	--	--	--	--	--	<5.0	67	--	--	--	480	8.2	--
				82-10-19	--	--	--	--	--	--	--	--	--	63	--	--	--	480	8.1	--
				83-10-19	--	--	--	--	--	--	--	--	--	58	--	--	--	480	8.4	--
				84-10-24	--	--	--	--	--	--	--	--	--	56	--	--	--	460	7.9	--
UJ-62-57-403	Gulf States Utilities Co., Vidor, well no. 1	433 - 483	CHCTL	80-10-20	--	--	--	--	--	--	--	--	.1	390	--	--	--	1560	7.5	21.0
				81-10-20	--	--	--	--	--	--	--	--	<5.0	440	--	--	--	1840	7.9	
				83-10-14	--	--	--	--	--	--	--	--	--	430	--	--	--	1800	7.8	25.0

See footnotes at end of table.

Table 8.--Chemical analyses of water from selected wells in the study area, 1980-84--Continued

Well	Owner	Depth or producing interval (feet)	Water-bearing unit	Date of sample	Silica, dissolved (mg/L as SiO2)	Iron, dissolved (µg/L as Fe)	Manganese, dissolved (µg/L as Mn)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Bicarbonate (mg/L as HCO3)	Carbonate (mg/L as CO3)	Sulfate, dissolved (mg/L as SO4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Dissolved solids, sum of constituents (mg/L)	Hardness (mg/L as CaCO3)	Specific conductance (microsiemens)	pH (standard units)	Temperature (deg C)
UJ-62-57-404	Gulf States Utilities Co., Vidor, well no. 2	430 - 481	CHCTL	80-10-20	--	--	--	--	--	--	--	--	8.5	1500	--	--	--	4800	7.2	21.5
				83-10-28	--	--	--	--	--	--	--	--	--	700	--	--	--	2700	7.7	24.0
				84-10-26	--	--	--	--	--	--	--	--	--	910	--	--	--	3270	7.4	24.5
UJ-62-57-405	Gulf States Utilities Co., Vidor, well no. 3	430 - 480	CHCTL	81-10-20	--	--	--	--	--	--	--	--	<5.0	1600	--	--	--	5050	7.6	24.5
				82-10-18	--	--	--	--	--	--	--	--	--	1600	--	--	--	5000	7.7	25.0
				83-10-28	--	--	--	--	--	--	--	--	--	440	--	--	--	1830	7.9	24.0
				84-10-26	--	--	--	--	--	--	--	--	--	1700	--	--	--	5660	7.5	25.0
UJ-62-57-406	Gulf States Utilities Co., Vidor, well no. 6	430 - 480	CHCTL	80-10-20	--	--	--	--	--	--	--	--	1.0	730	--	--	--	2600	7.4	21.0
				81-10-20	--	--	--	--	--	--	--	--	<5.0	1000	--	--	--	3300	7.7	24.0
				82-10-18	--	--	--	--	--	--	--	--	--	820	--	--	--	3000	7.7	25.0
				83-10-28	--	--	--	--	--	--	--	--	--	420	--	--	--	1820	7.8	24.0
				84-10-17	--	--	--	--	--	--	--	--	--	670	--	--	--	2540	7.6	24.0
UJ-62-57-407	Gulf States Utilities Co., Vidor, well no. 4	320 - 370	CHCTL	80-10-20	--	--	--	--	--	--	--	--	1.1	110	--	--	--	686	7.8	20.0
				81-10-20	--	--	--	--	--	--	--	--	<5.0	130	--	--	--	730	8.1	23.5
				82-10-18	--	--	--	--	--	--	--	--	--	130	--	--	--	740	8.0	24.0
				83-10-26	--	--	--	--	--	--	--	--	--	440	--	--	--	--	7.7	24.0
				84-10-17	--	--	--	--	--	--	--	--	--	120	--	--	--	770	8.0	23.5
UJ-62-57-408	Gulf States Utilities Co., Vidor, well no. 5	343 - 383	CHCTL	81-10-20	--	--	--	--	--	--	--	--	<5.0	120	--	--	--	760	8.2	23.0
				82-10-18	--	--	--	--	--	--	--	--	--	120	--	--	--	760	8.1	24.0
				84-10-17	--	--	--	--	--	--	--	--	--	120	--	--	--	804	7.7	23.0
1/ UJ-62-57-501	Florida Gas Co.	405 - 435	CHCTL	80-10-24	--	--	--	--	--	--	--	--	1.1	28	--	--	--	360	8.0	--
				81-10-20	--	--	--	--	--	--	--	--	<5.0	30	--	--	--	380	8.0	--
				82-12-09	--	--	--	--	--	--	--	--	--	33	--	--	--	360	7.8	--
				83-10-19	--	--	--	--	--	--	--	--	--	28	--	--	--	360	8.1	--
				84-10-17	--	--	--	--	--	--	--	--	--	28	--	--	--	368	8.0	--
UJ-62-57-502	The Texas Co.	478 - 528	CHCTL	80-10-30	--	--	--	--	--	--	--	--	1.1	23	--	--	--	340	7.9	--
				81-10-28	--	--	--	--	--	--	--	--	<5.0	22	--	--	--	350	8.0	--
				82-10-20	--	--	--	--	--	--	--	--	--	25	--	--	--	350	7.9	--
				83-10-25	--	--	--	--	--	--	--	--	--	23	--	--	--	350	7.9	--
				84-10-17	--	--	--	--	--	--	--	--	--	21	--	--	--	359	7.7	--
1/ UJ-62-57-605	Paul Comier	469 - 489	CHCTL	80-10-24	--	--	--	--	--	--	--	--	.8	30	--	--	--	320	7.8	--
				81-10-20	--	--	--	--	--	--	--	--	<5.0	36	--	--	--	320	7.9	--
				82-10-19	--	--	--	--	--	--	--	--	--	29	--	--	--	315	7.6	--
				83-10-20	--	--	--	--	--	--	--	--	--	26	--	--	--	300	7.9	--
				84-10-17	--	--	--	--	--	--	--	--	--	26	--	--	--	320	7.6	--
UJ-62-57-901	Gulf States Utilities Co., Sabine, well no. 1	575 - 625	CHCTL	80-10-23	--	--	--	--	--	--	--	--	5.5	1300	--	--	--	4200	7.9	22.0
				82-12-08	--	--	--	--	--	--	--	--	--	1200	--	--	--	3900	7.7	25.0
				83-10-27	--	--	--	--	--	--	--	--	--	1200	--	--	--	4300	7.9	25.0
				84-10-24	--	--	--	--	--	--	--	--	--	1200	--	--	--	4170	7.5	25.0

See footnotes at end of table.

Table 8.--Chemical analyses of water from selected wells in the study area, 1980-84--Continued

Well	Owner	Depth or producing interval (feet)	Water-bearing unit	Date of sample	Silica, dissolved (mg/L as SiO2)	Iron, dissolved (µg/L as Fe)	Manganese, dissolved (µg/L as Mn)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Bicarbonate (mg/L as HCO3)	Carbonate (mg/L as CO3)	Sulfate, dissolved (mg/L as SO4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Dissolved solids, sum of constituents (mg/L)	Hardness (mg/L as CaCO3)	Specific conductance (microsiemens)	pH (standard units)	Temperature (deg C)
UJ-62-57-904	Gulf States Utilities Co., Sabine, well no. 4	432 - 455	CHCTL	80-10-23	--	--	--	--	--	--	--	--	1.0	46	--	--	--	500	8.1	21.0
				81-10-29	--	--	--	--	--	--	--	--	<5.0	62	--	--	--	500	8.1	24.0
				82-12-08	--	--	--	--	--	--	--	--	--	47	--	--	--	500	8.2	24.0
UJ-62-57-905	Gulf States Utilites Co., Sabine, well no. 5	422 - 461	CHCTL	80-10-23	--	--	--	--	--	--	--	--	5.6	47	--	--	--	560	8.0	20.5
				81-10-29	--	--	--	--	--	--	--	--	<5.0	47	--	--	--	560	8.1	23.5
				82-12-08	--	--	--	--	--	--	--	--	--	49	--	--	--	560	8.1	24.0
				84-10-24	--	--	--	--	--	--	--	--	--	46	--	--	--	558	7.9	24.0
UJ-62-57-907	Gulf States Utilities Co., Sabine, well no. 7	604 - 654	CHCTL	80-10-23	--	--	--	--	--	--	--	--	1.3	200	--	--	--	900	7.9	23.0
				81-10-29	--	--	--	--	--	--	--	--	<5.0	210	--	--	--	980	8.0	25.5
				82-12-08	--	--	--	--	--	--	--	--	--	210	--	--	--	1000	8.2	26.0
				83-10-27	--	--	--	--	--	--	--	--	--	220	--	--	--	1030	8.0	25.0
				84-10-24	--	--	--	--	--	--	--	--	--	210	--	--	--	1010	7.8	25.0
UJ-62-57-908	Gulf States Utilities Co., Sabine, well no. 8	573 - 623	CHCTL	80-10-23	--	--	--	--	--	--	--	--	.8	190	--	--	--	900	7.9	22.0
				82-12-08	--	--	--	--	--	--	--	--	--	140	--	--	--	720	8.0	25.0
				83-10-27	--	--	--	--	--	--	--	--	--	170	--	--	--	840	8.1	25.0
				84-10-24	--	--	--	--	--	--	--	--	--	180	--	--	--	873	7.9	25.0
UJ-62-57-909	Gulf States Utilities Co., Sabine, well no. 9	410 - 460	CHCTL	83-10-27	--	--	--	--	--	--	--	--	--	54	--	--	--	570	8.1	24.0
				84-10-24	--	--	--	--	--	--	--	--	--	50	--	--	--	514	7.9	24.0
2/ UJ-62-57-911	Gulf States Utilities Co., Sabine, well no. 3-A	440 - 470	CHCTL	84-06-18	3/29	4/1100	--	5/4.4	6/1.6	7/119	--	--	8/2.8	9/55	--	--	20	560	7.5	--
UJ-62-58-304	Orange County WCID 2, well no. 1	626 - 706	CHCTL	80-10-21	--	--	--	--	--	--	--	--	3.6	180	--	--	--	860	7.4	21.5
				81-10-22	--	--	--	--	--	--	--	--	<5.0	180	--	--	--	870	7.4	25.0
				82-10-20	--	--	--	--	--	--	--	--	--	170	--	--	--	820	7.9	24.5
				83-10-18	--	--	--	--	--	--	--	--	--	150	--	--	--	820	7.6	24.0
				84-10-18	--	--	--	--	--	--	--	--	--	160	--	--	--	840	7.5	25.0
UJ-62-58-305	City of Orange, well no. 8	520 - 610	CHCTL	83-10-18	--	--	--	--	--	--	--	--	--	140	--	--	--	760	7.1	24.0
UJ-62-58-324	City of Pine-hurst, well no. 1	365 - 445	CHCTL	80-10-21	--	--	--	--	--	--	--	--	2.8	16	--	--	--	280	7.3	20.0
				81-10-22	--	--	--	--	--	--	--	--	<5.0	22	--	--	--	290	7.4	23.0
UJ-62-58-325	Orange County WCID 2, well no. 2	620 - 670	CHCTL	80-10-21	--	--	--	--	--	--	--	--	.8	150	--	--	--	780	7.3	21.5
				81-10-22	--	--	--	--	--	--	--	--	<5.0	150	--	--	--	770	7.6	25.0
				82-10-20	--	--	--	--	--	--	--	--	--	150	--	--	--	750	7.4	24.5
				83-10-18	--	--	--	--	--	--	--	--	--	130	--	--	--	740	7.5	24.5
				84-10-18	--	--	--	--	--	--	--	--	--	130	--	--	--	758	7.5	25.0

See footnotes at end of table.

Table 8.--Chemical analyses of water from selected wells in the study area, 1980-84--Continued

Well	Owner	Depth or producing interval (feet)	Water-bearing unit	Date of sample	Silica, dissolved (mg/L as SiO2)	Iron, dissolved (µg/L as Fe)	Manganese, dissolved (µg/L as Mn)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Bicarbonate (mg/L as HCO3)	Carbonate (mg/L as CO3)	Sulfate, dissolved (mg/L as SO4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Dissolved solids, sum of constituents (mg/L)	Hardness (mg/L as CaCO3)	Specific conductance (microsiemens)	pH (standard units)	Temperature (deg C)
UJ-62-58-326	City of Pinehurst, well no. 2	530 - 600	CHCTL	82-10-20	--	--	--	--	--	--	--	--	--	66	--	--	--	460	7.4	24.0
				83-10-25	--	--	--	--	--	--	--	--	--	60	--	--	--	450	7.2	24.0
				84-10-18	--	--	--	--	--	--	--	--	--	61	--	--	--	466	7.1	24.5
1/ UJ-62-58-402	Orangefield Independent School District	515 - 535	CHCTL	80-10-24	--	--	--	--	--	--	--	--	0.9	32	--	--	--	340	8.1	--
				81-10-21	--	--	--	--	--	--	--	--	<5.0	37	--	--	--	340	7.8	--
				82-10-20	--	--	--	--	--	--	--	--	--	49	--	--	--	400	7.8	--
				83-10-20	--	--	--	--	--	--	--	--	--	42	--	--	--	400	8.0	--
				84-10-17	--	--	--	--	--	--	--	--	--	36	--	--	--	377	7.7	--
UJ-62-58-409	J.W. Phillips Water System	564 - 651	CHCTL	80-10-31	--	--	--	--	--	--	--	--	.9	220	--	--	--	970	7.8	--
				81-10-21	--	--	--	--	--	--	--	--	<5.0	230	--	--	--	980	7.9	26.0
				82-10-20	--	--	--	--	--	--	--	--	--	220	--	--	--	1020	8.2	--
				83-10-20	--	--	--	--	--	--	--	--	--	200	--	--	--	970	8.1	--
				84-10-17	--	--	--	--	--	--	--	--	--	200	--	--	--	996	7.7	--
1/ UJ-62-58-423	B and B Water System	208 - 218	CHCTU	80-10-30	--	--	--	--	--	--	--	--	.8	73	--	--	--	800	8.0	--
				81-10-28	--	--	--	--	--	--	--	--	<5.0	74	--	--	--	810	8.0	--
				82-12-07	--	--	--	--	--	--	--	--	--	74	--	--	--	810	7.9	--
				83-10-25	--	--	--	--	--	--	--	--	--	68	--	--	--	800	8.0	--
				84-10-25	--	--	--	--	--	--	--	--	--	68	--	--	--	804	7.9	--
1/ UJ-62-58-513	Bayou Pines Trailer Park	205 - 215	CHCTU	80-10-29	--	--	--	--	--	--	--	--	48	63	--	--	--	860	7.7	--
				81-10-26	--	--	--	--	--	--	--	--	49	70	--	--	--	900	7.7	--
				82-10-22	--	--	--	--	--	--	--	--	--	66	--	--	--	870	7.4	--
				83-10-24	--	--	--	--	--	--	--	--	--	62	--	--	--	890	7.7	--
				84-10-19	--	--	--	--	--	--	--	--	--	59	--	--	--	867	7.4	--
UJ-62-58-605	Gulf Oil Products, well no. 4	604 - 717	CHCTL	80-10-22	--	--	--	--	--	--	--	--	.6	500	--	--	--	1900	7.6	18.0
				81-10-30	--	--	--	--	--	--	--	--	<5.0	580	--	--	--	2000	7.6	24.5
				82-12-08	--	--	--	--	--	--	--	--	--	580	--	--	--	2200	7.6	21.0
				83-10-27	--	--	--	--	--	--	--	--	--	1300	--	--	--	4500	7.5	24.5
				84-10-24	--	--	--	--	--	--	--	--	--	1000	--	--	--	3620	7.4	26.0
UJ-62-58-606	Gulf Oil Products, well no. 3	630 - 710	CHCTL	80-10-22	--	--	--	--	--	--	--	--	.8	240	--	--	--	1060	7.5	22.5
				81-10-30	--	--	--	--	--	--	--	--	<5.0	250	--	--	--	1060	7.7	25.5
				82-12-08	--	--	--	--	--	--	--	--	--	270	--	--	--	1220	7.6	25.0
				83-10-27	--	--	--	--	--	--	--	--	--	270	--	--	--	1220	7.7	25.0
				84-10-24	--	--	--	--	--	--	--	--	--	270	--	--	--	1220	7.5	25.0
UJ-62-58-608	Allied Chemical Co.	620 - 735	CHCTL	81-10-27	--	--	--	--	--	--	--	--	<5.0	300	--	--	--	1210	7.7	24.0
				82-10-21	--	--	--	--	--	--	--	--	--	380	--	--	--	1540	7.4	24.0
				83-10-20	--	--	--	--	--	--	--	--	--	300	--	--	--	1340	7.7	24.0
				84-10-16	--	--	--	--	--	--	--	--	--	290	--	--	--	1300	7.4	25.0
UJ-62-58-609	E.I. DuPont Co., well no. 103-3	634 - 723	CHCTL	80-10-30	--	--	--	--	--	--	--	--	.4	220	--	--	--	990	7.7	--
				81-10-28	--	--	--	--	--	--	--	--	<5.0	200	--	--	--	904	7.7	--
				82-12-07	--	--	--	--	--	--	--	--	--	190	--	--	--	940	7.7	22.0
				83-10-26	--	--	--	--	--	--	--	--	--	230	--	--	--	1070	7.7	25.0
				84-10-23	--	--	--	--	--	--	--	--	--	210	--	--	--	1050	7.6	24.0

See footnotes at end of table.

Table 8.--Chemical analyses of water from selected wells in the study area, 1980-84--Continued

Well	Owner	Depth or producing interval (feet)	Water-bearing unit	Date of sample	Silica, dissolved (mg/L as SiO2)	Iron, dissolved (µg/L as Fe)	Manganese, dissolved (µg/L as Mn)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Bicarbonate (mg/L as HCO3)	Carbonate (mg/L as CO3)	Sulfate, dissolved (mg/L as SO4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Dissolved solids, sum of constituents (mg/L)	Hardness (mg/L as CaCO3)	Specific conductance (microsiemens)	pH (standard units)	Temperature (deg C)
UJ-62-58-614	E.I. DuPont Co., well no. 103-1	726	CHCTL	80-10-30	--	--	--	--	--	--	--	--	4.7	210	--	--	--	980	7.9	--
				81-10-28	--	--	--	--	--	--	--	--	<5.0	250	--	--	--	1050	7.9	--
				82-12-07	--	--	--	--	--	--	--	--	--	250	--	--	--	1120	7.7	22.0
				83-10-26	--	--	--	--	--	--	--	--	--	30	--	--	--	200	7.7	23.5
				84-10-23	--	--	--	--	--	--	--	--	--	180	--	--	--	766	7.7	23.5
UJ-62-58-615	Firestone Petrochemical Center, well no. P-817	611 - 700	CHCTL	80-10-23	--	--	--	--	--	--	--	--	1.9	720	--	--	--	2600	7.7	21.0
				81-10-27	--	--	--	--	--	--	--	--	<5.0	1000	--	--	--	3300	7.6	24.0
				82-12-07	--	--	--	--	--	--	--	--	--	930	--	--	--	3300	7.3	23.0
UJ-62-58-616	Gulf Oil Products, well no. 2	718	CHCTL	80-10-22	--	--	--	--	--	--	--	--	3.0	1100	--	--	--	3600	7.2	21.0
UJ-62-58-623	A. Schulman Co.	440 - 460	CHCTL	80-10-22	--	--	--	--	--	--	--	--	2.3	16	--	--	--	383	7.9	22.5
				81-10-26	--	--	--	--	--	--	--	--	<5.0	24	--	--	--	390	8.1	--
				82-10-21	--	--	--	--	--	--	--	--	--	17	--	--	--	390	7.5	--
				83-10-20	--	--	--	--	--	--	--	--	--	18	--	--	--	390	8.2	--
				84-10-16	--	--	--	--	--	--	--	--	--	16	--	--	--	385	7.1	--
UJ-62-58-629	Firestone Petrochemical Center	595 - 680	CHCTL	80-10-23	--	--	--	--	--	--	--	--	.7	330	--	--	--	1340	8.0	21.0
				81-10-27	--	--	--	--	--	--	--	--	<5.0	330	--	--	--	1400	7.7	25.0
				82-12-07	--	--	--	--	--	--	--	--	--	300	--	--	--	1300	7.5	24.5
				83-10-25	--	--	--	--	--	--	--	--	--	250	--	--	--	1160	7.7	--
				84-10-23	--	--	--	--	--	--	--	--	--	250	--	--	--	1100	7.7	25.0
UJ-62-58-631	Firestone Petrochemical Center, well no. P-826	585 - 680	CHCTL	80-10-23	--	--	--	--	--	--	--	--	6.8	1000	--	--	--	3200	7.7	20.5
				81-10-27	--	--	--	--	--	--	--	--	<5.0	900	--	--	--	3000	7.6	23.5
				82-12-07	--	--	--	--	--	--	--	--	--	230	--	--	--	1000	7.7	23.0
				83-10-25	--	--	--	--	--	--	--	--	--	1000	--	--	--	3300	7.5	24.5
				84-10-23	--	--	--	--	--	--	--	--	--	1000	--	--	--	3650	7.3	24.0
UJ-62-58-632	Polysar Gulf Coast, Inc., well no. 1	640 - 710	CHCTL	80-10-21	--	--	--	--	--	--	--	--	1.0	230	--	--	--	1020	7.4	23.0
				81-10-29	--	--	--	--	--	--	--	--	<5.0	250	--	--	--	1080	7.7	24.5
				82-10-22	--	--	--	--	--	--	--	--	--	260	--	--	--	1100	7.5	25.0
				83-10-20	--	--	--	--	--	--	--	--	--	280	--	--	--	1260	7.8	25.0
				84-10-23	--	--	--	--	--	--	--	--	--	270	--	--	--	1260	7.5	25.0
UJ-62-5B-633	Polysar Gulf Coast, Inc., well no. 2	625 - 725	CHCTL	81-10-29	--	--	--	--	--	--	--	--	<5.0	400	--	--	--	1640	7.7	24.5
				82-10-22	--	--	--	--	--	--	--	--	--	420	--	--	--	1700	7.5	24.5
				83-10-20	--	--	--	--	--	--	--	--	--	270	--	--	--	1250	8.1	24.5
UJ-62-58-634	Polysar Gulf Coast, Inc., well no. 3	615 - 715	CHCTL	80-10-21	--	--	--	--	--	--	--	--	1.9	460	--	--	--	1840	7.3	21.5
				84-10-23	--	--	--	--	--	--	--	--	--	410	--	--	--	1740	7.5	23.0
UJ-62-58-635	R.C.W., Inc.	639 - 689	CHCTL	80-10-31	--	--	--	--	--	--	--	--	1.4	37	--	--	--	390	7.8	--
				81-10-30	--	--	--	--	--	--	--	--	<5.0	37	--	--	--	400	8.0	--
				82-10-22	--	--	--	--	--	--	--	--	--	41	--	--	--	380	7.5	--
				83-10-27	--	--	--	--	--	--	--	--	--	33	--	--	--	384	8.0	--
				84-10-23	--	--	--	--	--	--	--	--	--	33	--	--	--	378	7.8	--

See footnotes at end of table.

Table 8.--Chemical analyses of water from selected wells in the study area, 1980-84--Continued

Well	Owner	Depth or producing interval (feet)	Water-bearing unit	Date of sample	Silica, dissolved (mg/L as SiO2)	Iron, dissolved (µg/L as Fe)	Manganese, dissolved (µg/L as Mn)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Bicarbonate (mg/L as HCO3)	Carbonate (mg/L as CO3)	Sulfate, dissolved (mg/L as SO4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Dissolved solids, sum of constituents (mg/L)	Hardness (mg/L as CaCO3)	Specific conductance (microsiemens)	pH (standard units)	Temperature (deg C)
UJ-62-58-638	Gulf Oil Products, well no. 6	634 - 735	CHCTL	80-10-22	--	--	--	--	--	--	--	--	1.3	500	--	--	--	1920	7.4	22.0
				82-12-08	--	--	--	--	--	--	--	--	--	530	--	--	--	2000	7.5	24.5
				83-10-27	--	--	--	--	--	--	--	--	--	480	--	--	--	1900	7.6	24.5
				84-10-24	--	--	--	--	--	--	--	--	--	460	--	--	--	1840	7.5	25.0
UJ-62-58-639	Polysar Gulf Coast, Inc., well no. 4	620 - 725	CHCTL	80-10-21	--	--	--	--	--	--	--	--	1.4	280	--	--	--	1200	7.5	22.0
				81-10-29	--	--	--	--	--	--	--	--	<5.0	310	--	--	--	1320	7.9	24.5
				82-10-22	--	--	--	--	--	--	--	--	--	320	--	--	--	1300	7.6	25.0
				83-10-20	--	--	--	--	--	--	--	--	--	320	--	--	--	1400	7.9	25.0
UJ-62-58-640	Polysar Gulf Coast, Inc., well no. 5	612 - 718	CHCTL	80-10-21	--	--	--	--	--	--	--	--	.6	290	--	--	--	1250	7.4	21.5
				81-10-29	--	--	--	--	--	--	--	--	5.0	270	--	--	--	1340	7.7	25.0
				84-10-23	--	--	--	--	--	--	--	--	--	300	--	--	--	1360	7.6	25.0
1/ UJ-62-58-642	Donnar Corp.	420 - 426	CHCTL	80-10-22	--	--	--	--	--	--	--	--	.8	19	--	--	--	403	7.7	--
				81-10-26	--	--	--	--	--	--	--	--	<5.0	25	--	--	--	400	8.0	--
				82-10-21	--	--	--	--	--	--	--	--	--	21	--	--	--	410	7.9	--
				83-10-20	--	--	--	--	--	--	--	--	--	20	--	--	--	390	8.2	--
				84-10-16	--	--	--	--	--	--	--	--	--	18	--	--	--	399	8.0	--
UJ-62-58-701	The Texas Co.	704	CHCTL	80-10-30	--	--	--	--	--	--	--	--	.3	220	--	--	--	1000	8.0	25.0
				81-10-28	--	--	--	--	--	--	--	--	<5.0	200	--	--	--	1000	8.0	25.0
				82-12-07	--	--	--	--	--	--	--	--	--	220	--	--	--	1010	8.0	25.0
				83-10-25	--	--	--	--	--	--	--	--	--	200	--	--	--	1000	8.0	--
				84-10-25	--	--	--	--	--	--	--	--	--	210	--	--	--	1010	7.9	25.5
UJ-62-58-702	Orange County WCID 3	600 - 672	CHCTL	80-10-22	--	--	--	--	--	--	--	--	.7	220	--	--	--	980	7.8	22.0
				81-10-22	--	--	--	--	--	--	--	--	<5.0	200	--	--	--	1040	7.9	25.0
				82-10-21	--	--	--	--	--	--	--	--	--	240	--	--	--	1110	7.6	25.0
				83-10-24	--	--	--	--	--	--	--	--	--	160	--	--	--	--	8.0	25.0
				84-10-18	--	--	--	--	--	--	--	--	--	150	--	--	--	833	8.0	25.0
UJ-62-58-708	Gulf States Utilities Co., Sabine, well no. 6	465	CHCTL	80-10-23	--	--	--	--	--	--	--	--	2.3	39	--	--	--	620	9.5	31.0
				82-12-08	--	--	--	--	--	--	--	--	--	38	--	--	--	520	8.1	24.5
UJ-62-58-809	Orange County WCID 3, well no. 3	570 - 650	CHCTL	80-10-22	--	--	--	--	--	--	--	--	1.0	240	--	--	--	1120	7.8	22.0
				81-10-22	--	--	--	--	--	--	--	--	<5.0	220	--	--	--	1110	8.1	25.0
				82-10-21	--	--	--	--	--	--	--	--	--	230	--	--	--	1150	8.0	25.0
				83-10-24	--	--	--	--	--	--	--	--	--	220	--	--	--	1100	7.9	25.5
				84-10-18	--	--	--	--	--	--	--	--	--	220	--	--	--	1110	8.2	25.0
UJ-62-58-810	H.H. Silkwood	160 - 170	CHCTU	80-10-22	--	--	--	--	--	--	--	--	.6	230	--	--	--	1220	7.5	--
				81-10-22	--	--	--	--	--	--	--	--	<5.0	230	--	--	--	1130	7.8	--
				82-10-21	--	--	--	--	--	--	--	--	--	240	--	--	--	1100	7.7	--
				83-10-24	--	--	--	--	--	--	--	--	--	200	--	--	--	1240	7.9	--
				84-10-18	--	--	--	--	--	--	--	--	--	200	--	--	--	1250	7.6	--

See footnotes at end of table.

Table 8.--Chemical analyses of water from selected wells in the study area, 1980-84--Continued

Well	Owner	Depth or producing interval (feet)	Water-bearing unit	Date of sample	Silica, dissolved (mg/L as SiO2)	Iron, dissolved (µg/L as Fe)	Manganese, dissolved (µg/L as Mn)	Calcium, dissolved (mg/L as Ca)	Magnesium, dissolved (mg/L as Mg)	Sodium, dissolved (mg/L as Na)	Bicarbonate (mg/L as HCO3)	Carbonate (mg/L as CO3)	Sulfate, dissolved (mg/L as SO4)	Chloride, dissolved (mg/L as Cl)	Fluoride, dissolved (mg/L as F)	Dissolved solids, sum of constituents (mg/L)	Hardness (mg/L as CaCO3)	Specific conductance (microsiemens)	pH (standard units)	Temperature (deg C)
UJ-62-59-101	City of Orange, well no. 7	555 - 666	CHCTL	80-10-21	--	--	--	--	--	--	--	--	3.1	150	--	--	--	700	7.4	21.0
				81-10-21	--	--	--	--	--	--	--	--	<5.0	130	--	--	--	685	7.5	24.5
				82-10-20	--	--	--	--	--	--	--	--	--	130	--	--	--	710	7.6	24.0
				83-10-18	--	--	--	--	--	--	--	--	--	130	--	--	--	740	7.5	24.0
				84-10-18	--	--	--	--	--	--	--	--	--	140	--	--	--	781	6.9	24.0
UJ-62-59-123	City of Orange, well no. 9	529 - 643	CHCTL	80-10-21	--	--	--	--	--	--	--	--	.5	160	--	--	--	820	7.4	21.0
				81-10-21	--	--	--	--	--	--	--	--	<5.0	140	--	--	--	800	7.7	24.0
UJ-62-59-124	Equitable Bag Co.	590 - 640	CHCTL	80-10-29	--	--	--	--	--	--	--	--	1.4	160	--	--	--	780	7.3	24.5
				81-10-28	--	--	--	--	--	--	--	--	<5.0	150	--	--	--	780	7.3	24.5
				82-12-09	--	--	--	--	--	--	--	--	--	160	--	--	--	800	7.3	24.0
				83-10-27	--	--	--	--	--	--	--	--	--	150	--	--	--	780	7.5	24.5
				84-10-25	--	--	--	--	--	--	--	--	--	140	--	--	--	769	7.4	25.0
UJ-62-59-401	Marathon Oil Co.	555 - 573	CHCTL	80-10-29	--	--	--	--	--	--	--	--	1.4	36	--	--	--	380	7.4	22.5
				81-10-22	--	--	--	--	--	--	--	--	<5.0	46	--	--	--	380	8.0	22.5
				82-10-19	--	--	--	--	--	--	--	--	--	43	--	--	--	400	8.3	--
UJ-62-59-416	Levingston Shipyard	650 - 730	CHCTL	80-10-29	--	--	--	--	--	--	--	--	1.3	290	--	--	--	1270	7.3	24.0
				81-10-29	--	--	--	--	--	--	--	--	<5.0	310	--	--	--	1440	7.6	--
				82-10-19	--	--	--	--	--	--	--	--	--	350	--	--	--	1350	7.5	--
									Hardin County, Texas											
10/LH-61-55-104	City of Beaumont, Lumberton, well no. 3	290 - 765	CHCTL	80-02-08	12	4/<50	11/<50	5	1	69	185	--	--	10	12/0.2	282	15	312	8.2	--
10/LH-61-55-105	Lumberton M.U.D., well no. 3	343 - 770	CHCTL	83-10-18	15	4/60	11/<50	5	0.7	68	176	--	6.0	10	12/0.1	281	15	319	8.0	--

1/ Water sampled from storage tank.
2/ Analyzed by Kemron Environmental Services.
3/ Total silica.
4/ Total iron.
5/ Total calcium.
6/ Total magnesium.
7/ Total sodium.
8/ Total sulfate.
9/ Total chloride.
10/ Analyzed by Edna Wood Laboratories.
11/ Total manganese.
12/ Total fluoride.

★ U.S. GPO: 1987 561-282