GEOLOGY AND GROUND-WATER RESOURCES OF ORANGE COUNTY, TEXAS

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GEOLOGY AND GROUND-WATER RESOURCES OF ORANGE COUNTY, TEXAS

By

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GEOLOGY AND GROUND-WATER RESOURCES OF ORANGE COUNTY, TEXAS

ABSTRACT

The geologic formations that contain fresh--less than 1,000 ppm (parts per million) of dissolved solids--or slightly saline--1,000 to 3,000 ppm of dissolved solids--water in Orange County are the Goliad Sand, Willis Sand, Lissie Formation, Beaumont Clay, and Recent alluvium. The formations are, for the most part, hydrologically connected and generally are considered as a single hydrologic unit to which the term "Gulf Coast aquifer" has been applied.

The data suggest that the Gulf Coast aquifer in Orange County may be subdivided into three units: the "Lower" aquifer, the "Middle" aquifer, and the "Upper" aquifer. The "Lower" aquifer, consisting of the Goliad Sand, Willis Sand, and part of the Lissie Formation, contains fresh water in only the northern part of the county and is tapped by only a few domestic wells in the northwest part. The "Middle" aquifer which includes part of the Lissie Formation is the principal source of ground water in the county and yields as great as 3,500 gpm (gallons per minute) have been obtained from it. The "Upper" aquifer, which includes the Beaumont Clay and Recent alluvium, supplies fresh water for domestic use and livestock.

In 1962, the pumpage in Orange County was 20.6 mgd (million gallons per day) of which 18.6 mgd was from the "Middle" aquifer, the remaining 2 mgd being from the "Upper" aquifer. Of the water pumped from the "Middle" aquifer, 14 mgd was for industrial use, 3.9 mgd for public and domestic supplies, and 0.7 mgd for irrigation. Approximately 90 percent, or 1.8 mgd of the pumpage from the "Upper" aquifer was incidental to the mining of sand and gravel.

Since 1941, the water levels in the "Middle" aquifer have declined throughout the county, the greatest declines occurring in the southeastern part. In the area of large withdrawals for industry and public supply, the water levels have declined to as much as 35 feet below sea level, a net decline of more than 40 feet since 1941.

In the "Upper" aquifer, the largest declines in water levels are in the vicinity of sand and gravel pits. The maximum decline observed was 9.3 feet during the period 1941-63.

Land-surface subsidence apparently has not been a serious problem in Orange County. As water levels continue to decline, however, significant subsidence can be expected.

Most of the water in the "Middle" aquifer is fresh. In general, the water is soft to moderately hard and low in dissolved solids. Water high in chloride

content is obtained from some large-capacity wells in the "Middle" aquifer in the central and southeastern parts of the county. In these wells, slightly saline water directly underlies the fresh water, and when the well is pumped, the slightly saline water moves relatively freely upward.

The water in the "Upper" aquifer ranges widely in chemical quality but generally it is soft to very hard and low in dissolved solids; it may be slightly corrosive.

The coefficient of permeability of the "Middle" aquifer ranges from 940 to 2,060 gpd (gallons per day) per square foot and averages about 1,400 gpd per square foot. Specific capacities ranged from 6.6 to 29.6 gpd per foot of drawdown.

The ground-water resources of Orange County are only partly developed. The volume of fresh water stored in the sands underlying the county is estimated to be at least 18 million acre-feet, of which 14 million is in the "Middle" aquifer. Most of the water, however, is not recoverable by known methods at costs presently considered economical. Based on a number of assumptions, the "Middle" aquifer is capable of transmitting indefinitely about 87,000 acre-feet per year (78 mgd), which is nearly 4 times the present (1962) pumpage, with pumping levels not exceeding 400 feet along a line of discharge. After the water levels were lowered to 400 feet and at a maximum gradient of 21.8 feet per mile, the aquifer would transmit about 145,000 acre-feet per year (130 mgd).

The volume of fresh water stored in the "Upper" aquifer is estimated to be at least 4 million acre-feet. Doubtlessly, the aquifer is capable of sustaining considerably larger withdrawals than the 2 mgd pumped in 1962.

Although a large volume of fresh water is available from the "Middle" aquifer, the development of these supplies is limited by the threat of salt-water encroachment, either vertically or laterally. Additional large-scale development in the county should, if possible, be confined to the northern part.

The collection of basic hydrologic data should be continued with special emphasis on monitoring the progress of salt-water encroachment.

GEOLOGY AND GROUND-WATER RESOURCES OF ORANGE COUNTY, TEXAS

INTRODUCTION

Location and General Features of the Area

Orange County is in the West Gulf Coastal Plain in the extreme southeastern part of Texas (Figure 1). It has an area of 356 square miles. The county is bordered on the east and southeast by the Sabine River, which is also the boundary between Texas and Louisiana, on the north by Jasper and Newton Counties, on the west and southwest by the Neches River, and on the south by Sabine Lake, which is formed at the confluence of the Neches and Sabine Rivers. The county is adjoined on the west by Hardin and Jefferson Counties and on the east by Calcasieu and Cameron Parishes, Louisiana.

Orange County had a population of 1,916 in 1860. By 1900, the population had increased to only 5,905. During the period 1940-60, the population increased from 17,382 to 60,357.

Orange, which had a population of 25,605 in 1960, West Orange, Vidor, Bridge City, Orangefield, Mauriceville, and Echo are population centers of the county. The city of Orange, a deep-water port, is a center of the petrochemical industry and, along with Port Arthur and Beaumont in Jefferson County, forms a large industrial complex known locally as the "Golden Triangle."

Orange County derives its income principally from the petrochemical industry. Timber, farming, the raising of beef cattle and poultry, and production of oil and gas are also important to the economy of the area. Oil was discovered in Orange County in 1913; about 79,111,475 barrels was produced to January 1, 1959, of which 2,776,211 barrels was produced in 1958, according to the records of the Texas Railroad Commission.

Purpose and Scope of the Investigation

The Orange County investigation was started in September 1962 as a cooperative project of the Sabine River Authority of Texas, the city of Orange, the Orange Chamber of Commerce, the Texas Water Commission, and the U.S. Geological Survey. Its purpose was to determine and describe the occurrence, availability, dependability, quality, and quantity of the ground water in Orange County, particularly with reference to the sources of water suitable for public supply, industrial, and irrigation use.

The investigation included a determination of the location and extent of sands containing fresh water (less than 1,000 parts per million dissolved

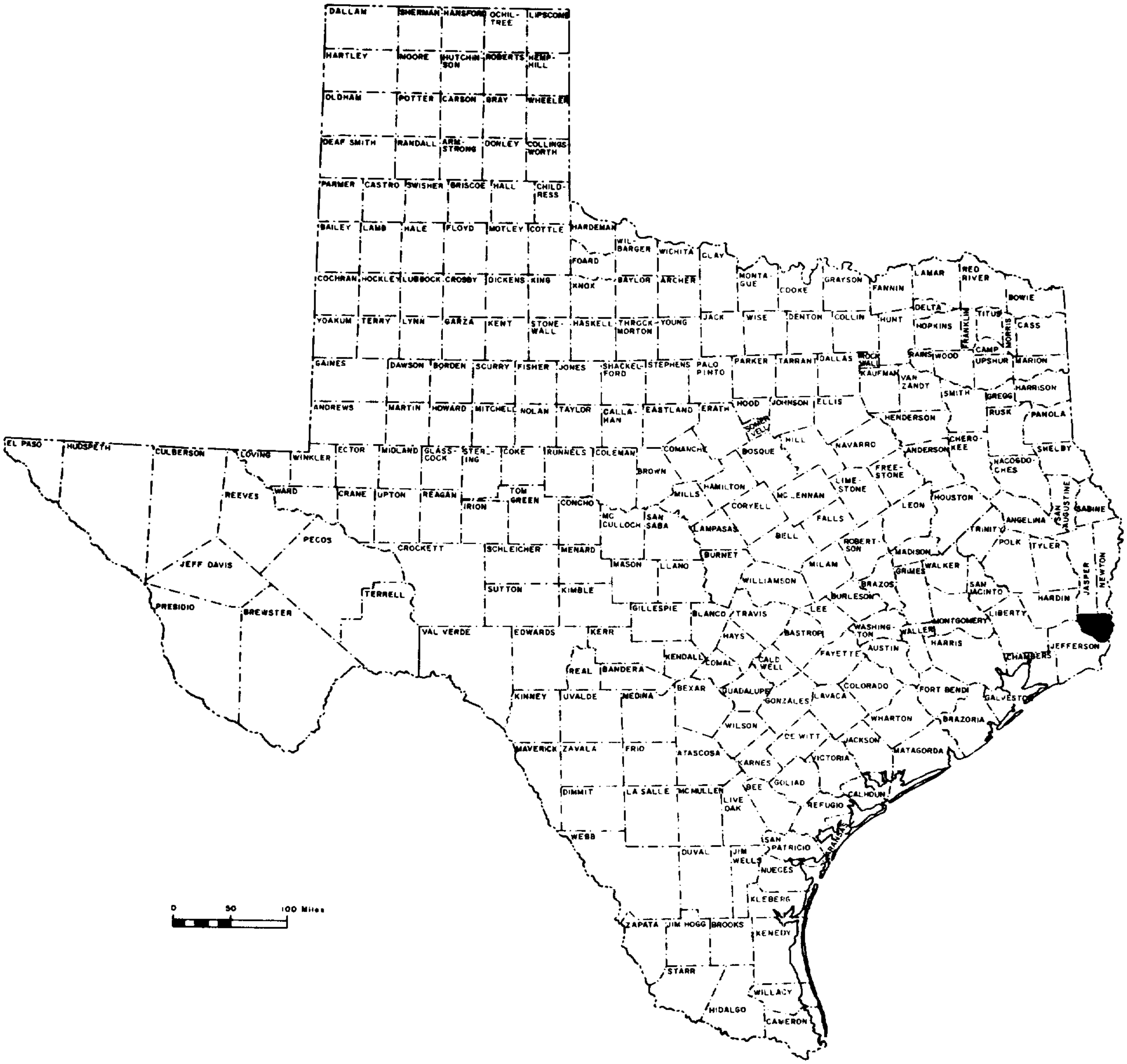

Figure 1

Map of Texas Showing Location of Orange County

U. S. Geological Survey in cooperation with the Texas Water Commission and Others

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solids) and slightly saline water (1,000 to 3,000 parts per million dissolved solids), the quantity of ground water pumped and the effect the pumping has had on water levels, the hydraulic characteristics of the aquifers, and the quantity of ground water available for development.

Previous Investigations

Among the first investigations of the ground-water resources of Orange County was that by Taylor (1907), who included in his study the whole Coastal Plain of Texas, discussing briefly the wells in Orange County. Deussen (1914), in a reconnaissance investigation of the southeastern part of the Texas Coastal Plain, discussed in more detail than did Taylor the geology and ground water of Orange County and included a list of wells and springs and drillers' logs of wells.

In 1941, Livingston and Cromack (1942) inventoried 208 wells and included chemical analyses and drillers' logs in their report. Most of the well data are included in this report. Table 1 shows the well numbers used by Livingston and Cromack and the corresponding numbers used in this report.

A report by Wood, Gabrysch, and Marvin (1963) discussed the order of magnitude of the ground-water supplies potentially available from the principal water-bearing formations in the Gulf Coast region of Texas, including Orange County.

Periodic measurements of water levels have been made in wells in Orange County since 1949 as part of the observation well program in Texas. The records have been published periodically by the Texas Water Commission. Records of water levels in some observation wells in Orange County also are published by the U.S. Geological Survey in annual reports on the water levels and artesian pressures in the United States (Hackett, 1962, p. 165-166).

Methods of Investigation

The investigation of the ground-water resources of Orange County included an inventory of 434 wells, including all industrial, public supply, and irrigation wells, and a representative number of livestock and domestic wells (Table 3). Electric logs of 40 oil wells and 105 stratigraphic test holes of the Sun Oil Co. were used in the correlation and evaluation of the subsurface characteristics of the water-bearing sands. The electric logs, together with drillers' logs of selected water wells (Table 4), were used as an aid in determining the total thickness of sand containing fresh to slightly saline water. The locations of the wells are shown on Plate 1.

Samples of water were collected from a large number of wells to determine the chemical quality of the water (Table 5). Pumping tests were made to determine the hydraulic characteristics of the fresh-water-bearing sands (Table 2). Measurements of water levels were made in as many wells as possible, and available records of past fluctuations of water levels were used to determine the effect of pumpage on water levels.

Municipal, industrial, and irrigation pumpage was inventoried. Part of the inventory was based on records of the local Agricultural Stabilization Committee of the U.S. Department of Agriculture, the Texas Water Commission, and the Sabine River Authority. Elevations of water wells were determined from

Table 1.--Well numbers used in this report and corresponding numbers used in the report by Livingston and Cromack (1942)

Old number	New number	Old number	New number	Old number	New number
1	UJ-61-56-115	27	UJ-61-64-307	52	UJ-62-49-803
2	UJ-61-56-116	28	UJ-61-64-203	53	UJ-62-49-707
4	UJ-61-56-110	29	UJ-61-64-202	54	UJ-62-49-801
5	UJ-61-56-402	30	UJ-61-64-401	55	UJ-62-49-708
6	UJ-61-56-403	31	UJ-61-64-313	56	UJ-62-49-802
7	UJ-61-56-405	32	UJ-61-64-308	57	UJ-62-49-503
8	UJ-61-56-406	33	UJ-61-64-310	58	UJ-62-49-204
9	UJ-61-56-502	34	UJ-62-57-101	59	UJ-62-49-603
10	UJ-61-56-506	35	UJ-61-64-309	60	UJ-62-49-609
11	UJ-61-56-304	36	UJ-62-57-411	61	UJ-62-49-606
12	UJ-62-49-106	37	UJ-62-57-702	62	UJ-62-49-301
13	UJ-62-49-102	38	Not used	63	UJ-62-50-403
14	UJ-61-56-306	39	UJ-62-57-415	64	UJ-62-50-407
15	UJ-61-56-601	40	UJ-62-57-414	65	UJ-62-50-103
16	UJ-61-56-607	41	UJ-62-57-413	66	UJ-62-50-104
17	UJ-61-56-915	42	UJ-62-57-412	67	UJ-62-50-204
18	UJ-61-56-914	43	UJ-62-57-507	68	UJ-62-50-505
19	UJ-61-56-916	44	UJ-62-57-508	69	UJ-62-50-503
20	UJ-62-49-705	45	UJ-62-57-204	70	UJ-62-50-504
21	UJ-62-49-706	46	UJ-62-57-203	71	UJ-62-50-202
22	UJ-61-56-917	47	UJ-62-57-102	72	UJ-62-50-607
23	UJ-62-57-103	48	UJ-62-57-104	73	UJ-62-50-303
24	UJ-61-56-918	49	Not used	74	UJ-62-51-102
25	UJ-61-64-311	50	UJ-62-57-202	75	UJ-62-51-101
26	UJ-61-64-312	51	UJ-62-57-205	76	UJ-62-51-404

Table 1.--Well numbers used in this report and corresponding numbers used in the report by Livingston and Cromack (1942)--Continued

Old number	New number	Old number	New number	Old number	New number
77	UJ-62-51-405	102	UJ-62-57-802	127	UJ-62-58-508
78	UJ-62-51-403	103	UJ-62-57-906	128	UJ-62-58-509
79	UJ-62-50-903	104	UJ-62-58-703	129	UJ-62-58-510
80	UJ-62-50-904	105	UJ-62-58-701	130	UJ-62-58-107
81	UJ-62-50-608	106	UJ-62-58-704	131	UJ-62-58-202
82	UJ-62-50-603	107	UJ-62-58-705	132	UJ-62-58-106
83	UJ-62-50-501	108	UJ-62-58-706	133	UJ-62-58-105
84	UJ-62-50-805	109	UJ-62-58-707	134	UJ-62-58-205
85	UJ-62-50-806	110	UJ-62-58-805	135	UJ-62-58-203
86	UJ-62-50-705	111	UJ-62-58-806	136	UJ-62-58-102
87	UJ-62-50-706	112	UJ-62-58-807	137	UJ-62-50-704
88	UJ-62-49-901	113	UJ-62-58-505	138	UJ-62-50-701
89	UJ-62-49-903	114	UJ-62-58-506	139	UJ-62-50-803
90	UJ-62-49-902	115	UJ-62-58-507	140	UJ-62-50-802
91	UJ-62-50-702	116	UJ-62-58-419	141	UJ-62-50-907
92	UJ-62-50-703	117	UJ-62-58-420	142	UJ-62-51-713
93	UJ-62-57-302	118	UJ-62-58-421	143	UJ-62-51-712
94	UJ-62-57-606	119	UJ-62-58-422	144	UJ-62-51-704
95	UJ-62-57-604	120	UJ-62-58-417	145	UJ-62-50-901
96	UJ-62-57-603	121	UJ-62-58-408	146	UJ-62-58-314
97	UJ-62-57-602	122	UJ-62-58-416	147	UJ-62-58-315
98	UJ-62-57-502	123	UJ-62-58-415	148	UJ-62-58-316
99	UJ-62-57-801	124	UJ-62-58-412	149	UJ-62-58-317
100	Not used	125	UJ-62-58-413	150	UJ-62-58-318
101	UJ-62-57-506	126	UJ-62-58-409	151	UJ-62-58-319

Table 1.--Well numbers used in this report and corresponding numbers used in the report by Livingston and Cromack (1942)--Continued

Old number	New number	Old number	New number	Old number	New number
152	UJ-62-58-320	171	UJ-62-58-904	190	UJ-62-59-120
153	UJ-62-58-321	172	UJ-62-58-905	191	Not used
154	UJ-62-58-322	173	UJ-62-58-906	192	UJ-62-59-121
155	UJ-62-58-323	174	UJ-62-58-630	193	Not used
156	UJ-62-58-302	175	UJ-62-58-607	194	UJ-62-59-106
157	UJ-62-58-313	176	UJ-62-58-901	195	UJ-62-59-117
158	UJ-62-58-627	177	Not used	196	UJ-62-59-105
159	UJ-62-58-628	178	UJ-62-59-404	197	UJ-62-59-104
160	UJ-62-58-601	179	UJ-62-59-405	198	UJ-62-59-122
161	UJ-62-58-602	180	UJ-62-58-303	199	UJ-62-59-406
162	UJ-62-58-624	181	UJ-62-59-110	200	UJ-62-59-407
163	UJ-62-58-625	182	UJ-62-59-111	201	UJ-62-59-408
164	UJ-62-58-603	183	UJ-62-59-112	202	UJ-62-59-409
165	UJ-62-58-511	184	UJ-62-59-109	203	UJ-62-59-410
166	UJ-62-58-512	185	UJ-62-59-113	204	UJ-62-59-411
167	UJ-62-58-808	186	UJ-62-59-114	205	UJ-62-59-412
168	UJ-62-58-804	187	UJ-62-59-102	206	UJ-62-59-413
169	UJ-62-58-803	188	UJ-62-59-118	207	UJ-62-59-414
170	UJ-62-58-903	189	UJ-62-59-119	208	UJ-62-59-415

topographic maps. Data gathered during previous ground-water studies of Orange County and adjacent areas were used in the preparation of this report.

Well-Numbering System

The well-numbering system used in this report is a statewide system adopted by the Texas Water Commission for use throughout the State and is based on latitude and longitude.

Under this system, each 1-degree quadrangle in the State is given a number consisting of two digits. These are the first two digits in the well number. The 1-degree quadrangles are divided into 7½-minute quadrangles, which are also given 2-digit numbers from 01 to 64. These are the third and fourth digits of the well number. Each 7½-minute quadrangle is subdivided into 2½-minute quadrangles and given a single digit number from 1 to 9. This is the fifth digit of the well number. The wells within a 2½-minute quadrangle are given 2-digit numbers as they are inventoried, starting with 01. These are the last two digits of the well number used to identify each well. The first four digits are shown in the upper left corner of each 7½-minute quadrangle on the well map (Plate 1), and the last three digits appear at the well location. A 2-letter prefix is used to identify the county. The prefix assigned to Orange County is UJ, and that to Jefferson County is PT.

Physiography and Drainage

Orange County is in the West Gulf Coastal Plain physiographic province. The land surface is a nearly smooth featureless depositional plain rising from sea level to about 35 feet. The highest point in the county is about midway along the northern boundary. All of Orange County is drained by the Neches and Sabine Rivers and their tributaries, except for a small area in the southern part of the county which is drained by small streams flowing directly into Sabine Lake. The Neches and Sabine Rivers flow southward along the western and eastern boundaries of the county and empty into Sabine Lake, which is an extension of the Gulf of Mexico. Water is diverted from the Sabine River by the Sabine River Authority for industrial and irrigation use. In 1961, the Authority pumped about 49,000 acre-feet. The diversion, which may total as much as 100,000 acre-feet per year, is made near the northeast corner of the county.

The broad flat valleys of the Neches and Sabine Rivers are covered with coastal-type marsh vegetation and are subject to flooding during periods of high tides caused by storms. Along the rivers and waterways, some natural levees and spoil banks, which rise above the flat marshes, support tree growth. Between the valleys of the Neches and Sabine Rivers, the land surface is a slightly dissected plain that rises gently from elevations of approximately 10 feet on the south to more than 30 feet along most of the northern boundary of the county. The plain is characterized by grass-covered surfaces and, in many places, by a dense growth of trees. In the northern part of the county, the surface generally is sandy and forested; in the southern part, the surface is clayey and comparatively treeless.

Climate

Orange County has a warm humid climate as indicated by Figures 2 and 3, which show records of precipitation, temperature, and evaporation at Beaumont in

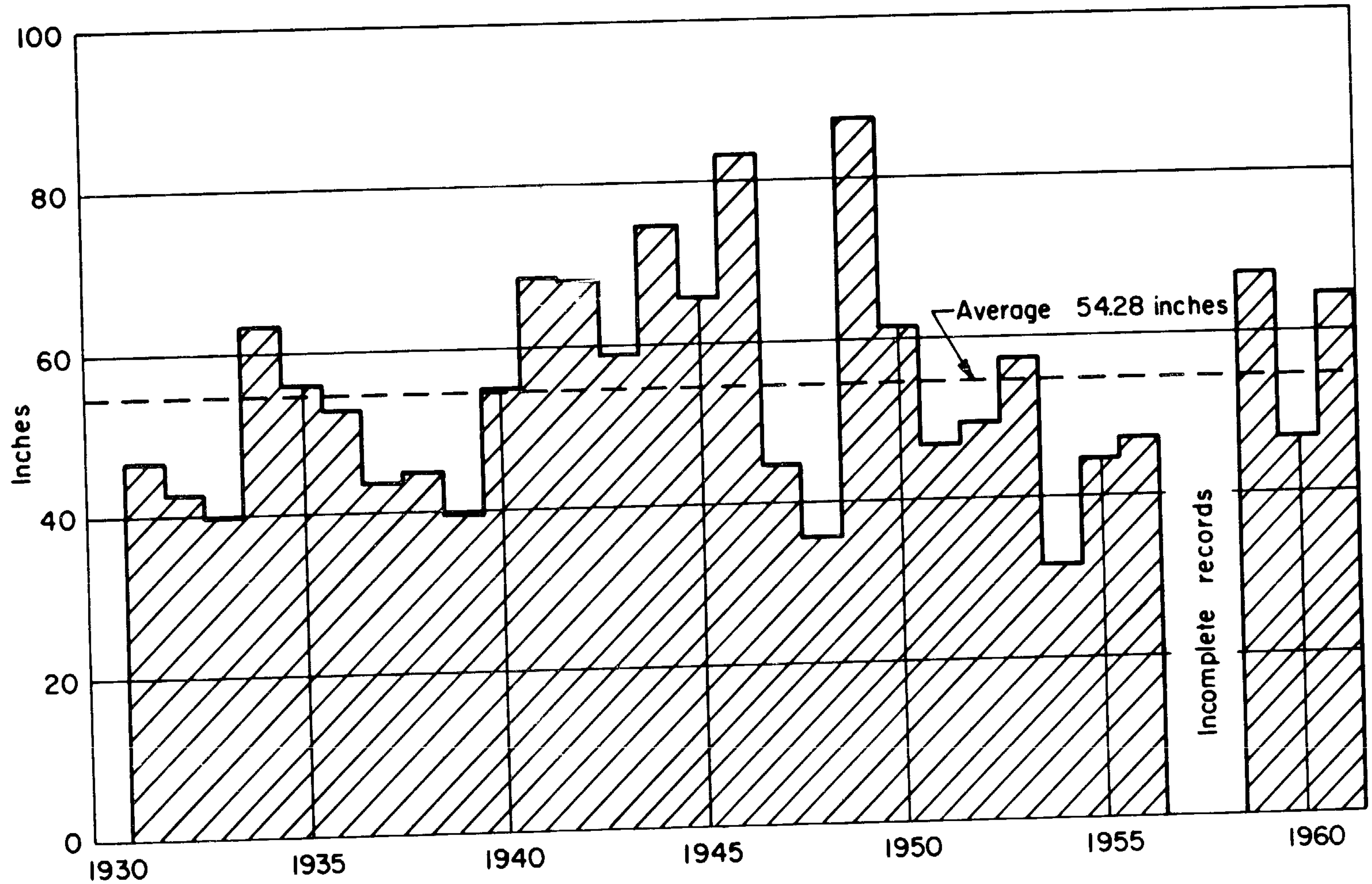

Figure 2

Annual Precipitation at Beuumont, Jefferson County

(From records of U.S. Weather Bureau)

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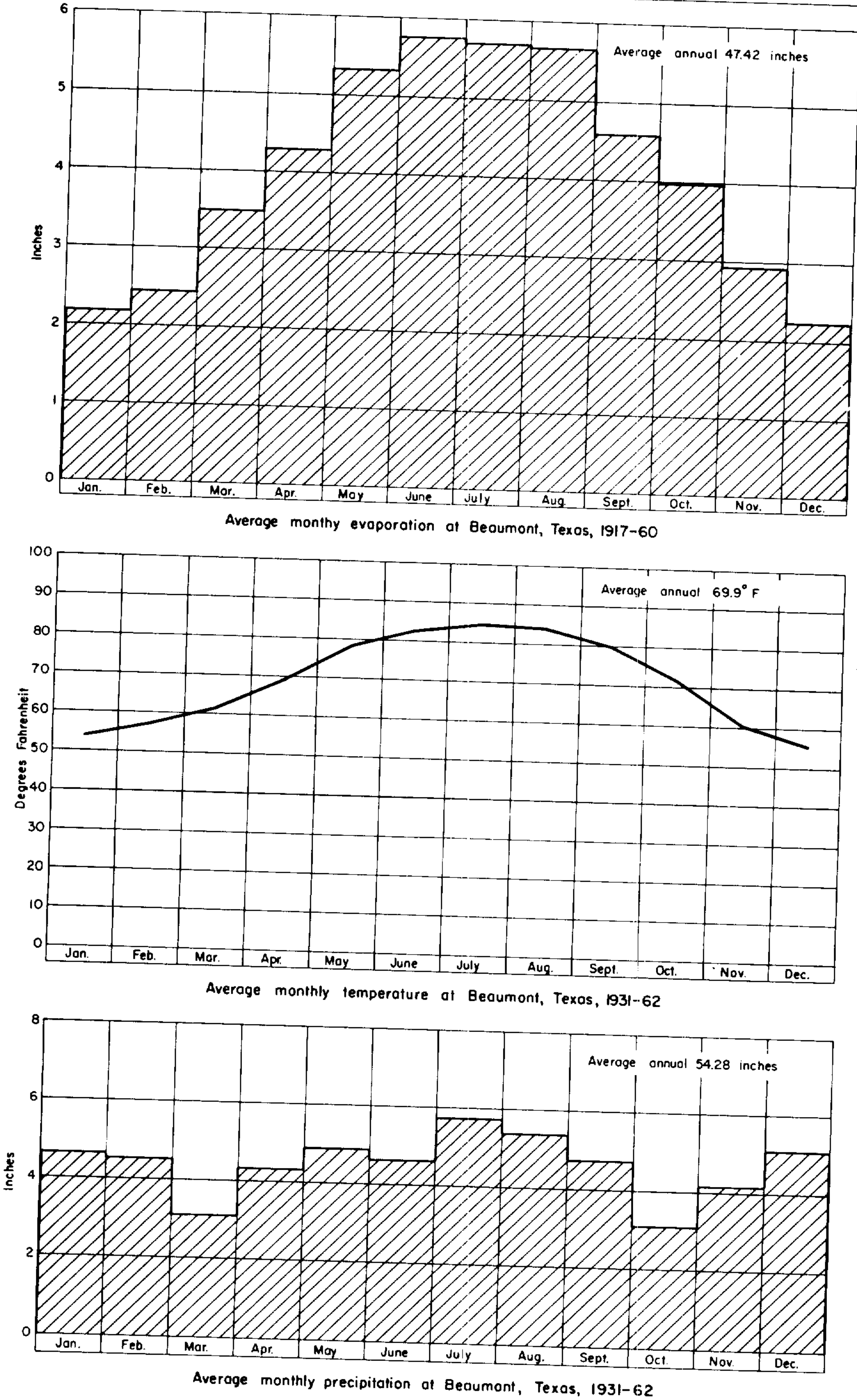

Figure 3

Monthly Precipitation, Temperature, and Evaporation at Beaumont, Jefferson County

(From records of U.S. Weather Bureau, and Bloodgood, Patterson, and Smith, 1954)

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neighboring Jefferson County. Precipitation, averaging about 54 inches annually, is fairly well distributed throughout the year, being greatest from May to September and least from January through April. Droughts occur infrequently and generally are not prolonged.

The average annual temperature at Beaumont is about 70°F. Temperatures below freezing occur on the average of only 12 days per year; temperatures above 100°F are unusual. Approximate dates of the first and last killing frosts are December 2 and March 2, respectively, and the long growing season of about 275 days is favorable for agriculture.

The average monthly evaporation from a free water surface, as determined at the Agricultural Experiment Station near Beaumont, is shown in Figure 3. The adjusted potential average annual evaporation of 47.42 inches is 87 percent of the average annual precipitation.

Acknowledgments

The author expresses appreciation to those who contributed information and assistance in the gathering of field data and in the preparation of the report. The officials of municipalities, water districts, and industries gave freely of their records and time. Particular thanks are due the officials of Phillips Chemical Co., Texas Portland Cement Co., Orange County Water Control and Improvement District No. 1 (Vidor), and the city of Orange for their support and assistance in conducting pumping tests; to E. I. Du Pont de Nemours for supplying records of their wells and reports of their studies of the ground water in the area; and to Sun Oil Co. for permitting the use of electrical logs of their stratigraphic tests.

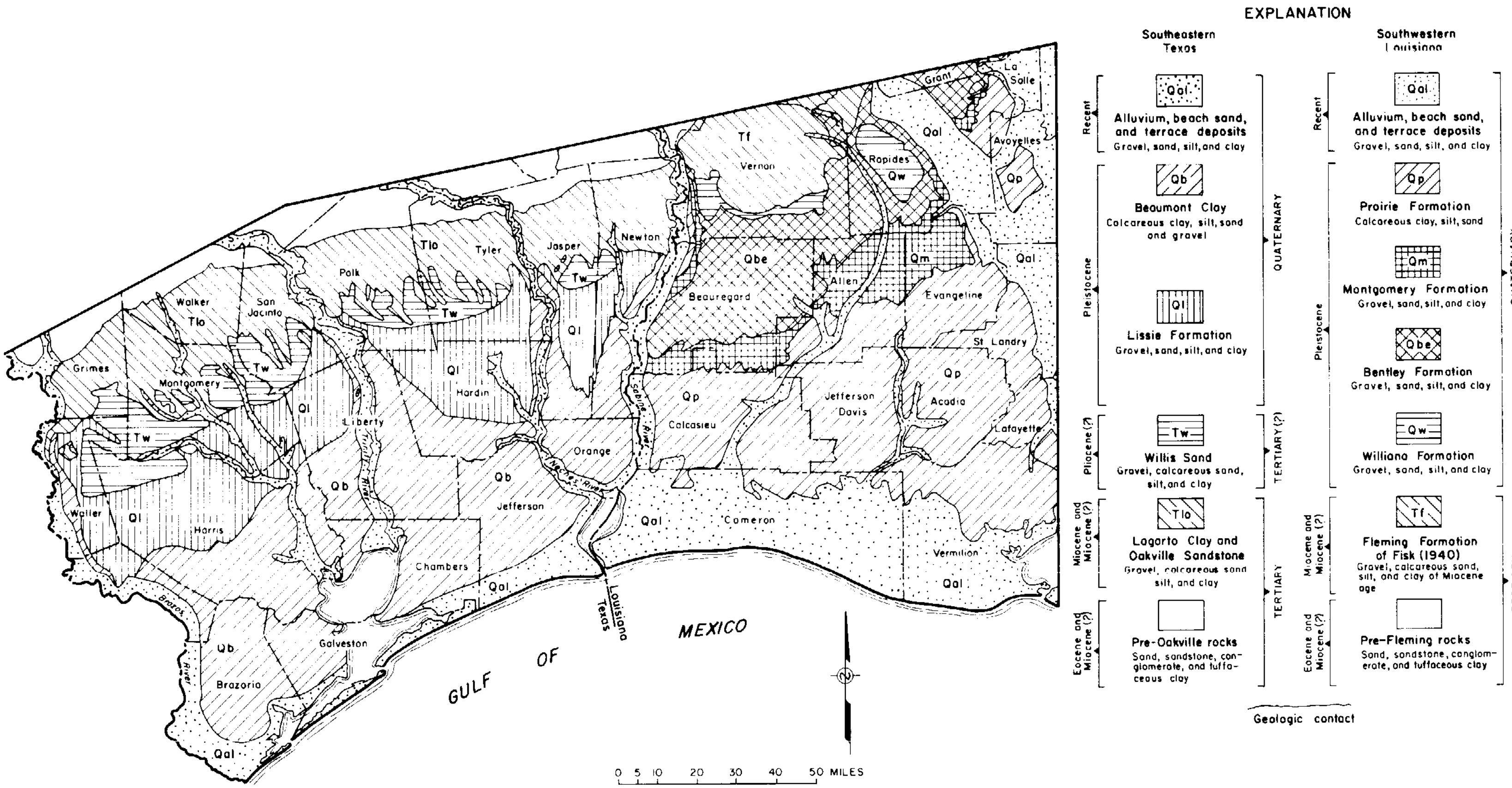
Well drillers generously supplied drillers' logs, electrical logs, and well-completion data. All landowners contacted granted access to their lands, wells, and records. Jones Water Well Service was especially helpful in assembling data in the Vidor area.

GEOLOGY AS RELATED TO THE OCCURRENCE OF GROUND WATER

General Geology

The geologic formations that contain fresh or slightly saline water in Orange County are, in order of decreasing age, the Goliad Sand of Pliocene age, the Willis Sand of Pliocene(?) age, the Lissie Formation and Beaumont Clay of Pleistocene age, and the alluvium of Recent age. Only the Beaumont Clay and Recent alluvium are exposed in Orange County; the formations older than the Beaumont, with the exception of the Goliad, crop out north of the county. Figure 4 shows the outcrop areas of the formations throughout a large area in southeastern Texas and southwestern Louisiana. It also shows the outcrop area of the Lagarto Clay and Oakville Sandstone, both of which contain saline water in Orange County. The explanation of the map shows the nomenclature used for the geologic units in Louisiana.

The formations consist of sand, gravel, silt, and clay that were built up by rivers as coalescing fans on and near the continent and as marine and lagoonal deposits along the coast. The beds are not persistent in lithology,



Geology of Texas except Hardin County from Geologic Map of Texas (Darton, Stephenson, and Gardner, 1937)
Geology of Hardin County modified from Geologic Map of Texas
Geology of Louisiana from Louisiana Geological Survey; Fisk (1940), and Welch (1942)

Figure 4

Geologic Map of Southeastern Texas and Southwestern Louisiana

U.S. Geological Survey in cooperation with the Texas Water Commission and Others dip, or thickness because of their origin and method of deposition. The predominantly sandy zones are made up of lenticular beds of sand, silt, or clay; the clayey zones contain many thin beds of sand. The formations change in lithology both in the direction of dip and laterally along the strike. Individual beds and lenses of sand, gravel, and clay commonly are not continuous over wide areas, but instead pinch out or grade laterally or vertically into finer or coarser materials. However, some sand beds are persistent and can be traced for several miles before they grade into beds having different lithology. The changes in lithology are shown in the cross sections (Plates 2-4).

The formations underlying Orange County form a monocline that dips gently toward the coast, the dip of each formation being slightly steeper than that of the overlying formations. The alternation of permeable and relatively impermeable strata within the monoclinal structure is favorable to the occurrence of water under artesian pressure.

Salt domes underlie Orange County in several locations. The salt domes are deep seated, the highest known emplacement of salt being more than 7,000 feet below sea level at Orangefield. The domes apparently do not affect the availability and quality of the ground water in the county.

Faults occur in Orange County but generally have little or no surface expression. The majority are normal faults downthrown toward the coast, and they seemingly have no effect on the movement of ground water in the county.

Geologic Formations and Their Water-Bearing Properties

The following physical description of the geologic formations comprising the aquifers in Orange County are based largely on the detailed work of Bernard (1950) in Jasper, Newton, and Orange Counties, supplemented by drillers' and electrical logs obtained during the investigation and descriptions of formations in other areas of Texas and Louisiana where detailed stratigraphic work has been done.

Goliad Sand

The Goliad Sand of Pliocene age is not recognized in the outcrop in southeastern Texas, but it is believed to be present in the subsurface in Orange County at progressively greater depths gulfward. The Goliad consists of chalky white and pink bentonitic clay streaked with red and purple gravelly beds and lenses of lime-cemented sandstone. The sand typically is pinkish- or whitish-gray and contains many black grains of chert, giving a salt and pepper appearance. The thickness of the Goliad in Orange County is not known definitely because of the difficulty in differentiating it from the overlying Willis Sand.

No water wells are known to penetrate the Goliad Sand in Orange County, but electric logs of oil tests indicate that slightly to moderately saline water (1,000 to 10,000 parts per million dissolved solids) could be obtained from wells tapping the Goliad in a small area in the northern and northwestern parts of the county. Southward in the direction of dip, the water becomes more mineralized.

Collectively, the Goliad Sand, Willis Sand, and a part of the Lissie Formation constitute the "Lower" aquifer of this report.

Willis Sand

The Willis Sand of Pliocene(?) age does not crop out in Orange County, the nearest exposure being in Jasper and Newton Counties. Where it crops out, the Willis consists principally of sand, reddish in color in many places, and gravel, silt, and clay. Bernard (1950, p. 117-119) noted that gravel in the Willis is common in the outcrop in its inland margin and is rare in its seaward margin where sand predominates. The Willis was not differentiated in the subsurface in drillers' or electric logs (Plates 2-4) from the underlying and overlying formations owing to the similarity of the sediments. The thickness of the Willis in Orange County is not known; in Hardin County, Baker (1963, p. 39) reported 90 feet of Willis in the subsurface; in Vernon Parish, Louisiana, Jones and others (1954, p. 65) reported a thickness of 142 feet for equivalent strata.

The Willis Sand is not known to yield fresh water to wells in Orange County; electric logs indicate that it contains slightly to moderately saline water in most of the county.

Lissie Formation

The Lissie Formation of Pleistocene age crops out in Jasper and Newton Counties and underlies Orange County at depths ranging from less than 50 to about 250 feet. In the outcrop area, Bernard (1950, p. 122-125) describes the Bentley and Montgomery Formations (equivalents of the Lissie Formation) as consisting of a basal gravelly sand which grades upward into finer sand, silt, and clay. Gravel may not occur everywhere at the base, but may also occur in lenses in an upper sand phase. Much of the sediments of the Lissie are similar to those of the Willis Sand from which the Lissie, at least partly, was derived.

In the subsurface in Orange County, electric logs (Plates 2-4) show that the Lissie consists, at least in part, of a persistent thick, in places massive, sand, to which Rose (1943, p. 3) applied the name Alta Loma Sand. White and others (1932, p. 7) believed the massive sand to be the basal part of the Beaumont Clay. Deussen (1914, p. 154-155) in describing wells in Galveston County included the sand with the Lissie Formation. Based on the use of electric logs and the projection of the sand updip, it appears that the Alta Loma Sand of Rose (1943) crops out in the Lissie Formation; hence, the Alta Loma might properly be assigned as a member of the Lissie or even deserve ranking as a separate formation.

In the subsurface, the Alta Loma Sand consists of fine to coarse sand and some gravel. Drillers report that the Alta Loma also contains pyrite and fossils such as wood, sweet gumballs, chinquapins, and hickory nuts. The Alta Loma rests on a rather irregular erosional surface. The configuration of this surface is shown by means of contours on the base of the Alta Loma (Figure 5). The base slopes from an altitude of about 350 feet below sea level in the northwest corner of the county to nearly 1,000 feet in the southeastern part. Several irregularities are shown in Figure 5, the most conspicuous being a southward-trending trough that passes through Pine Forest and a mound adjoining the trough about 2 miles southwest of that community.

Immediately overlying the Alta Loma Sand is a bed of clay 70 to 200 feet thick. Whether this clay is part of the Lissie Formation or the Beaumont Clay is not known, but for the purposes of this report, it is included with the Lissie

Formation. In places, this clay contains thin beds of sand that are capable of yielding small quantities of fresh water.

Because the Alta Loma Sand differs both lithologically and hydrologically from the underlying parts of the Lissie Formation and the overlying Beaumont Clay, it is considered a distinct aquifer, the "Middle" aquifer, in this report. The "Middle" aquifer is the principal source of fresh ground water in Orange County. It supplies large quantities of fresh or slightly saline water to municipal and industrial wells. Yields as large as 3,500 gpm (gallons per minute) have been obtained from wells in the "Middle" aquifer. That part of the Lissie underlying the Alta Loma Sand of Rose (1943) constitutes part of the "Lower" aquifer.

Beaumont Clay

The Beaumont Clay unconformably overlies the Lissie Formation. In Orange County, the deltaic coastwise plain of the Beaumont Clay forms the land surface of all of the county except along the rivers and coast where it is covered by Recent alluvium. Much of the outcrop of the Beaumont in the northern part of the county is covered by a fine sandy loam because of a greater proportion of sand near the base of the formation; southward, the Beaumont becomes progressively more clayey, and the soils are heavy and dark in the southern part of the county.

The Beaumont Clay generally is described as consisting predominantly of clay; however, it also contains much sandy material. A fairly persistent sand bed occurs at the base of the Beaumont in Orange County except locally where the sand is absent and the contact between the Beaumont and the underlying clay bed in the upper part of the Lissie is difficult to distinguish. Electric logs (Plates 2-4) show that the sand increases in thickness updip due principally to its merging with other sand bodies and crops out in the northern and northwestern parts of the county. The dip of the basal sands is about 7 feet per mile. The thickness of the Beaumont Clay ranges from about 100 feet in the northwest corner of the county to about 300 feet in the southeast corner.

Sand beds in the Beaumont Clay yield fresh water to domestic and livestock wells in Orange County except in the southwestern part where the water is slightly saline. The Beaumont constitutes part of the "Upper" aquifer of this report.

Alluvium

Alluvium of Recent age is exposed along the Neches and Sabine Rivers in Orange County and along the southern boundary of the county. The elevation of the alluvial surface ranges from sea level to about 5 feet.

The Recent alluvium consists of basal, generally gravelly sand, grading upward into finer sand, silt, and clay. According to Kane (1959, p. 228), the base of the Recent alluvium is 120 feet below sea level where the Neches River empties into Sabine Lake. Upstream from the mouth of the Neches River, the upper sequence of alluvium (late Recent) averages 40 feet in thickness (Bernard, 1950, p. 134). A persistent bed of sand about 60 feet thick is noted in the logs of water wells along the Neches River southwest and west of Vidor.

The alluvium supplies small quantities of fresh water to fishing camps and week-end homes. The alluvium probably is capable of furnishing larger quantities of water, but large-scale development of the ground water in the alluvium would induce or accelerate movement of saline water from the rivers. The Recent alluvium, in conjunction with the Beaumont Clay, is included in the "Upper" aquifer in this report.

Aquifers

An aquifer is defined as a geologic formation, group of formations, or a part of a formation that is water bearing. In Orange County, the geologic formations from the Goliad Sand to the Recent alluvium are, for the most part, hydrologically connected, and generally have been considered as a single hydrologic unit. In the Sabine River Basin, Baker and others (1963, p. 20) applied the term "Gulf Coast aquifer" to all the formations containing fresh or slightly saline water between the Catahoula Sandstone and the Beaumont Clay; thus, the formations in Orange County, with the exception of the Recent alluvium, are part of the Gulf Coast aquifer as defined. However, available data, including electric logs, chemical analyses of water samples, and hydrologic properties, suggest that the Gulf Coast aquifer in Orange County may be subdivided into three units: the "Lower" aquifer, the "Middle" aquifer, and the "Upper" aquifer. The aquifers are shown in Plates 2, 3, and 4.

"Lower" Aquifer

The "Lower" aquifer, as used in this report, consists of the Goliad Sand, Willis Sand, and that part of the Lissie Formation that underlies the Alta Loma Sand of Rose (1943). The aquifer yields fresh water only in the northern part of the county; it is capable of yielding moderate to large quantities of slightly to moderately saline water to wells in the rest of the county.

"Middle" Aquifer

The "Middle" aquifer consists principally of beds of generally massive sand, the Alta Loma Sand of Rose (1943). Its distribution in Orange County is illustrated by the cross sections (Plates 2-4). The aquifer is the principal source of ground water in Orange County and yields large quantities of fresh or slightly saline water. Most of the water in the aquifer is fresh--less than 1,000 ppm (parts per million) dissolved solids--and the sands are more permeable than those in the "Lower" aquifer. The Alta Loma probably is correlated with the "500-" and "700-foot" sands of the Chicot aquifer in Calcasieu Parish, Louisiana, which adjoins Orange County on the east.

"Upper" Aquifer

The "Upper" aquifer includes the Beaumont Clay and the Recent alluvium. The aquifer, as shown in Plates 2, 3, and 4, underlies the entire county and extends into Louisiana where it probably is correlative with the "200-foot" and "shallow sands" of the Chicot aquifer and the Recent alluvium as described by Harder (1960, p. 26-27). In contrast to the "Middle" aquifer, the sand beds in the "Upper" aquifer are not as massive. Plates 2, 3, and 4 show that the "Upper" aquifer is separated from the "Middle" aquifer by a clay layer up to 200 feet thick.

Small to large quantities of fresh to slightly saline water can be obtained from the "Upper" aquifer except in the southwestern and southern parts of the county where the water becomes too mineralized for most purposes.

GROUND-WATER HYDROLOGY

Occurrence of Ground Water

The principal source of ground water in Orange County is precipitation on the land surface in the county and in adjoining areas which drain into the county mostly on the north. Most of the precipitation, however, does not reach the zone of saturation, but either runs off, evaporates, or is transpired by plants while still soil moisture. The water reaching the zone of saturation is contained in the pore spaces between sand grains. The upper surface of the zone of saturation is the water table.

The aquifers in Orange County may be divided into two types--water table or unconfined aquifers and artesian or confined aquifers. Water-table conditions occur in areas where the water falling on the land surface can percolate downward through porous spaces in the ground to the zone of saturation, the upper surface of which is under atmospheric pressure only and is free to rise or fall in response to changes in the volume of water stored. Water-table conditions occur in the outcrop of the aquifers in and near Orange County and in the flood plains along the Neches and Sabine Rivers.

Artesian conditions exist where the water-bearing formation is overlain by a less permeable formation and the water in the aquifer is under hydrostatic pressure, rising above the top of the aquifer in wells penetrating it. Artesian conditions occur downdip from the outcrop of the individual sands in Orange County. The level or surface to which the water will rise in artesian wells is called the piezometric surface, and the term, although synonomous with the "water table" in the outcrop area, is used in this report as applying only in the artesian area.

Ground water is present also in the less permeable clays that are interbedded with the sands and gravels. Under natural conditions, the entire pressure system is in balance, the weight of the overburden being supported partly by the pressure head and partly by resistance of the aquifer skeleton to deformation. If water is withdrawn from the sands, the pressure head is lowered and an imbalance in pressure exists between the sand and clay. Water will tend to move from the higher pressured clay to the sand and, thereby, decrease the supporting pressure in the clay. The system will then yield to compression and the land surface will subside.

Recharge to water-bearing sands in Orange County is from precipitation and by movement of ground water into the county from surrounding areas. The "Upper" aquifer is recharged by movement of water from the land surface downward to the water table; whereas, recharge to the "Middle" aquifer and the "Lower" aquifer occurs principally in the outcrop areas north of Orange County. A part of the rainfall in the outcrop areas enters the aquifers and moves laterally to points of surface discharge. In Orange County, the amount of precipitation falling on the surface exceeds the amount that can be transmitted downdip, and consequently, the excess water is rejected in the recharge area. Locally, recharge to the "Middle" aquifer may occur by downward movement of water from the "Upper" aquifer or by upward movement from the "Lower" aquifer in areas where the piezometric surface in the "Middle" aquifer is lower than that in the "Upper" or "Lower" aquifers.

Ground water in Orange County moves from areas of recharge to areas of discharge under the influence of gravity. The general direction of movement is down the dip of the aquifers--that is, southeastward. Locally, however, in areas of withdrawals of water by pumping, the direction of movement is toward these areas from all directions. The rate of movement of ground water is estimated to be a few tens of feet per year based on the natural undisturbed hydraulic gradient. Velocities vary, however, depending on the hydraulic gradient, the permeability and porosity, and the temperature of the water at any locality.

Ground water in the aquifers underlying Orange County is discharged both naturally and artificially. In the recharge areas of the aquifers in Orange County, ground water is discharged naturally into streams and, where the water level is near the land surface, large quantities of water are discharged by evapotranspiration. In the downdip or artesian part of the aquifers, discharge in areas undisturbed by pumping occurs by vertical leakage of water upward through the confining beds into other aquifers and eventually to the land surface. The amount of water moving upward is not known, but it depends on the thickness and permeability of the intervening beds and the head differential between the aquifers. Ground water is discharged artificially by pumping from wells and excavations or pits that intersect the water table.

Hydraulic Characteristics of the Aquifers

"The worth of an aquifer as a fully developed source of water depends largely on two inherent characteristics: its ability to store and its ability to transmit water" (Ferris and others, 1962, p. 70). These characteristics are referred to as the coefficient of storage and transmissibility.

The coefficient of storage (S) of an aquifer is the volume of water it releases from or takes into storage per unit surface area of the aquifer per unit change in the component of head normal to that surface. In the water-table aquifer, the coefficient of storage is nearly equal to the specific yield, which is the amount of water a saturated formation will yield by draining under the force of gravity. The storage coefficients of water-table aquifers range from about 0.05 to about 0.30; whereas, those of artesian aquifers range from about 0.00001 to 0.001. Where artesian conditions prevail, the coefficient of storage is a measure of the elasticity of the aquifer.

The coefficient of storage is important in any calculation of the quantity of water that could be obtained from an aquifer, but the availability of the water depends primarily on the ability of the aquifer to transmit water. The coefficient of permeability is a measure of that ability and is defined as the rate of flow of water in gallons per day through a cross-sectional area of 1 square foot under a unit hydraulic gradient (1 foot per foot) at a temperature of 60°F. In field practice, the adjustment to 60°F is commonly disregarded, and the permeability is then understood to be a field coefficient at the prevailing water temperature. The coefficient of transmissibility (T) is the product of the field coefficient of permeability and the saturated thickness of the aquifer.

Table 2.--Summary of aquifer tests in Orange County

Well number	Date	Coefficient of transmissibility (gpd per ft)	Coefficient of storage	Specific capacity (gpd per foot of drawdown)	Remarks
UJ-61-56-901	Dec. 29, 1962	70,000	--	6.6	Recovery test
902	Dec. 28, 1962	90,000	--	8.4	Do.
903	do	210,000	8.8×10^{-4}	--	Do.
904	do	170,000	9.1×10^{-4}	--	Do.
64-301	Dec. 26, 1963	170,000	8.0×10^{-4}	--	Do.
62-51-701	Oct. 29, 1962	260,000	2.1×10^{-3}	--	Do.
702	do	310,000	1.5×10^{-3}	10.2	Specific capacity reported by driller
704	do	270,000	6.3×10^{-2}	--	Recovery test
706	do	260,000	--	--	Do.
707	do	350,000	--	29.6	Do.
58-305	May 22, 1963	140,000	--	26.3	Do.
609	Feb. 22, 1946	200,000	--	17.2	--
611	Feb. 21, 1946	310,000	6.0×10^{-4}	--	Recovery test
59-102	May 21, 1963	130,000	1.3×10^{-3}	--	Do.
103	do	160,000	--	28.0	--
105	do	210,000	5.9×10^{-3}	--	Recovery test
107	May 20, 1963	200,000	--	23.6	Do.
117	do	200,000	2.6×10^{-3}	--	Do.
402	Feb. 21, 1946	280,000	4.7×10^{-4}	--	Do.
403	do	230,000	5.0×10^{-4}	--	Do.

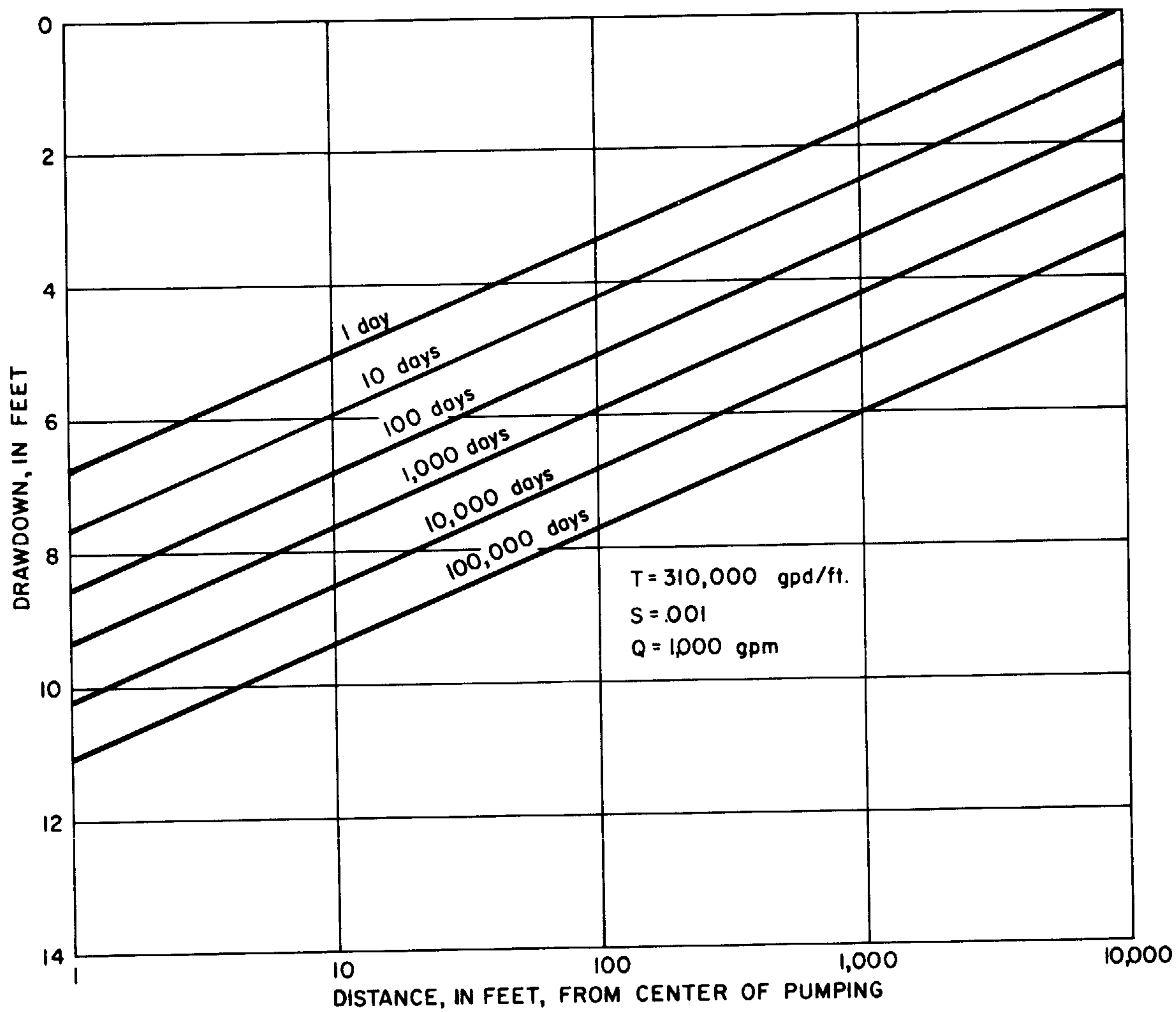


Figure 7

Graph Showing Relation Among Drawdown, Distance, and Time Due to Pumping in the "Middle" Aquifer

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differs from the theoretical specific capacity because of one or more reasons. Improper well construction or development, unfavorable local geologic conditions, screening only part of the available aquifer, plugging of screen, formation, or gravel pack by organic material such as bacterial or algal growths or inorganic material such as gels or precipitates, all are factors contributing to a decrease in specific capacity. In some wells, the effective diameter may be increased by proper development, and as a result, the observed specific capacity may be larger than the theoretical.

The measured specific capacities of 8 wells in the "Middle" aquifer in Orange County ranged from 6.6 to 29.6 gpm per foot of drawdown, averaging 18.7 (Table 2). Higher specific capacities, as high as 43.7 gpm per foot of drawdown, have been reported. The low specific capacities in relation to the high transmissibility may be attributed to the fact that none of the wells tested were screened opposite more than 120 feet of sand, although in some parts of the county, the sand is more than 300 feet thick. In addition, Wood and others (1963, p. 40) reported that "...the measured specific capacities of most wells in the region [Gulf Coast] are smaller than the theoretical, indicating that many of the sands in the gravel-packed zone are poorly connected to the interior of the screen so that 'screen losses' are considerable during pumping."

Use of Ground Water

During the early days of settlement of Orange County, the only water used was for domestic and livestock purposes and was obtained from shallow dug wells or from ponds and streams. The first deep water well (UJ-61-56-406) in Orange County was drilled in 1902, about 7 miles northwest of Vidor. Other deep wells were drilled during the next few years chiefly in the southern part of the county. During the period 1910-40, ground water was developed for public supply, boiler feed in saw mills, railroads, and oil and gas production; a water supply for one petroleum refinery in Jefferson County was developed in Orange County during the same period.

According to Livingston (Written communication, 1942), the withdrawal of ground water in 1941 in Orange County was 2.6 mgd (million gallons per day), most of which was from the "Middle" aquifer; probably less than 100,000 gpd (gallons per day) was from the "Upper" aquifer, and a smaller but unknown quantity was from the "Lower" aquifer in the northwestern part of the county.

The use of ground water has increased substantially in the past 20 years in response to a significant increase in population and expansion of industry. According to the records of the Texas Water Commission, the total withdrawals of ground water increased from 7 mgd in 1955 to about 10 mgd in 1958. By the end of 1962, the pumpage was 20.6 mgd, of which 18.6 mgd was from the "Middle" aquifer, the remaining 2 mgd being from the "Upper" aquifer. Of the water pumped from the "Middle" aquifer, 14 mgd was for industrial use, 3.9 mgd for public and domestic supplies, and 0.7 mgd for irrigation. Of the water used for public supply, nearly 3 mgd was used by the city of Orange. Of the water pumped from the "Upper" aquifer, about 100,000 gpd was for domestic use, 65,000 gpd for industry, and an estimated 1,800,000 gpd was from sand pits, the pumping being incidental to the mining of sand and gravel. The water pumped from the sand and gravel pits probably does not return to the aquifer as it is discharged into canals and streams which eventually flow into the Gulf of Mexico.

Irrigation with ground water in Orange County began in 1908, when well UJ-62-50-603 was used to irrigate 300 acres. According to Livingston (Written communication, 1942), very little rice is irrigated with ground water during years of normal rainfall, and practically none is irrigated with ground water during wet years. The use of ground water for irrigation, principally of rice, has decreased in the past few years, owing principally to acreage limitations instituted in 1955, under the Federal price-support program for rice. Furthermore, ground water is pumped for irrigation primarily to supplement the surface-water supply. In 1949, about 10,500 acres was irrigated, only 500 acres of which was irrigated with ground water; in 1962, about 4,500 acres was irrigated in the county, 240 acres of which was irrigated with ground water and 200 acres with both surface and ground waters, the remaining acreage being irrigated with surface water.

Changes in Water Levels

Prior to large-scale pumping in Orange County, the deep wells drilled in the early 1900's had strong artesian flows. Livingston (Written communication, 1942) concluded that the original artesian head in the "Middle" aquifer was sufficient to raise the water about 25 to 30 feet above sea level at Orange. As more deep wells were drilled, many of which were allowed to flow freely, the artesian pressure decreased. World War II accelerated the demand for water, and by the end of the war, most of the wells in the "Middle" aquifer had ceased to flow; by about 1950, all the deep water wells had ceased to flow. In addition to the pumpage in Orange County, the development of the ground-water supplies in other areas, particularly in the "500-" and "700-foot" aquifers in Calcasieu Parish, Louisiana, contributed also to the decline in water levels. Historical records of water levels in selected wells in Orange County are given in a report of the U.S. Geological Survey (Hackett, 1962, p. 165-166).

Declines in water levels in wells tapping the "Middle" aquifer are illustrated by the hydrographs of water levels in four wells as shown in Figure 8. The water level in well UJ-62-59-105, in south Orange near the center of the area of large withdrawals for industry and public supply, declined about 41 feet during the period 1942-63, an average decline of 1.8 feet per year. In this same well, the water level rose sharply in 1959, reflecting reduction in pumpage because of the above-normal rainfall at Orange during 1958 and 1959. Records of the U.S. Weather Bureau show that annual rainfall at Beaumont during the 2-year period was 64.54 and 79.43 inches, or 14 and 29 inches above normal. In 1962, the water level declined 6 feet to a record low, reflecting an increase in pumpage due partly to below-normal rainfall and partly to an increase in the development of the ground-water resources for industrial and municipal uses.

The hydrographs of wells UJ-62-57-502, UJ-62-50-603, and UJ-62-50-701 are representative of wells relatively distant from centers of large concentrated withdrawals. The water levels in these wells declined an average of about 1 foot per year during the 23-year period of record.

Figures 9 and 10 show the approximate altitudes of water levels in wells in the "Middle" aquifer in Orange and Jefferson Counties. In 1941, the water level in wells in the "Middle" aquifer was fairly uniform, ranging from an altitude of nearly 25 feet above sea level in the northwest corner of the county to slightly less than 15 feet in the southeastern part (Figure 9). The map shows also a slight depression in the eastern part of Orange, where the water level was less than 10 feet above sea level.

Owing to the substantial increase in pumping since 1941, the water levels in the "Middle" aquifer have declined throughout the county, the greatest declines occurring in the southeastern part of the county where large withdrawals, principally for industry, are concentrated. In 1962-63, the piezometric surface was below sea level throughout a large part of the county (Figure 10). The cone of depression, first observed in 1941, had deepened considerably by 1962-63 and occupied a large area in the southeastern part of the county. A comparison of the maps (Figures 9 and 10) show that in the vicinity of Orange and West Orange, water levels have declined to as much as 35 feet below sea level, or a net decline of more than 40 feet since 1941. A large part of this decline is the result of pumping in the county, but a part undoubtedly is due to pumping in the "500-" and "700-foot" sands in Calcasieu Parish, Louisiana. In a small area southeast of Vidor, the water levels have declined to as much as 20 feet below sea level, or a net decline of about 30 feet since 1941. Most of the decline in this area probably occurred since 1961 when six wells were drilled to supply water for industry.

Few records are available concerning the changes in water levels in the "Upper" aquifer. Most of the pumpage from the aquifer is related to the mining of sand and gravel; consequently, the largest declines in water levels are in the vicinity of sand and gravel pits. This is shown clearly in Figure 11, which shows several cones of depression in the water surface, the deepest cone being about 4 miles southwest of Vidor. The cone of depression southwest of Orange shows the effect of pumping from the aquifer in the vicinity of Orangefield.

Available records show that during the period 1941-63, the declines in water levels in three wells tapping the "Upper" aquifer in the northern part of the county ranged from 1.0 foot in well UJ-62-49-102 to 9.3 feet in well UJ-62-51-102. The latter well obtains water from the basal part of the "Upper" aquifer for industrial use. During the same period, the water levels in three wells in the southern part of the county in grid 62-57 showed rises ranging from 0.9 foot in well UJ-62-57-604 to 4.1 feet in well UJ-62-57-102.

Relation of Water-Level Declines to Land Subsidence

According to Winslow and Wood (1959, p. 1030) the removal of ground water and the consequent lowering of artesian pressure has resulted in a subsidence of the land surface in almost the entire upper Gulf Coast region of Texas, which included Orange County. In an artesian aquifer, such as the "Middle" aquifer, the artesian pressure helps support the framework of the aquifer, and when the artesian pressure is lowered, water is released from storage in the aquifer and the beds are compacted, most of the compaction taking place in the fine-grained sediments. The amount of compaction, or subsidence, depends on the thickness of the fine-grained sediments and the amount of decline in artesian head.

Winslow and Wood (1959, fig. 3, p. 1032) estimated that in the southern part of Orange County, the land surface subsided at least 0.25 foot during the period 1918 to 1954, based on releveling of previously established level lines by the U.S. Coast and Geodetic Survey. They also show that during this same period, some subsidence had occurred over an area encompassing probably more than half the county. Data are not available to determine the extent of subsidence since 1954, but it is probable that the land surface has continued to subside, at least in localized areas, where large declines in artesian pressure have occurred. Land-surface subsidence apparently has not been a serious problem in Orange County. However, additional subsidence can be expected as water

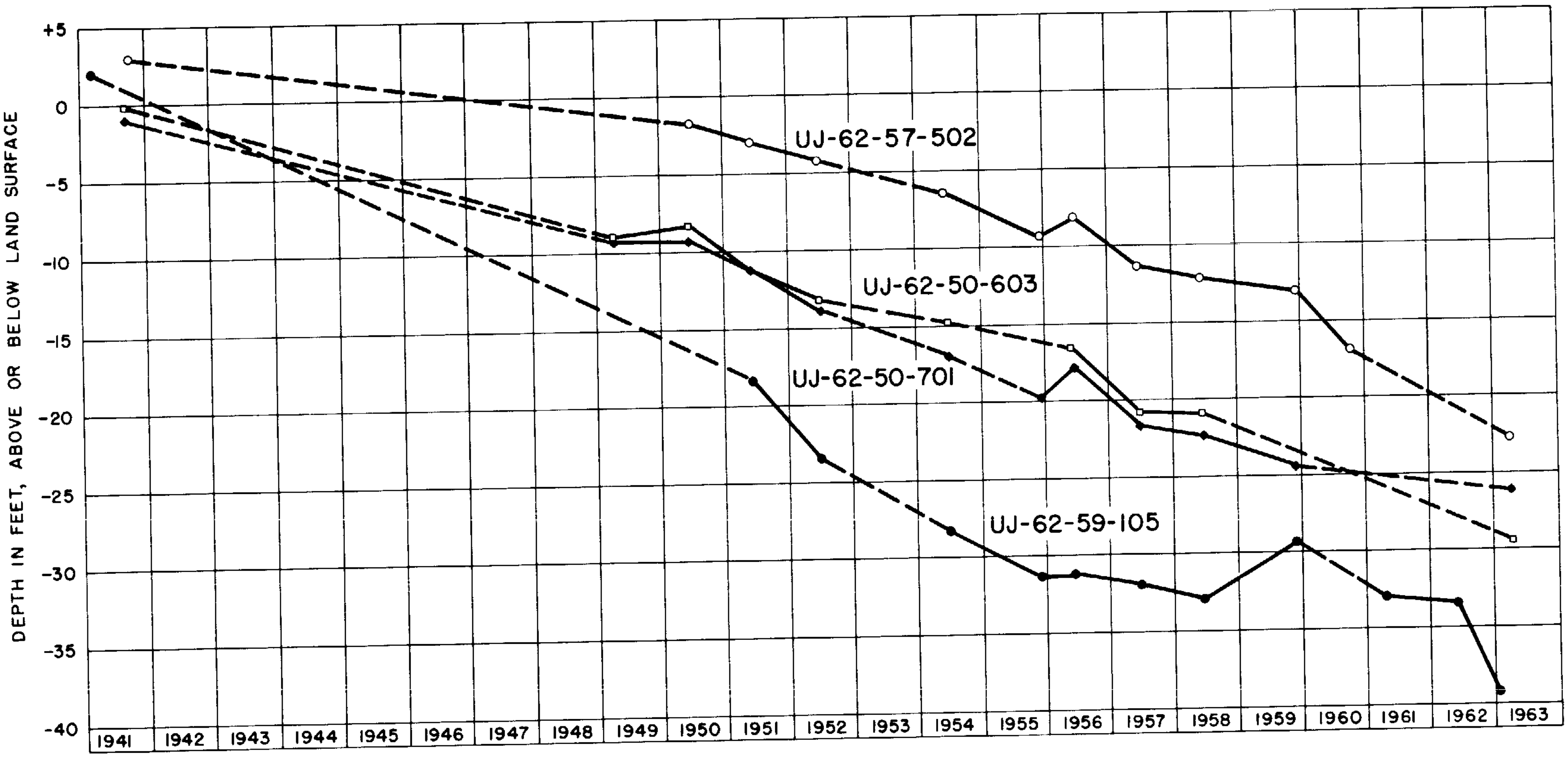

Figure 8

Hydrograph of Water Levels in Wells Tapping the "Middle" Aquifer, Orange County

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levels continue to decline. A program of observation of subsidence should be started in the Orange County area to be carried on in conjunction with a continuing program of collection of water-level and pumpage records.

Quality of Ground Water

The chemical quality of water depends upon the dissolved minerals present; the quality commonly determines its suitability for use. A general classification of water, according to dissolved-solids content, is as follows (Winslow and Kister, 1956, p. 5):

Description	Dissolved-solids content (parts per million)
Fresh	Less than 1,000
Slightly saline	1,000 to 3,000
Moderately saline	3,000 to 10,000
Very saline	10,000 to 35,000
Brine	More than 35,000

The U.S. Public Health Service (1962, p. 7) has established standards for the chemical quality of water to be used by common carriers engaged in interstate commerce. These standards are commonly used in evaluating water for use as a public supply. The following are the limits of concentration for some of the constituents:

Substance	Concentration (ppm)
Chloride (Cl)	250
Fluoride (F)	(*)
Iron (Fe)	.3
Manganese (Mn)	.05
Nitrate (NO_3)	45
Sulfate (SO_4)	250
Total dissolved solids	500

* According to the Public Health Service (1962, p. 41), the optimum fluoride level for a given community depends on climatic conditions because the amount of water (and consequently the amount of fluoride) ingested is influenced primarily by air temperature. Presence of fluoride in average concentrations greater than twice the optimum value, 0.8 ppm (parts per million) in Orange County based on an annual average of maximum daily air temperature of 79.1°F at Beaumont, or 1.6 ppm may constitute grounds for rejection of the supply.

Water having concentrations of chemical constituents in excess of the recommended limits may be objectionable for various reasons. Maxcy, (1950, p. 271) in relating nitrate concentrations to the occurrence of methemoglobinemia ("blue-baby" disease), recommends an upper limit of 44 ppm of nitrate as NO_3 in water used for infant feeding. The presence of nitrate in large concentrations may indicate pollution by sewage or organic material.

Excessive concentrations of iron and manganese in water cause reddish-brown or dark gray precipitates that discolor clothes and stain plumbing fixtures. Such high iron-bearing water on exposure to air becomes turbid, but the water will become clear if it is quiescent.

Water having a chloride content exceeding 250 ppm may have a salty taste and sulfates in water in excess of 250 ppm may produce a laxative effect. However, persons may become accustomed to use of these waters in a relatively short time if the concentrations are not too great.

Calcium and magnesium are the principal constituents in water that may cause hardness. Excessive hardness causes increase in consumption of soap and induces the formation of scale in hot water heaters and water pipes. A classification commonly used with reference to hardness is as follows: 60 ppm or less, soft; 61-120 ppm, moderately hard; 121-180 ppm, hard; and more than 180 ppm, very hard. If water used in steam boilers has more than 75 ppm hardness as calcium carbonate (American Society for Testing Materials, 1959, p. 24) it should be treated to prevent the formation of scale. In high-pressure boilers the tolerance is much less than 75 ppm.

The quality of water for industry does not depend necessarily on whether the water is acceptable for human consumption. One of the major items of concern to most industries is the development of water supplies which do not contain corrosive or scale-forming constituents which affect the efficiency of boilers and cooling systems. The quality of water requirements for miscellaneous industries vary widely with each type of processing presenting individual requirements. Suggested water quality tolerances for a number of industries are summarized by Hem (1959, p. 253) from Moore (1940).

The suitability of water for irrigation depends on the chemical quality of the water and other factors such as soil texture and composition, types of crops, irrigation practices, and climate. The most important chemical characteristics pertinent to the evaluation of water for irrigation are the proportion of sodium to total cations, an index of the sodium hazard; total concentrations of soluble salts, an index of the salinity hazard; RSC (residual sodium carbonate); and concentration of boron. A system of classification commonly used for judging the quality of water for irrigation was proposed by the U.S. Salinity Laboratory Staff (1954, p. 69-82). The classification is based primarily on the salinity hazard as measured by the electrical conductivity of the water and the sodium hazard as measured by the SAR (sodium-adsorption ratio). However, this system of classification (Figure 12) may not be directly applicable to Orange County because of the relatively high rainfall. However, if the use of doubtful water is contemplated, consideration should be given to the type of soil to be watered, the local conditions of drainage, and the crops to be irrigated.

An excessive concentration of boron renders a water unsuitable for irrigation. Scofield (1936, p. 286) indicated that boron concentrations of as much as 1 ppm are permissible for irrigating most boron-sensitive crops and concentrations of as much as 3 ppm are permissible for the more boron-tolerant crops.

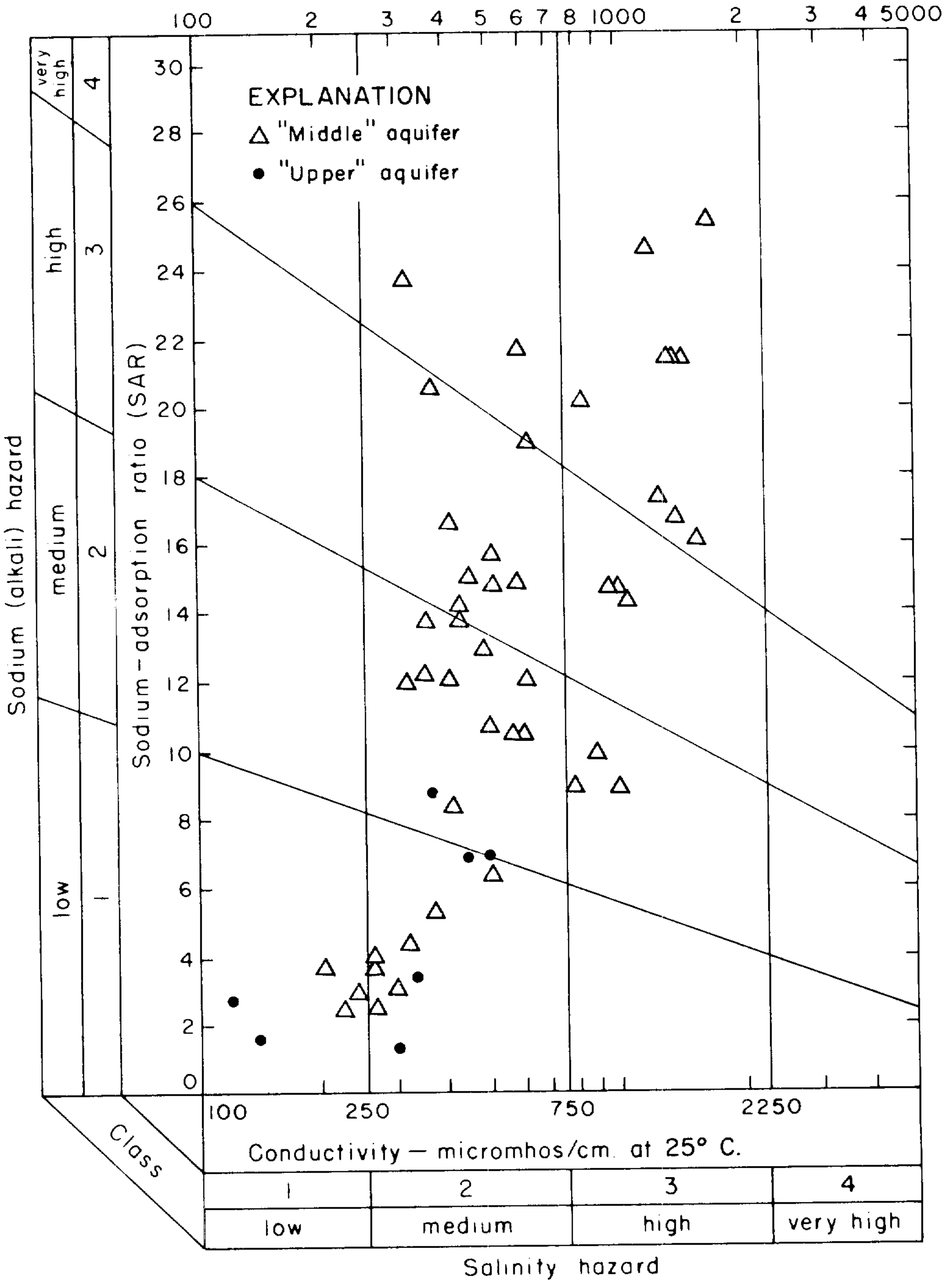

Figure 12

Diagram for the Classification of Irrigation Waters

(After United States Salinity Laboratory Staff, 1954, p. 80)

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Another factor used in assessing the quality of water for irrigation is the RSC (residual sodium carbonate) of the water. Excessive RSC will cause the water to be alkaline, and the organic content of the soil will tend to dissolve. The soil may become a grayish black and the land areas affected are referred to as "black alkali." Wilcox (1955, p. 11) states that laboratory and field studies have resulted in the conclusion that water containing more than 2.5 epm (equivalents per million) RSC is not suitable for irrigation. Water containing from 1.25 to 2.5 epm is marginal and water containing less than 1.25 epm RSC probably is safe. However, it is believed that good irrigation practices and proper use of amendments might make it possible to use a marginal water successfully for irrigation. Furthermore the degree of leaching may modify the permissible limits to some extent.

"Lower" Aquifer

Only the upper part of the "Lower" aquifer yields water of good chemical quality in Orange County and only in the northern part of the county (Plates 2 and 4). Inasmuch as fresh water is available in relatively large quantities in sands above the "Lower" aquifer in this area, very few wells actually penetrate it. Elsewhere in the county, the water in the "Lower" aquifer is saline. The dissolved-solids content exceeded 1,000 ppm in all samples and the chloride content ranged from a low of 88 ppm to a high of 17,500 ppm. In most samples, however, the chloride content ranged from 520 to 798 ppm (Table 5).

"Middle" Aquifer

The "Middle" aquifer is the principal source of fresh water in Orange County. The results of chemical analyses (Table 5) and the electric logs (Plates 2-4) show that most of the water in the aquifer is fresh. In general, the water is soft to moderately hard and low in dissolved solids, sulfate, nitrate, and fluoride. Sodium and bicarbonate are the principal constituents except in the southeastern part of grid 62-58 where sodium and chloride predominate.

Several large-capacity wells in Orange, West Orange, Vidor, and Echo, as well as some small-capacity wells elsewhere in the county, yield water that contains objectionable amounts of iron. In 19 of 46 samples, iron exceeded 0.3 ppm; in 2 samples, the iron content exceeded 6.9 ppm. The iron can be removed by aeration of the water as is done by the city of West Orange.

The chloride content of water from the "Middle" aquifer ranges widely. In the northwestern part of the county where the aquifer contains only fresh water, the chloride content generally is less than 50 ppm. Downdip from this area, the aquifer contains an increasingly greater thickness of slightly saline-water-bearing sands, and as a result, most of the large-capacity wells that are screened in the fresh-water part of the aquifer yield objectionable amounts of chloride. In these wells, the concentration of chloride depends on the rate and duration of pumping and the proximity of the salt-water interface. This is shown in the chloride graph (Figure 13) of well UJ-62-58-305 (city of Orange well 8). It shows that the chloride content increased from 200 ppm about 15 minutes after pumping started to about 240 ppm after 1,000 minutes pumping. Records of the city of Orange show that the chloride content in the water from the well increased to a maximum of about 310 ppm after an extended period of pumping. Increases of a similar magnitude have been reported in some wells in

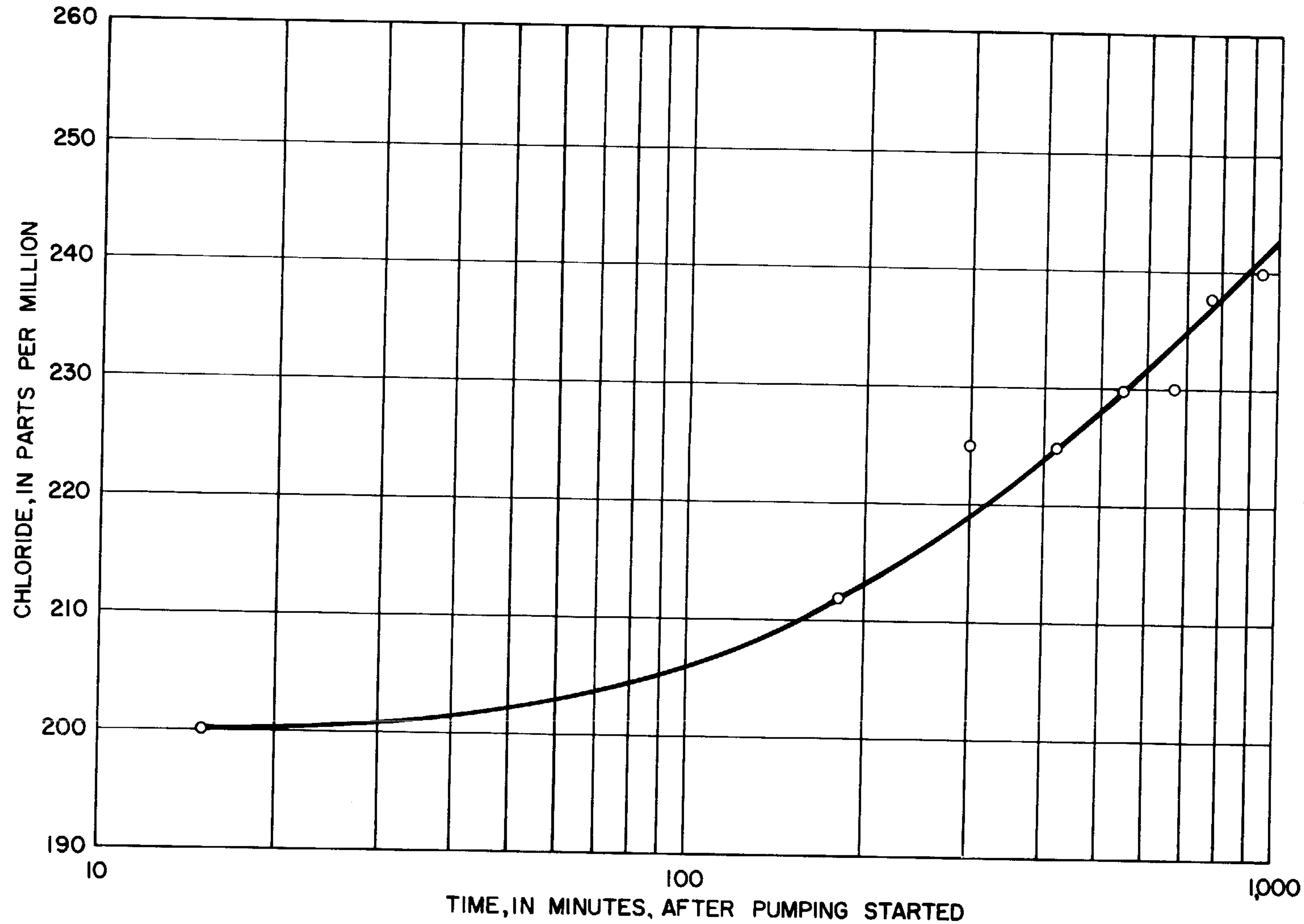

Figure 13

Changes in Chloride Concentration in Water From Well UJ-62-58-305

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the heavily-pumped industrial area of West Orange and Orange, in an area about 4 miles south of Vidor, and in the vicinity of Orangefield.

The high chloride content of water from some wells screened in the fresh-water part of the aquifer is due principally to the "coning upward" of the slightly saline water that directly underlies the fresh water, but also to a lesser extent to the lateral movement of the more mineralized water that adjoins the fresh water. Electric logs (Plates 2, 3, and 4) show that in some of the large-capacity wells the fresh water-salt water interface is in a thick sand section, the fresh-water part of which is screened in the wells. Thus, in some wells at least, the fresh water may not be separated from the salt water by even a thin layer of clay. Consequently, when such a well is pumped, the slightly saline water moves relatively freely upward into the fresh-water body. In the industrial area in Orange and West Orange, the increase in the chloride content of water from wells in the "Middle" aquifer may also be due to a small extent to the lateral movement of a nearby salt-water interface in response to the large withdrawals of ground water.

Gas has been noted in water from a considerable number of wells in the "Middle" aquifer, particularly in the vicinity of Bridge City and Orangefield. Some well owners reported having flared the gas in the past. The occurrence of gas in the ground water and the reports of oil skims in water wells are credited with stimulating the exploration that resulted in the discovery of the oil field at Orangefield.

Most of the water pumped from the "Middle" aquifer in 1962 was for industrial use. Where chemical quality is a critical factor, treatment of the water supplies for industrial use sometimes is necessary. The observed silica content in water from the "Middle" aquifer ranged from 18 to 72 ppm, but in most of the samples it ranged from 40 to 50 ppm. Moore (1940, p. 263) suggested the following allowable concentration of silica in boilers operating at various pressures: less than 150 psi (pounds per square inch), 40 ppm; 150-250 psi, 20 ppm; 250-400 psi, 5 ppm; and more than 400 psi, 1 ppm.

Locally, the pH of the water from the "Middle" aquifer may be less than 7.0. Of 77 samples of water analyzed, 19 samples had a pH of less than 7.0; however, none was lower than 6.2.

The temperature of ground water is often of great importance to industries planning to use the water. Usually, ground water has a more uniform temperature than surface water; consequently, it is more desirable for certain industrial uses. The observed temperature of water from the "Middle" aquifer ranged from 72.7 to 77.3°F in wells that ranged in depth from 375 to 726 feet. On this basis, the thermal gradient is about 1°F per 100 feet, which compares favorably with that of the Gulf Coast aquifer in Hardin County (Baker, 1963, p. 121), but is considerably less than the thermal gradient of 1°F per 79 feet obtained for the aquifers in Calcasieu Parish, Louisiana (Harder, 1960, fig. 10).

Irrigation with ground water is not practiced extensively in Orange County. The chemical analyses of water from the "Middle" aquifer indicate that the sodium hazard ranges from low to very high and the salinity hazard from low to high, according to the classification of the U.S. Salinity Laboratory (Figure 12). Although the classification is useful in a general way for evaluating the water in Orange County, it should not be used rigidly. Where rainfall is high or where flooding of crops such as rice is practiced, considerable leaching occurs, thereby reducing the harmful effects of water that otherwise might be considered as doubtful or unsuitable. Moreover, much of the ground water used for irrigation in the county merely supplements the surface-water supply.

Boron is not known to be a problem in water from the "Middle" aquifer in Orange County. Of four samples analyzed, all contained less than 1.0 ppm.

Residual sodium carbonate (RSC) in excess of 2.5 epm (equivalents per million), the upper limit of concentration in marginal irrigation water, was present in 36 water samples of a total of 54 from the "Middle" aquifer. The higher concentrations of RSC were generally found in water from wells 500 or more feet deep. However, concentrations of RSC less than 1 epm were noted in three deep wells.

"Upper" Aquifer

The "Upper" aquifer supplies only small amounts of water for domestic and industrial purposes in Orange County. The water ranges widely in chemical quality within short distances, but where the sands in the "Upper" aquifer are thick, the water has a marked similarity in quality to that in the underlying "Middle" aquifer. The water generally is soft to very hard, low in dissolved solids, chloride, and sulfate. Of 79 samples analyzed, only 12 had more than 500 ppm dissolved solids. The chloride content of water from the "Upper" aquifer generally is less than 100 ppm except in the southeastern part of the county; in grid 62-58, as much as 665 ppm chloride and 1,286 ppm dissolved solids were observed. In water from one well (UJ-62-49-106) in the northern part of the county, the chloride and dissolved-solids contents were 1,410 and 2,500 ppm. The high mineralization of this water may represent contamination from surface sources.

In general, nitrate and fluoride are not problems in the "Upper" aquifer in Orange County. Table 5 shows that the nitrate content exceeded 45 ppm in 4 shallow wells, the maximum being 240 ppm in well UJ-62-49-603, which is 18 feet deep. Of these wells, 3 were sampled in 1941 and have since been abandoned; the nitrate content in the water from the fourth well (UJ-62-51-101) was 0.0 in 1963.

The temperature of the water from the "Upper" aquifer, as determined from only 2 wells 175 and 220 feet deep, averaged about 70°F, which is about the mean annual air temperature at Beaumont.

In 1962, about 65,000 gpd was pumped from the "Upper" aquifer for industry in Orange County. In general, the water from the "Upper" aquifer may be slightly corrosive, the pH in 19 samples ranging from 5.3 to 7.2 (Table 5). The silica content in 8 samples ranged from 18 to 29 ppm and averaged 24 ppm. In general, the iron content was less than 0.3 ppm, although as much as 14.0 ppm was measured in a sample from well UJ-61-56-305.

Although no water was pumped from the "Upper" aquifer for irrigation, chemical analyses indicate that the water is suitable for irrigation, being low to medium in both sodium and salinity hazards (Figure 12). The RSC values in 13 samples ranged from 0.0 to 3.42 epm, exceeding 2.5 epm in only 3 samples.

Disposal of Oil-Field Brines

According to data obtained from the files of the Texas Railroad Commission, about 18.4 million barrels of oil-field brine was produced in Orange County during 1961, of which 59 percent was diverted to surface-water courses, 35.8 percent to open surface pits, and 5.2 percent to injection wells, through which the water is injected into deep saline-water-bearing formations.

The disposal of oil-field brines into surface-water courses is restricted principally to the southern part of the county where most of the surface water as well as the shallow ground water is saline.

Approximately one-third of the brine produced in Orange County in 1961 was diverted into open surface pits, all of which were in the southern part of the county where the soil is clayey and the shallow aquifers contain mostly saline water. In general, open surface pits are ineffective as means of disposing of brine in Orange County principally because the average annual evaporation rate of about 47 inches is offset by an average annual precipitation of about 54 inches. Moreover, the evaporation rate is reduced further owing to the surface film of oil usually present in the pits. Although some of the brine placed in surface pits seeps into the ground and eventually percolates downward to the water table, a part is released or overflows to surface-water courses.

In the northern part of the county where the soil is sandy and the shallow ground-water and surface-water supplies are fresh or only slightly saline, improper disposal of the oil-field brines in the past has resulted in fairly large areas where vegetation was killed and soil damaged. These areas of "tree kills" emphasized the need of a more effective method of brine disposal. The records of the Texas Railroad Commission show that nearly all the brine produced in the northern part of the county during 1961 was disposed of by injection wells, and by 1962, all the brine was diverted to injection wells.

In summary, the disposal of oil-field brines seemingly has not resulted in serious damage to the chemical quality of the ground-water supplies in Orange County. Nevertheless, considerable care should be exercised in the disposal of brines as well as other municipal and industrial wastes in those parts of the county that are underlain by fresh or slightly saline ground water.

Relation of Fresh Ground Water to Salty Ground Water

The geologic formations comprising the fresh water aquifers in Orange County consist of sediments that were deposited beneath the Gulf and contained salt water at the time of deposition, or were deposited in fresh water but were later filled with salt water at a time of higher sea level. At some time after deposition, the sea receded and the process of recharge and discharge began. Fresh water furnished to the recharge area began to force the saline water downdip to discharge areas until the pressure exerted by the saline water equaled the pressure of the fresh water. Flushing of the salt water from the sands may have been accomplished in several ways. Winslow and others (1957, p. 387-388) concluded that the discharge in Harris County, Texas, under conditions similar to those in Orange County took place through the overlying clays. Before large withdrawals by wells began, the system was probably in dynamic equilibrium--that is, the fresh water-salt water interface was nearly stationary because the pressure head of the fresh water that was moving downdip from the outcrop and discharging upward through the clays was balanced by the static head of the salt water.

In some areas, notably in the vicinity of Orange, large ground-water withdrawals have upset the equilibrium, and as a result, the salt water is probably moving updip in response to a reversal of the hydraulic gradient. Updip movement of salt water can be expected at any place where large concentrated withdrawals lower the artesian pressure head and upset the equilibrium at the fresh water-salt water interface. The rate of movement updip is slow, depending on the hydraulic gradient and permeability of the sands.

The geologic sections (Plates 2, 3, and 4) show the relation of fresh water and salt water in Orange County. They show that the fresh water-salt water interface occurs in the upper part of the "Lower" aquifer in most places in the northern one-fourth of the county. The interface slopes steeply upward until it coincides with the base of the "Middle" aquifer at which point the interface slopes gently throughout most of the central part of the county. In the southern and southeastern parts of the county, the interface slopes steeply upward, ultimately passing out of the "Middle" aquifer into the "Upper" aquifer. Plate 3 shows the wedging out of the fresh water in a southwesterly direction. In the southwestern part of the county, the fresh water-salt water interface slopes upward so that at or near the Neches River no fresh water is available in the aquifers. The locations of these rather rapid changes in the thickness of the fresh-water body represent the southern and southwestern extent of flushing of the sands by fresh water.

The contact between fresh water and saline water (containing more than 1,000 ppm dissolved solids) is not sharp but consists of a zone of diffusion in which the water is slightly saline. The zone ranges widely in thickness, being thickest in the northwestern part of the county (Plate 2).

The presence of saline water in the aquifers in Orange County presents the most serious problem concerning the development of ground water in the county. Salt-water encroachment is threatened both from below and laterally, especially in the southern part of the county. A program of periodic resampling of key wells throughout the county should be undertaken so as to chart the possible movement of saline water toward centers of pumping. The resampling should be done in conjunction with a continuing inventory of pumpage and observation of water levels.

AVAILABILITY OF GROUND WATER

Nearly all of Orange County is underlain by sands containing fresh and slightly saline water extending to various depths (Figures 14 and 15). The bases of the fresh and of the slightly saline water were determined from a comparison of the resistivity of water-bearing sands on electric logs with the quality of the water in the sands. On this basis, the apparent resistivity of sands containing fresh water (less than 250 ppm chloride and generally less than 1,000 ppm dissolved solids) based on the long normal and lateral curves is about 30 or more ohms m^2/m (square meter per meter). The apparent resistivity of sands containing slightly saline water (250 to 1,000 ppm chloride and generally 1,000 to 3,000 ppm dissolved solids) is about 10 to 30 ohms m^2/m.

The approximate altitude of the base of fresh water in the "Lower" and "Middle" aquifers ranges from about 900 feet below sea level in the north-central part of the county, to about 200 feet below sea level in the southwestern part (Figure 14). The base of the slightly saline water extends to considerably greater depths, ranging from more than 1,600 feet below sea level in the northwestern part of the county to about 600 feet near the Neches River in the southwestern part (Figure 15). The slope of the base of slightly saline water is uniformly steep in the northern part of the county, becoming relatively flat throughout most of the central part.

The saturated thickness of the fresh-water sands in the "Middle" aquifer ranges from 0 in the western, southwestern, and extreme southern parts of the county to about 400 feet in the eastern and northeastern parts and probably averages about 225 feet (Figure 6). Data are insufficient to determine the aggregate thickness of the fresh-water sands in the "Lower" aquifer but based on electric logs (Plates 2, 3, and 4), the maximum probably is less than 200 feet. Figure 14 shows that in slightly more than three-fourths of the county the "Lower" aquifer contains no fresh water. The thickness of the fresh water-bearing sands in the "Upper" aquifer ranges from 0 to 145 feet and averages about 75 feet.

The volume of fresh water stored in the sands underlying Orange County is estimated to be at least 18 million acre-feet, of which 14 million acre-feet is in the "Middle" aquifer. The water stored in the "Middle" aquifer alone is equivalent to a lake nearly 60 feet deep having an area equal to that of Orange County. However, only a small fraction of the water stored in the sands is economically recoverable by known methods at present costs. The amount of fresh water actually available to wells depends chiefly on the ability of the aquifer to transmit water, the amount of water in storage, and the rate of recharge. However, many other undetermined factors also have a great bearing on the availability of fresh ground water, including the amount of natural discharge that can be salvaged, the effect of vertical leakage in areas of lower artesian pressure, and the effects of updip salt-water movement.

Calculations of availability of fresh water in this report are made only for the "Middle" aquifer, although the volume of fresh water in transient storage is calculated for the "Upper" aquifer. The data for the "Lower" aquifer are meager, and the inclusion of the calculations of the availability of fresh water for that aquifer actually would add only a relatively small amount to the total availability of fresh ground water in the county.

The following assumptions were used to estimate the availability of fresh water in the "Middle" aquifer. First, it was assumed that wells were installed along a line extending west-southwest roughly parallel to the outcrop of the aquifer, and that the wells were pumped in such a way as to lower the water levels to 400 feet along the line. For the purposes of computation, the line of discharge is midway between the outcrop, which is north of the county, and the downdip limit of fresh water (Figure 14); hence, the line actually is in Jasper and Newton Counties about 5 miles north of Mauriceville. The assumed line is about 20 miles long. If the line of discharge were in Orange County, salt-water encroachment would occur before the effect of pumping could reach the outcrop, resulting in a decrease in the maximum amount of water that could be obtained from the aquifer. It was assumed also that during the pumping period, no water was recharged to the aquifer except along the center line of the outcrop (assumed effective line source of recharge) and that the recharge was adequate to keep the altitude of water levels everywhere the same along the line of recharge. It was assumed that the altitude of water levels was the same and remained the same both at all points along the line of discharging wells and along the line representing the downdip limits of fresh water. By lowering the water levels to 400 feet, a large segment of the aquifer would be dewatered;

therefore, the coefficient of storage was assumed to be 0.10. The coefficient of transmissibility of the "Middle" aquifer was assumed to be 310,000 gpd per foot. It was assumed that the hydraulic gradient in the aquifer is the slope of a straight line from the water level at the line of recharge to the water level along the line of discharging wells. The average transmission capacity is the average of that based on the 1962 hydraulic gradient and on the maximum hydraulic gradient.

Under these assumed conditions, about 9,000,000 acre-feet of fresh water would be removed from storage in the "Middle" aquifer by lowering the water levels to 400 feet along the line of discharging wells. At the present (1962) hydraulic gradient of 3.5 feet per mile, the aquifer transmits about 24,000 acre-feet of water per year (21 mgd) which is 2.5 mgd more than the 1962 pumping rate. At the average gradient (12.6 feet per mile) under the assumed conditions, however, the aquifer would transmit about 87,000 acre-feet per year (78 mgd). After the water levels were lowered to 400 feet (maximum gradient of 21.8 feet per mile), the aquifer would transmit about 145,000 acre-feet per year (130 mgd).

If withdrawals were increased to as much as 100,000 acre-feet per year (89 mgd) and assuming that recharge is sufficient to supply the water that can be transmitted at an average hydraulic gradient, it would take about 740 years to lower the water levels to 400 feet along the line of discharge. It would take only about 45 years of pumping 300,000 acre-feet per year (268 mgd) to lower the water levels to 400 feet.

The amount of recharge on the estimated 450 square miles of effective recharge area in Jasper and Newton Counties necessary to replace the water moving downdip at the maximum transmission capacity (145,000 acre-feet per year) would be about 6 inches per year, or about 10 percent of the annual precipitation. It is doubtful that recharge would be adequate to maintain water levels in the outcrop at that rate; however, recharge probably would be adequate to maintain water levels at the transmission capacity of the average gradient, 87,000 acre-feet per year (78 mgd) which is nearly 4 times the present (1962) rate of pumping. This would require about 3.6 inches of recharge per year.

The volumes of water available from the "Middle" aquifer at the various hydraulic gradients are predicated on the assumptions given (beginning on page 46), and it is obvious that some of the assumptions could not be met. For example, the assumed line of discharge is north of Orange County; however, if the assumed line of discharging wells were installed in Orange County, the hydraulic gradient would be somewhat less. Consequently, the volume of water transmitted by the aquifer would be less. It should be noted, however, that the proximity of the wells to the downdip limit of fresh water ultimately affects the amount of fresh water that can be obtained from the aquifer before contamination by the updip movement of salt water. Furthermore, in a large part of the county, the fresh-water and salt-water bodies are hydraulically connected; consequently, pumping in these areas results in the upward movement of the salt water into the fresh-water sands.

The theoretical computations as given above indicate merely the ability of the "Middle" aquifer to transmit water. The limiting factor for the development of ground water in Orange County is the threat of salt-water encroachment. Additional large-scale development in the county should, if possible, be confined to the northern part. It seems likely that a total development of perhaps as much as 90,000 acre-feet per year could be safely undertaken if the wells are properly located and the development is managed properly.

The quantity of fresh water in the "Upper" aquifer that is available for development was not determined. The volume of fresh water stored in the sands in the "Upper" aquifer is estimated to be at least 4 million acre-feet, based on an average saturated sand thickness of about 75 feet and a porosity of 30 percent. This roughly is equivalent to a lake 18 feet deep having an area equal to that of Orange County.

In 1962, only 2 mgd of water was pumped from the "Upper" aquifer. Doubtlessly, the aquifer is capable of sustaining considerably larger withdrawals principally because of a probable high potential rate of recharge, both by precipitation and streamflow. In a large part of the county, the aquifer is full and water is being discharged naturally to streams or by evapotranspiration in areas where the water table is near or at the land surface. Locally, however, large but concentrated withdrawals incident to the mining of sand and gravel deposits have resulted in the streams serving also as a source of recharge. Throughout most of the county, this condition would be beneficial, except in the southern and southwestern parts of the county where the rivers and marshes contain water that is saline. Large withdrawals in or near these areas likely would cause the degradation of the fresh water by the intrusion of the saline surface water.

WELL CONSTRUCTION

Generally, when a well is to be drilled for public supply or industrial use in Orange County, a test hole is drilled by the hydraulic-rotary method, to the depth desired, usually the base of the "Middle" aquifer. During drilling, formation samples are collected and upon completion of the test hole an electric log commonly is run, principally to determine the occurrence of sands containing fresh water. In some test holes, drill-stem tests are made to determine precisely the quality of the water.

If the data collected from the test hole indicate favorable conditions, the pilot hole, or test hole, is reamed to 16 to 24 inches in diameter from the surface to or near the top of the first sand that is to be screened to accommodate the pump-pit casing. The purpose of the pump-pit casing which ranges from 12 to 20 inches in diameter is to provide ample space for installation and submersion of the pump. The pump-pit casing, also known as surface casing, is then installed and cemented into place. Common practice is to pump enough cement into the hole so as to cause some of it to return to the surface in the annular space (about 2 inches) between the casing and the wall of the hole.

The section of sand to be screened (35 to 120 feet thick) is then reamed to a large diameter (usually 30 inches) using the largest drilling bit that can pass the surface casing. The screen then is installed; the bottom of the screen being closed off usually with a back-pressure valve, which permits the use of fluid in keeping the hole clean during the placing of the screen and prevents water and sand from entering through the bottom of the string after the screen is emplaced.

All the large-capacity public supply, industrial, and irrigation wells in Orange County are completed in the "Middle" aquifer. The construction of a typical industrial or public-supply well is shown in Figure 16. The wells are finished with a single section of wire-wrapped screen and a gravel envelope. The screen consists of pipe 6 to 14 inches in diameter that has been perforated and wrapped with stainless-steel wire. Generally the openings in the screen, ranging from 0.016 to 0.050 inches in diameter, are larger than the diameters of most of the sand grains but smaller than the diameters of most of the gravel particles in the gravel envelope. Blank pipe of the same diameter as the screen extends about 100 feet from the top of the screen into the pump pit casing. Sized gravel is placed around the screen by means of a gravel tube, which is withdrawn as the well is filled with gravel. The gravel increases the effective diameter of the well and protects the casing from caving of the sand.

The well is developed by surging, swabbing, pumping, back-washing, or by the use of chemicals or by a combination of these processes until the specific capacity and sand-water ratio are satisfactory. Finally, the well is tested by pumping for 4 to 24 hours during which samples of water are collected for chemical and bacterial analyses. The wells are constructed and developed so as to produce 225 to 3,500 gpm.

The size and type of pump installed depends principally upon the pumping lift and the quantity of water needed. In general, the public-supply, industrial, and irrigation wells in Orange County have high-capacity deep-well turbine pumps powered by electricity. Pump settings in 1963 ranged from 80 to 130 feet below land surface.

Most of the small-capacity wells that furnish water for domestic use and small industry in the county are completed with a single screen, the screen being an integral part of the pipe that conducts the water out of the well. The sizes of the screen and pipe range from 1¼ to 4 inches. In some small-capacity wells more than one size of screen or pipe may be used.

In the construction of some small public-supply wells, 4- or 6-inch casing is placed from the surface to the top of the sand and cemented. Then a slightly smaller size screen is lowered through the pipe and set into the sand. A short section (1 to 10 feet) of blank pipe and a lead nipple are placed on top of the screen. The lead nipple is battered down to form a seal between the pipe, to which the screen is attached, and the surface pipe. A variety of screen types have been used, but stainless steel has become the most widely used because of its strength and resistance to corrosion. Most of the smaller wells are equipped with small centrifugal pumps where pumping lifts are less than 20 feet, and with small capacity deep-well turbine or jet pumps where the lift is more than 20 feet. Submersible pumps are used in a few of the small wells.

NEED FOR FUTURE STUDIES

Large additional supplies of water can be obtained from the aquifers underlying Orange County. It seems likely that as much as 90,000 acre-feet of water could be produced annually from the "Middle" aquifer, the principal aquifer in the county, provided that the new wells are properly located and that the development is properly managed. Any new large-scale development should be located in the northern part of the county, keeping the development as far as possible from the saline water.

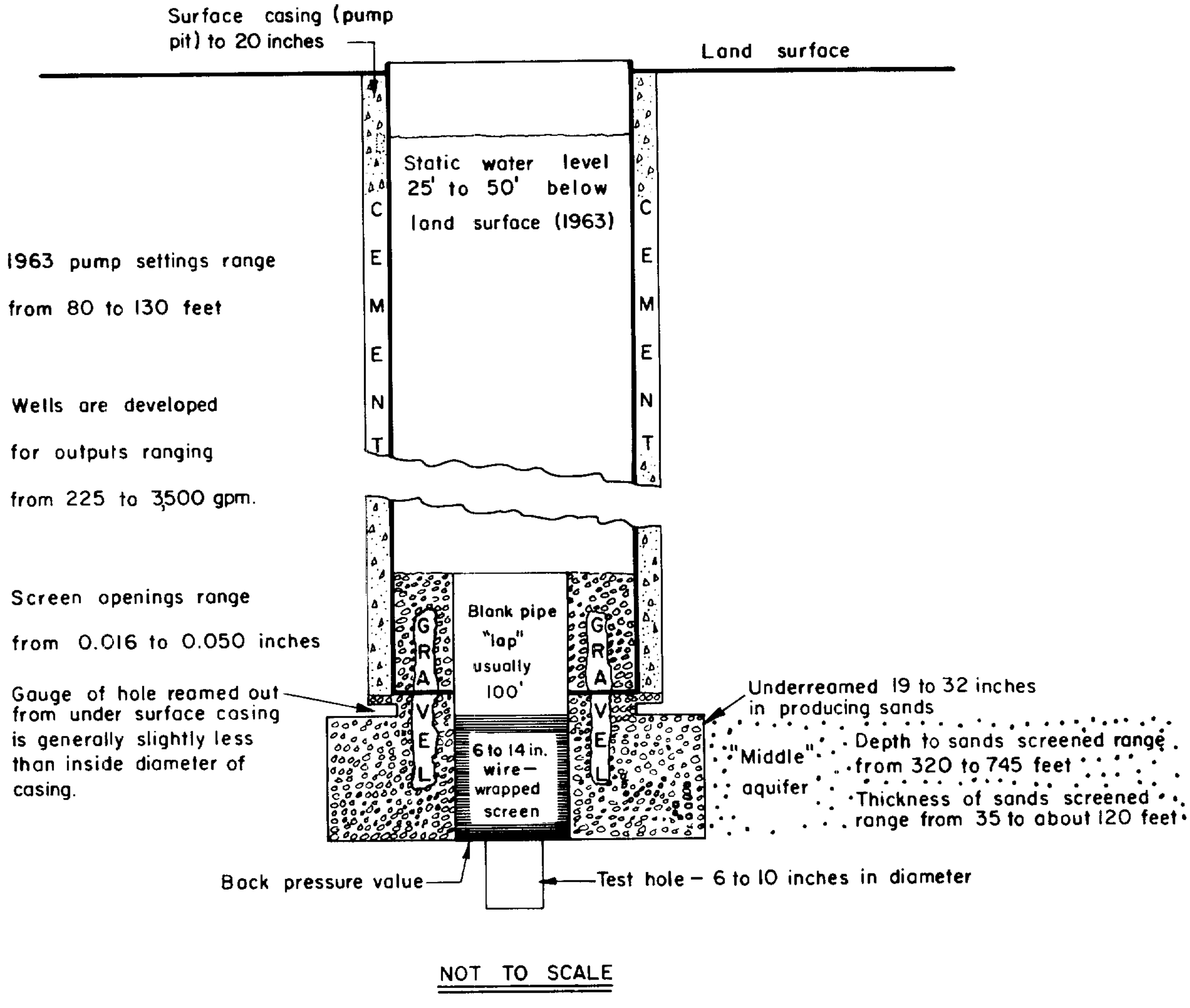

Figure 16

Diagram of a Typical Large-Capacity Well Tapping the "Middle" Aquifer in Orange County

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The most apparent effect of any large-scale development of ground water, such as in Orange County at present, is the decline of water levels in wells. The decline in itself is not significant in Orange County, except as it affects the cost of pumping from greater depths. The "Middle" aquifer is artesian and the decline of water levels merely represents a decrease in pressure in the system. The aquifer, for all practical purposes, is as full of water as it ever was. The principal problem related to the development of ground water in Orange County is the threat of contamination by salt water, which is controlled by the lowering of water levels. Of lesser importance is the subsidence of the land surface which accompanies the decline in water levels.

The present investigation has described the basic geologic and hydrologic framework of the aquifers. To more fully understand and cope with the problems concerned with ground-water development will require a continued collection of basic hydrologic data. Several items of work are needed in order to keep abreast with the expanding ground-water development which is anticipated.

A continuing inventory should be made of all the new large-capacity wells. This inventory should include the collection of drillers' and electric logs and records of well construction. In conjunction with this, an annual inventory of pumpage of water should be made throughout the area. This should include records of water pumped from individual wells so that the pumpage from the different aquifers can be distinguished.

The program of observation of water levels in wells should be expanded to give more complete areal coverage and wells tapping the various aquifers should be included in the program. This information is needed to delineate the vertical hydraulic gradients between the aquifers, as well as to chart the direction and rate of lateral movement in the aquifers.

A program should be established for the periodic resampling of water from key wells to chart the possible movement of salt water into the fresh-water parts of the aquifers. The observations should be made so as to determine not only the lateral movement of salt water but also the vertical movement.

As new wells are drilled in the area, aquifer tests should be made to obtain additional information concerning the hydraulic properties of the aquifers.

A program of releveling lines of bench marks by the U.S. Coast and Geodetic Survey throughout the area should be encouraged so as to measure the subsidence of land surface.

It should be pointed out that the continuing program of basic-data collection must necessarily extend into the adjoining counties as the effects of development in those areas will have effects on the ground-water supplies in Orange County. It is expected that the area of observation should include, in addition to Orange County, at least the southern one-third of Jasper and Newton Counties, and parts of Hardin and Jefferson Counties. The observations should also be correlated with similar observations which are being made by the U.S. Geological Survey in adjoining areas in Louisiana.

The ultimate objective of the continuing program should be to provide a method for more precise quantitative evaluations of the aquifers in the Orange County area, including predictions of the effects of future development on water levels, salt-water encroachment, and land-surface subsidence. Such predictions can be made by mathematical methods; however, these are lengthy and complex and in recent years, electrical analog models have been increasingly used in the evaluation of aquifers. Such a model has recently been completed for the aquifers underlying the Houston area. The program outlined above would provide data from which a model of the aquifers underlying the Orange County area could be constructed. The model, which would actually simulate the complex hydrogeologic conditions in the aquifers underlying the area, could be used to determine future changes in water levels, the direction and rate of ground-water movement, and estimates of land-surface subsidence based on any assumed future rates and patterns of pumpage.

REFERENCES CITED

American Society for Testing Materials, 1959, Manual on industrial water and industrial waste water: Am. Soc. for Testing Materials Spec. Tech. Pub. 148-D, 2nd Ed., with new and revised methods--1959 [1960], 653 p.

Baker, B. B., Dillard, J. W., Souders, V. L., and Peckham, R. C., 1963, Reconnaissance investigation of the ground-water resources of the Sabine River Basin, Texas: Texas Water Comm. Bull. 6307, 57 p., 7 figs., 8 pls.

Baker, E. T., Jr., 1963, Geology and ground-water resources of Hardin County, Texas: U.S. Geol. Survey open-file rept.

Bernard, H. A., 1950, Quaternary geology of southeast Texas: Louisiana State Univ., doctoral dissertation, 165 p., 48 figs., 6 pls.

Bloodgood, D. W., Patterson, R. E., and Smith, R. L., Jr., 1954, Water evaporation studies in Texas: Texas Agr. Expt. Sta. Bull. 787, 83 p.

Cooper, H. H., Jr., and Jacob, C. E., 1946, A generalized graphical method for evaluating formation constants and summarizing well-field history: Am. Geophys. Union Trans., v. 27, p. 526-534.

Darton, N. H., Stephenson, L. W., and Gardner, Julia [compilers], 1937, Geologic map of Texas: Dept. Interior, U.S. Geol. Survey.

Deussen, Alexander, 1914, Geology and underground waters of the southeastern part of the Texas Coastal Plain: U.S. Geol. Survey Water-Supply Paper 335, 365 p., 9 pls.

Ferris, J. G., Knowles, D. B., Brown, R. H., and Stallman, R. W., 1962, Theory of aquifer tests, U.S. Geol. Survey Water-Supply Paper 1536-E, 173 p., 28 figs.

Fisk, H. N., 1940, Geology of Avoyelles and Rapides Parishes: Louisiana Dept. Conserv. Bull. 18, 240 p., 50 figs., 12 pls.

Hackett, O. M., 1962, Ground-water levels in the United States, 1956-59, south-central states: U.S. Geol. Survey Water-Supply Paper 1549, 192 p., 13 figs.

Harder, A. H., 1960, Geology and ground-water resources of Calcasieu Parish, Louisiana: U.S. Geol. Survey Water-Supply Paper 1488, 102 p., 9 pls., 29 figs.

Hem, J. D., 1959, Study and interpretation of the chemical characteristics of natural water: U.S. Geol. Survey Water-Supply Paper 1473, 269 p., 2 pls., 40 figs.

Jones, P. H., Turcan, A. N., Jr., and Skibitzke, H. E., 1954, Geology and ground-water resources of southwestern Louisiana: Louisiana Dept. Conserv., Geol. Survey Bull. 30, 255 p.

Kane, H. E., 1959, Late Quaternary geology of Sabine Lake and vicinity, Texas and Louisiana: Gulf Coast Assoc. Geol. Soc. Trans., v. 9, p. 225-235.

Livingston, Penn, and Cromack, G. H., 1942, Records of wells and springs, drillers' logs, water analyses, and map showing location of wells and springs in Orange County, Texas: Texas Board Water Engineers duplicated rept., 42 p., 1 fig.

Maxcy, D. F., 1950, Report on the relation of nitrate concentration in well waters to the occurrence of methemoglobinemia in infants: Natl. Research Council Bull. Sanitary Engineering and Environment, p. 265-271, App. D.

Meinzer, O. E., and others, 1942, Physics of the earth, v. 9, Hydrology: New York, McGraw-Hill Book Co., p. 385-478.

Moore, E. W., 1940, Progress report of the committee on quality tolerances of water for industrial uses: New England Water Works Assoc. Jour., v. 54, p. 263.

Rose, N. A., 1943, Progress report on the ground-water resources of the Texas City area, Texas: U.S. Geol. Survey open-file rept., 45 p., 3 figs.

Scofield, C. S., 1936, The salinity of irrigation water: Smithsonian Inst. Ann. rept., 1934-35, p. 275-287.

Sundstrom, R. W., Hastings, W. W., and Broadhurst, W. L., 1948, Public water supplies in Eastern Texas: U.S. Geol. Survey Water-Supply Paper 1047, 285 p.

Taylor, T. U., 1907, Underground waters of the Coastal Plain of Texas: U.S. Geol. Survey Water-Supply Paper 190, 73 p., 3 pls.

U.S. Public Health Service, 1962, Public Health Service drinking-water standards: Public Health Services Pub. 956, 61 p., 1 fig.

U.S. Salinity Laboratory Staff, 1954, Diagnosis and improvement of saline and alkali soils: U.S. Dept. Agriculture Handb. 60, 160 p., 32 figs.

Welch, R. N., 1942, Geology of Vernon Parish: Louisiana Dept. Conserv. Bull. 22, 90 p., 16 figs., 6 pls.

Wenzel, L. K., 1942, Methods for determining permeability of water-bearing materials, with special reference to discharging well methods: U.S. Geol. Survey Water-Supply Paper 887, 192 p., 6 pls.

White, W. N., Livingston, Penn, and Turner, S. F., 1932, Ground-water resources of the Houston-Galveston area, Texas: Dept. Interior memo. for the Press, 14 p., 5 figs.

Wilcox, L. V., 1955, Classification and use of irrigation waters: U.S. Dept. Agriculture Circ. 969, 19 p., 4 figs.

Winslow, A. G., Doyel, W. W., and Wood, L. A., 1957, Salt water and its relation to fresh ground water in Harris County, Texas: U.S. Geol. Survey Water-Supply Paper 1360-F, p. 375-407, 11 figs., 4 pls.

Winslow, A. G., and Kister, L. R., Jr., 1956, The saline water resources of Texas: U.S. Geol. Survey Water-Supply Paper 1365, 105 p., 12 figs., 9 pls.

Winslow, A. G., and Wood, L. A., 1959, Relation of land subsidence to ground-water withdrawals in the upper Gulf Coast region, Texas: Mining Eng., p. 1030-1034.

Wood, L. A., Gabrysch, R. K., and Marvin, Richard, Reconnaissance investigation of the ground-water resources of the Gulf Coast region, Texas: Texas Water Comm. Bull. 6305, 114 p., 18 figs., 15 pls.

Table 3.--Records of wells in Orange and Jefferson Counties

All wells are drilled unless otherwise noted in remarks column.
Water level : Reported water levels given in feet; measured water levels given in feet and tenths.
Method of lift and type of power : A, airlift; C, cylinder; Cf, centrifugal; E, electric; G, gasoline, butane or Diesel engine; H, hand; J, jet; N, none; T, turbine. Number indicates horsepower.
Use of water : D, domestic; Ind, industrial; Irr, irrigation; N, none; P, public supply; S, stock.
Water-bearing unit : L, "Lower" aquifer; M, "Middle" aquifer; U, "Upper" aquifer.

Well	Owner	Driller	Date completed	Depth of well (ft)	Diameter of well (in.)	Water-bearing unit	Altitude of land surface (ft)	Water level: Below land-surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*UJ-61-56-101	H. H. Houseman	Jones Water Well Service	1961	220	2	U	25	--	--	J,E, 1/3	D,S	
102	-- McVey	--	1955?	196	2	U	24	15.3	Sept. 7, 1962	N	D	
103	B. H. Thibodeaux	R. M. Tannahill	1946	76	2	U	23	15	1946	J,E, 1/3	D	
104	do	Jones Water Well Service	1962	218	2	U	22	12	June 1962	J,E,	D	Screened from 210 ft to bottom.[1]
105	O. E. Mumford	R. M. Tannahill	1961	136	2	U	26	--	--	J,E, 1/3	D	Screened from 130 ft to bottom.
106	R. N. Hallmark	-- Parrot	1962	69	1	U	22	--	--	J,E, 1/3	D	
107	Utah Brown	Utah Brown	1954?	27	1	U	22	13.8 14.8	Sept.11, 1962 Dec. 12, 1962	N	N	Observation well.
108	Donald F. Porter	Jones Water Well Service	1962	178	2	U	22	13.4	Dec. 12, 1962	J,E, 1/3	D	Screened from 168 ft to bottom.[1]
109	Kermit C. Richter	R. M. Tannahill	1958	138	1	U	21	--	--	J,E, 1/3	D	
* 110	Tex-Tara	--	--	100	1	U	17	10.7	Dec. 11, 1962	N	N	Well obstructed at 15 ft.
111	W. A. Scarbrough	Jones Water Well Service	1962	140	1	U	22	8.3	Sept. 4, 1962	J,E, 1/3	D,S	
112	Joe Foster	--	1957	200	1	U	22	10	1957	J,E	D	Screened from 194 ft to bottom.
113	Elmo Root	Jones Water Well Service	1962	47	1	U	12	10.0	Dec. 11, 1962	J,E, 1/3	D	Screened from 42 ft to bottom.[1]
114	J. C. Young	J. C. Young	1960	21	1	U	11	9	1960	J,E	D	Driven well, screened from 17 ft to bottom.
* 115	H. H. Houseman	--	--	693?	8	L	21	17.7	Sept.11, 1962	J,E, 1/2	D,S	Old well.
* 116	do	--	--	800?	6	L	21	16.7 19.4	Sept.11, 1962 Nov. 30, 1962	N	N	Do.
201	Miller Vidor Land Co.	Gulf Oil Co.	1958	3,036	--	--	26	--	--	--	--	Oil test.[2]

See footnotes at end of table.

Table 3.--Records of wells in Orange and Jefferson Counties--Continued

	Well	Owner	Driller	Date completed	Depth of well (ft)	Diameter of well (in.)	Water-bearing unit	Altitude of land surface (ft)	Water level: Below land-surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
	UJ-61-56-202	Frost National Bank of San Antonio	Humble Oil & Refining Co.	1953	7,763	--	--	27	--	--	--	--	Oil test.2/
	203	Parafine Oil Corp. et al. well 1	do	1954	8,201	--	--	26	--	--	--	--	Do.
	204	E. V. Miller	Seismic Crew	1943?	67	1	U	21	--	--	J,E	D	
	205	Sun Oil Co.	Sun Oil Co.	1938	995	--	U	33	--	--	N	N	Stratigraphic test.
*	301	Fred Hetzel	Jones Water Well Service	1960	458	2	M	30	28	1960	J,E, 1/2	D	
	302	Fred Pastal	do	1962	152	2	U	28	7	1962	J,E	D	Screened from 142 ft to bottom.1/
	303	Leon Hayes	Leon Hayes	1960	18	--	U	29	8.6	Sept. 4, 1962	J,E, 1/4	D	Driven well, screened from 15 ft to bottom.
*	304	Frank Williamson	C. C. Corbitt	1940	65	1	U	28	--	--	N	N	Abandoned in 1948.
*	305	J. B. Eaves	Jones Water Well Service	1961	47	1	U	28	--	--	J,E, 1/3	D	Screened from 41 ft to bottom.
*	306	do	--	1940	79	1	U	29	11.7	Nov. 28, 1962	N	N	
	307	J. F. Arrington	Jones Water Well Service	1962	367	2	M	28	22	Aug. 1962	J,E, 1/3	D	
	308	Harvey Bellard	do	1958	400?	2	M	24	--	--	J,E, 1/2	D	Supplies water for 2 houses.
	309	Mrs. B. Blond	do	--	500?	2	M	30	--	--	J,E, 1/2	D	
	310	Alday Drilling Co.	Alday Drilling Co.	1962	60	2	U	27	9.1	Dec. 13, 1962	N	N	
	311	Earl B. Landry	Jones Water Well Service	1962	47	1	U	29	11	May 1962	J,E, 1/3	D	1/
*	312	J. C. Winger	do	1961	402	2	M	29	25	Dec. 1961	J,E, 1/3	D	Screened from 392 ft to bottom.1/
*	313	Sidney Andrews	do	1962	378	2	M	30	24	Aug. 1962	J,E	D	Screened from 368 ft to bottom.1/
	401	M. Levy	H. H. Burr	--	187	--	U	17	15	Oct. 1962	J,E	D	
*	402	Ed and Jerry Stedman	Frank Balcar	--	460	6	M	16	16.2	Dec. 3, 1962	T,E	D,S	Estimated flow 20 gpm, Dec. 16, 1941.
*	403	do	do	--	460	8	M	16	1.5 10.8	Feb. 15, 1941 Dec. 3, 1962	N	N	Reported to flow when drilled.
	404	M. Levy	-- Stedman	1958?	185?	2	U	16	--	--	J,E	D,S	

See footnotes at end of table.

Table 3.--Records of wells in Orange and Jefferson Counties--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Diameter of well (in.)	Water-bearing unit	Altitude of land surface (ft)	Water level: Below land-surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*UJ-61-56-405	Ed and Jerry Stedman	Frank Balcar	1919	1,470	6,4	L	14	--	--	N	N	Estimated flow 30 gpm on Sept. 26, 1941; abandoned by 1962.
406	do	--	1902	740	6	L	18	--	--	N	N	Estimated flow 2 gpm on Sept. 26, 1941. Obstruction in well at 22 ft, in 1962.
501	Ben Hicks	Jones Water Well Service	1962	67	1	U	12	10	1962	J,E	D	Screened from 63 ft to bottom.
* 502	B. E. Quinn	Republic Oil Co.	1925?	600	6	L	8	11.9	Apr. 6, 1941	N	N	Reported ceased flowing in 1955.
503	B. B. Goss	Jones Water Well Service	1962	47	1	U	11	1	Feb. 1962	J,E, 1/3	D	Screened from 42 ft to bottom.
504	R. J. Hoffman	do	1962	150	2	U	17	3.6	Dec. 11, 1962	N	N	Screened from 142 ft to bottom.[1]
505	Cole Thompson	Bill Roane	1958?	110?	2,1	U	23	--	--	J,E, 1/3	D	
* 506	do	Paul Acheson	1937	167	1	U	24	7.2	Apr. 4, 1941	N	N	Screened from 160 ft to bottom.
* 507	C. R. Jordon	R. M. Tannahill	1962	432	2,1	M	25	--	--	J,E, 1/4	D	Screened from 422 ft to bottom.
508	do	do	1953	89	1	U	25	12.0	Dec. 12, 1962	N	N	Screened from 84 ft to bottom; abandoned due to taste and red water.
* 601	E. R. Hicks	--	1923	160	2	U	27	--	--	N	N	Abandoned and plugged by 1963.
* 602	Vidor School District	Jones Water Well Service	1960	462	3,2	M	25	29	1960	J,E, 2-1/2	P	
* 603	S. L. Maddoax	do	1962	192	1	U	13	+ 5	Jan. 1962	J,E, 1/3	D	Screened from 184 ft to bottom. Very slight flow on Feb. 15, 1963.[1]
604	H. R. Smith	do	1962	237	2,1	U	26	11	Apr. 1962	J,E	D	Screened from 231 ft to bottom.[1]
* 605	Bell Oil Co.	do	1962	294	2	--	24	11	May 1962	J,E	D	Supplies water for service station.[1]
* 606	Lee Whitmire	do	1961	468	2,1	M	24	27	Oct. 1961	J,E, 1/3	D	Screened from 460 ft to bottom.[1]
* 607	G. W. Coppenger	Richard Beaumont	1937	80	1	U	20	--	--	N	N	
608	Miller Vidor Land Co.	Mattexco Inc.	1959	8,152	--	--	23	--	--	N	N	Oil test.[2]
609	Sun Oil Co.	Sun Oil Co.	1938	1,009	--	--	25	--	--	N	N	Stratigraphic test.
610	do	do	1938	1,008	--	--	27	--	--	N	N	Do.

See footnotes at end of table.

Table 3.--Records of wells in Orange and Jefferson Counties--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Diameter of well (in.)	Water-bearing unit	Altitude of land surface (ft)	Water level: Below land-surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
UJ-61-56-703	E. Beaumont Town site	Superior Oil Co.	1941	7,001	--	--	5	--	--	N	N	Oil test.[2]
801	Atlantic Refining Co.	--	1945	9,121	--	--	6	--	--	N	N	Do.
901	Orange County Water Control & Improvement District No.1 well 2	Layne-Texas Co.	1959	410	6	M	21	33.4	Dec. 29, 1962	T,E, 25	P	Casing: 10-in. cemented to surface. Producing section screened with .050 gauge stainless steel wire on 6-in. pipe from 350 to 400 ft. Hole opposite screen underreamed to 26-in. and gravel-packed with 112 to 113 ft of gravel. Equipped to pump 250 gpm at total head of 255 ft. Original drawdown reported 16 ft after 24-hours pumping 264 gpm.
* 902	Orange County Water Control & Improvement District No.1 well 1	Layne-Texas Co.	1955	475	14,8	M	19	33.2	Dec. 26, 1962	T,E, 40	P	Test hole drilled and Widco logged to 650 ft, drill-stem tested and plugged back and developed at 475 ft. Casing 14-in. cemented to surface. Producing section screened with 8-in. pipe from 410 to 460 ft. Top of 8-in. blank at 289 ft. Hole opposite screen underreamed to 30-in. and gravel-packed with 113 ft of gravel.
903	Mrs. -- Brown and H. L. Wright	H. H. Burr	1953	480	2	M	21	33.4	Feb. 28, 1963	N	N	Screened from 456 to 478 ft. Observation well.
904	H. R. Wyatt	do	1951	468	2,1	M	21	33.4	Oct. 18, 1962	N	N	Screened from 452 to 468 ft.
905	Vidor Independent School District	Jones Water Well Service	1962	461?	3	M	21	26	1962	J,E, 2-1/2	P	Supplies water for school.
906	do	H. H. Burr	1954	476	4,3	M	21	21	1959	T,E, 5	P	Screened from 455 to 475 ft.
* 907	do	Jones Water Well Service	1962	420	4,2	M	23	35.6	Mar. 8, 1963	T,E, 2	P	Screened from 400 ft to bottom.[1]
908	J. C. Arnold	do	1962	400	3	M	22	21	1962	J,E	P	Screened from 380 ft to bottom.
909	G. A. Woods	R. M. Tannahill	1947?	180	1	U	22	13	1962	J,E	D	Supplies water for two houses.
* 910	do	do	1957	400	2	M	21	--	--	J,E	D	
* 911	Jones Water Well Service	Jones Water Well Service	1962	486	4,2	M	12	22.5	Mar. 8, 1963	T,E, 1	P	Screened from 468 ft to bottom.[1]
* 912	A. L. Chesser	do	1962	507	4,2	M	25	36.3	do	T,E	P	Screened from 489 ft to bottom. Supplies water for six houses. Pump set at 75 ft.[1]
* 913	Smith's Vidor Sand Pit	Smith's Vidor Sand Pit	1955?	30	--	U	14	21.0	Mar. 19, 1963	Cf,E, 75	Ind	Sand pit, estimated average of one million gpd pumped to lower water surface and remove sand.

See footnotes at end of table.

Table 3.--Records of wells in Orange and Jefferson Counties--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Diameter of well (in.)	Water-bearing unit	Altitude of land surface (ft)	Water level: Below land-surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*UJ-61-56-914	Bill Humberson	Alton Christian	1931	57	1	U	22	--	--	N	N	
* 915	A. M. Philmon	C. C. Corbitt	1941	102	1	U	24	--	--	N	N	Screened from 97 ft to bottom.
* 916	W. C. Robinson	Paul Acheson	1940	64	1	U	24	--	--	N	N	Screened from 50 ft to bottom. Abandoned in 1962.
* 917	Anna Wise	do	1940	143	1	U	20	--	--	N	N	Screened from 135 ft to bottom.
* 918	Mrs. R. N. Carter	do	1940	120	1	U	21	--	--	N	N	
* 64-101	Marine Sport Co.	R. M. Tannahill	1963	130	2	U	7	--	--	J, E, 1-1/2	D, Ind	
* 201	Ken Matthews	do	1962	136	3,2	U	8	14	1962	J, E	P, Ind	
* 202	E. McLaughlin	--	1941	30	1	U	11	--	--	N	N	
* 203	C. T. Bunch	J. B. Jordan	1941	125	2	U	12	--	--	J, E, 1/3	D, S, P	
* 204	Alfred Huebner	--	1953	35	--	U	8	23	Mar. 1963	--	--	Sand pit; estimated 500,000 gpd pumped to lower water surface and remove sand.
205	Mrs. -- Tallafuries	--	1953	30	--	U	11	16	1963	C, E	--	Sand pit.
* 206	do	Burtman Drilling Co.	1962	161	4	U	10	13.2	Mar. 5, 1963	A, G	N	Drilled to supply oil test.
* 207	Bill McDonald	Jones Water Well Service	1962	430	2,1	M	12	22	Aug. 1962	J, E	D, S	Screened from 420 ft to bottom.1/
301	Earnest Green	Paul Acheson	1950?	445	1	M	20	32	Nov. 21, 1962	N	N	Screened from 440 ft to bottom.
* 302	Vidor Independent School District	B & L Drilling Co.	1956	521	8,6	M	21	--	--	T, E, 10	P	Supplies water for school.
303	Tony Morrell	Jones Water Well Service	1962	504	2,1	M	19	32.8	Dec. 4, 1962	J, E	D	Screened from 494 ft to bottom.
* 304	Technical Engineering Petroleum Service Co.	H. H. Burr	1955	400	2	M	15	19	1955	J, E, 1/3	D	Screened from 385 ft to bottom.
* 305	Luther Keaster	Jones Water Well Service	1962	472	2,1	M	17	30	Aug. 1962	J, E	D	Screened from 462 ft to bottom.1/
* 306	H. J. & W. Inc.	do	1963	555	4,2	M	17	27.7	Mar. 7, 1963	T, E 1-1/2	P	Screened from 525 ft to bottom. Temp. 73°F.1/
* 307	V. W. Ward	Paul Acheson	1940	200	1	U	19	--	--	N	N	Screened from 192 ft to bottom. Abandoned in 1963.

See footnotes at end of table.

Table 3.--Records of wells in Orange and Jefferson Counties--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Diameter of well (in.)	Water-bearing unit	Altitude of land surface (ft)	Water level: Below land-surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*UJ-61-64-308	Mrs. -- Davis	Paul Acheson	1940	105	2	U	12	6.8	Mar. 26, 1941	N	N	Unused.
* 309	Homer Gaddy	do	1940	128	1	U	16	--	--	N	N	Screened from 120 ft to bottom.
* 310	do	do	1940	135	1	U	17	--	--	N	N	Screened from 127 ft to bottom.
* 311	Joe Baker	do	1940	151	1	U	21	--	--	N	N	Screened from 147 ft to bottom. Sand from 139 ft to bottom.
* 312	H. T. Kilpatrick	do	1941	144	1	U	19	--	--	N	N	Screened from 136 ft to bottom.
* 313	H. B. Fall	--	--	20	1	U	6	--	--	N	N	
401	City of Beaumont	Layne-Texas Co.	1937	--	--	--	3	--	--	N	N	Abandoned water test. All water salty below 300 ft.1/
PT- 502	Gulf States Utility Co.	Coastal Water Wells	1957	435	20,10	M	10	20.6	Feb. 28, 1963	T,E	Ind	Casing cemented to surface. Produces slightly saline water. In Jefferson County. Test hole.
503	do	do	1956	442	16,10	M	15	48.2 26.7	Jan. 28, 1963 Feb. 28, 1963	N	N	Test hole. In Jefferson County.
505	Mobil Oil Refinery	Texas Water Wells Inc	1961	775	20,12	M	26	37.6	Feb. 27, 1963	T,G, 600	Ind	Test hole. Pumps 3,000 gpm of saline water. Screens at 420-454, 514-544, 528-628, and 710-770 ft. In Jefferson County.
506	do	do	1959	908	20,12	M	25	37.7	do	T,G, 300	Ind	Test hole. Pumps 3,000 gpm of saline water. Casing cemented. Screens at 415-455, 510-550, 600-630, and 680-760 ft. In Jefferson County.1/
*UJ- 507	John W. Mecom	J. W. Greak	1963	249	4	M	12	20.5	Mar. 5, 1963	A,G	Ind	Supply well for oil rig.
PT- 508	Gulf States Utility Co.	Coastal Water Wells, Inc.	1956	1,612	16	--	--	--	--	--	--	Conductor used at top of hole. In Jefferson County.1/
509	do	do	1956	542	20,10	M	8	19.7	Feb. 28, 1963	N	N	Abandoned in 1958. In Jefferson County.
510	do	do	1957	244	16,10, 8	U	13	10.7	Jan. 28, 1963	N	N	Abandoned in 1962. In Jefferson County.
UJ- 601	Miller-Vidor well B-1	Atlantic Refining Co.	1948	8,478	--	--	2	--	--	N	N	Oil test.2/
62-49-101	Lutcher Moore Lumber Co. well 1	Meredith & Co.	1957	7,298	--	--	31	--	--	--	--	Do.
* 102	E. L. Corrigan	H. H. Stanton	1940	69	2,1	U	28	4.2 5.2	Apr. 29, 1941 Dec. 15, 1962	N	N	Sand from 38 ft to bottom.
103	do	Jones Water Well Service	1960	366	2	M	27	--	--	J,E	D	
104	Dan T. Thomas	J. C. Mosier	1954?	79	1	U	32	11.4	Dec. 15, 1962	N	N	Abandoned.

See footnotes at end of table.

Table 3.--Records of wells in Orange and Jefferson Counties--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Diameter of well (in.)	Water-bearing unit	Altitude of land surface (ft)	Water level: Below land-surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
UJ-62-49-105	Dan T. Thomas	J. C. Mosier	1962	172	2	U	32	4	1962	J,E	D	
* 106	J. D. Thomas	--	--	40	33	U	33	6.6	Apr. 29, 1941	N	N	Dug well. Abandoned. Old Well.
201	Stark & Brown well 1	Dick Schwab	1940	7,322	--	--	29	--	--	N	N	Oil test.[2]
202	Camp Edgar Hunting Club	Frank Michelle	1955?	60?	1	U	30	12.0	Dec. 15, 1962	J,E	D	
203	W. A. Stanley, Jr.	W. A. Stanley, Jr.	1948	28	36	U	28	14.7	Dec. 17, 1962	C,E	D	
* 204	Mrs. Alva Willy	Bob Stanton	1923	80?	2	U	27	--	--	N	N	
205	Marcel Willy	Cecil Kerby & -- Burr	1954	100	1	U	29	--	--	J,E	D,S	Screened from 90 ft to bottom.
206	T. W. Stark	J. C. Mosier	1955	360	2	M	28	--	--	J,E, 1/2	D	
207	Wayne Willy	do	1956	358	2	M	28	--	--	J,E, 1/3	D	
208	Harris Willy	J. C. Mosier	1948	165	1	U	29	15	1948	J,E	D,S	Screened from 145 ft to bottom. Supplies water for 2 houses.
301	Pevey & Moore	Frank Balcar	--	300	6	M	30	8.6	Feb. 9, 1941	N	N	Abandoned in 1962. Old well.
401	Edward N. Green well 1	Gray Wolf Co. & North Central Oil Co.	1956	8,031	--	--	26	--	--	--	--	Oil test.[2]
402	Sun Oil Co.	Sun Oil Co.	1938	1,000	--	--	29	--	--	--	--	Stratigraphic test.
501	-- Stark well 1	Union Producing Co.	1951	8,708	--	--	26	--	--	--	--	Oil test.[2]
502	-- Brown well 1	do	1950	8,300	--	--	28	--	--	--	--	Do.
* 503	G. L. Linscomb	J. B. Jordan	1940	117	1	U	26	10.6	Mar. 18, 1963	N	N	
* 504	do	Jones Water Well Service	1962	96	2,1	U	26	15	Sept. 1962	J,E	D,S	Screened from 88 ft to bottom.[1]
505	Newton County Lumber Co.	Houston Oil Co.	1952	2,200	--	--	26	--	--	--	--	Salt water disposal well. Injection zone 1,554-1,939 ft.
506	Sun Oil Co.	Sun Oil Co.	1939	996	--	--	20	--	--	N	N	Stratigraphic test.
* 601	D. E. Cohenour	Coastal Water Well Corp.	1946	658	20,12	M	27	35.7	Dec. 20, 1962	T,G	Irr	Screened from 574 ft to 654 ft. Irrigated 240 acres of rice in 1959.[1]
602	B. Williams well 3	Sun Oil Co.	1954	8,222	--	--	23	--	--	--	--	Oil test.[2]

See footnotes at end of table.

Table 3.--Records of wells in Orange and Jefferson Counties--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Diameter of well (in.)	Water-bearing unit	Altitude of land surface (ft)	Water level: Below land-surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*UJ-62-49-603	Sid Willy	--	--	18	36	U	25	4.0	Apr. 29, 1941	N	N	Dug well. Abandoned in 1952. Old well.
604	D. E. Cohenour	Frank Michelle	1962	450	2	M	25	32.1	Mar. 17, 1963	N	D,S	
605	Roy Willy	J. C. Mosier	1962	88	2	U	24	12.1	Dec. 17, 1962	J,E	D	
* 606	G. V. Manuel	A. C. Brown	1937	100?	2	U	23	--	--	N	N	
607	Jordan Linscomb	J. C. Mosier	1956	148	1	U	25	--	--	J,E, 1/3	D	Screened from 144 ft to bottom.
608	D. P. Adams	J. D. Simmons	--	12	--	U	22	--	--	N	N	Dug well. Abandoned.
609	Irving Brewer	--	--	14	30	U	26	3.7	May 1, 1941	N	N	
610	Sun Oil Co.	Sun Oil Co.	1938	996	--	--	24	--	--	N	N	Stratigraphic test.
701	Gulf Oil Co.	--	1957	180	4	U	22	6.8	Mar. 8, 1963	T,E	D,Ind	Supplies water for service station.
* 702	K. D. Home Builders	Jones Water Well Service	1962	220	4,2	U	23	11	Apr. 1962	J,E	P	Screened from 202 ft to bottom. Supplies water for 12 houses.[1]
* 703	James P. Wilson	do	1962	730	2,1	M	20	32	Sept. 1962	J,E	D	Screened from 693 ft to bottom.[1]
* 704	J. D. Maines	do	1962	596	2,1	M	21	32	June 1962	J,E	D	Screened from 588 ft to bottom.[1]
* 705	Johnnie Steelburg	Johnnie Steelburg	1937	18	1	U	21	--	--	N	N	
* 706	H. J. Hebert	Paul Acheson	1940	194	1	U	20	--	--	N	N	Screened from 190 ft to bottom.
* 707	Kurt R. Nauck	Kurt R. Nauck	1932	65	1	U	18	--	--	N	N	
* 708	E. E. Singleton	J. B. Jordan	1940	105	1	U	21	--	--	N	N	
* 801	E. C. Singleton	do	1939	105	1	U	19	--	--	N	N	Abandoned in 1955.
* 802	J. L. Singleton	do	1940	172	2	U	21	--	--	J,E, 1-1/2	D,S	
* 803	O. C. Chesson	--	1933	98	1	U	16	--	--	N	N	
* 901	Harve Linscomb Estate	--	1903	20	36	U	23	13.5	May 1, 1941	N	N	Dug well. Abandoned and filled.
* 902	S. O. Peveto	--	--	580	6	M	17	.2	June 9, 1941	N	N	Abandoned. Obstruction at 14 ft.
* 903	Mrs. James Aaron	J. B. Jordan	1939	85	1	U	17	--	--	N	N	
50-101	Powell Lumber Co.	Timberland Exploratory Co.	1958	7,856	--	--	26	--	--	--	--	Oil test.[2]

See footnotes at end of table.

Table 3.--Records of wells in Orange and Jefferson Counties--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Diameter of well (in.)	Water-bearing unit	Altitude of land surface (ft)	Water level: Below land-surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
UJ-62-50-102	Sun Fee Well 1	Timberland Exploratory Co. & Concho Petroleum Co.	1958	8,100	--	--	26	--	--	--	--	Oil test.2/
* 103	Geo. Helm	A. C. Brown	1935	91	1	U	26	5 10.3	1935 Feb. 8, 1963	N	N	Screened from 82 ft to bottom.
* 104	William Manuel	-- Leslie	1937	113	2	U	27	--	--	N	N	
105	Sun Oil Co.	Sun Oil Co.	1938	985	--	--	--	--	--	N	N	Stratigraphic test.
* 201	Heard Bros.	Coastal Water Well Corp.	1944	590	20,12	M	26	31.4	Jan. 21, 1963	T,G	Irr	Steel screen bottomed at 586 ft.1/
202	Powell Lumber Co.	--	1919	710	24,10	M	24	2.2 27.0 30.0	Apr. 10, 1941 Dec. 10, 1959 Feb. 6, 1963	T,G	Irr	Irrigated about 30 acres in 1959. Not used in 1958.
203	J. D. Heard & Son	J. C. Mosier	1957	67	2	U	27	--	--	J,E, 1/3	D	Screened from 55 ft to bottom.
* 204	Charles W. Myers	--	--	165	2	U	25	--	--	J,E, 1/3	S	Not used for drinking purposes due to iron color and taste.
301	C. A. Morgan well 1	Christensen & Matthews	1951	7,704	--	--	32	--	--	--	--	Oil test.2/
302	-- Sokolski well 1	Woods Drilling Co.	1949	8,009	--	--	29	--	--	--	--	Do.
303	J. E. Carter	--	--	75	4	U	29	15.1 15.9	Apr. 10, 1941 Jan. 31, 1963	N	N	
* 401	Mauriceville Independent School District	L & M Water Wells	1961	354	3,2	M	25	30	Sept. 1961	J,E, 1-1/2	P	Supplies water for school. Screened from 338 ft to bottom.
402	do	Frank Michelle	1955?	363	3	M	25	--	--	J,E, 1	P	Supplies water for school.
* 403	Kansas City & Southern RR.	George Glidden	1937	140	10	U	25	12	Apr. 1941	T,E	Ind, RR	Casing: 10-in. to 118 ft. Screened from 118 ft to bottom. Supplies water for railroad. Reported discharge 50 gpm in 1941.1/
404	TEXLA Lumber Co.	Frank Michelle	1961	94	4	U	26	14	1961	J,A	P,Ind	Screened from 84 ft to bottom.
405	do	--	--	350	3	M	26	33.6	Feb. 8, 1963	N	N	Observation well.
* 406	Hermann Fredrick	Frank Michelle	1958	216	2	M	25	5	Apr. 1958	C,E, 1/3	D,S	Screened from 210 ft to bottom.
* 407	T. J. Fredrick	George Glidden	1932?	425	2	M	24	3.1	Apr. 10, 1941	J,E	D,S	Screened from 419 ft to bottom.

See footnotes at end of table.

Table 3.--Records of wells in Orange and Jefferson Counties--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Diameter of well (in.)	Water-bearing unit	Altitude of land surface (ft)	Water level: Below land-surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*UJ-62-50-501	Robert Stark	Robert Stark	1940	108	2	U	19	--	--	N	N	Abandoned.
* 502	Lewis & Thompson	-- Darden	1962	500?	3	M	19	--	--	J,E 1-1/2	P	Supplies water for Meadow Lark subdivision.
* 503	A. L. Hutchins	--	--	102	4	U	22	10.1 13.1	Feb. 12, 1941 Mar. 21, 1963	J,E, 1/3	D,S	
504	do	-- Hathaway	1918	831	10	M	22	--	--	N	N	Drilled for irrigation. Water salty. Abandoned. 1/
* 505	C. H. Meriwether	C. H. Meriwether	1940	114	3	U	22	12.6	Feb. 12, 1941	N	N	
601	W. H. Kent	-- Peveto	1963	364	2	M	24	35.7	Jan. 18, 1963	N	D	Screened from 357 ft to 363 ft.
602	Huber Oil Co.	--	--	400	4	M	22	30.7	Feb. 6, 1963	A	N	Supplied water for drilling oil test.
603	Lutcher & Moore Lumber Co.	Layne-Bowler Co.	1908	720	24,10	M	20	.0	Sept.12, 1941 Mar. 21, 1963	N	N	Observation well.
604	Kinard Estate	J. C. Mosier	1954	400?	2	M	19	--	--	J,E, 1	P	Supplies water for subdivision.
605	do	do	1959	125	2	U	19	--	--	J,E, 1	P	Do.
606	Powell Lumber Co.	Sun Oil Co.	1930	1,000	--	--	22	--	--	N	N	Stratigraphic test.
* 607	Tom Teal	Tom Teal	1939	15	36	U	24	7.2	May 2, 1941	N	N	Dug well.
608	P. Houseman	George Glidden	1941	135	2	U	17	11	Feb. 1941	N	N	Screened from 125 ft to bottom.
609	Sun Oil Co.	Sun Oil Co.	1938	995	--	---	22	--	--	N	N	Stratigraphic test.
* 701	W. L. Burton	Layne-Bowler	1910	782	24,12	M	18	1.2 26.1	Feb. 14, 1941 Mar. 20, 1963	N	N	Observation well.
702	American National Bank	--	--	--	24	--	18	2.4	Mar. 1, 1941	N	N	Old well.
703	do	--	--	800	8	M	17	--	--	N	N	Well 847 in U. S. Geological Survey Water-Supply Paper 335, 1914. Obstructed in 1941. Old well.
704	Stark Estate	George Glidden	1928	600?	6	M	19	.6 30.8	May 31, 1941 Mar. 20, 1963	N	N	Observation Well.
* 705	W. H. Stark	Ed Mott	1921	700	6,1	M	19	.7	May 1, 1941	N	N	Reported to flow until 1926. Obstruction at 30 ft in 1963, no water.
* 706	Irvin Brewer	Irvin Brewer	1930	115	3,1	U	18	8.2	do	N	N	Screened from 100 ft to bottom.
* 801	American Rice Growers Assn.	Frank Michelle	1962	449	2	M	20	32	1962	J,E, 1/2	P	Screened from 441 ft to bottom

See footnotes at end of table.

Table 3.--Records of wells in Orange and Jefferson Counties--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Diameter of well (in.)	Water-bearing unit	Altitude of land surface (ft)	Water level: Below land-surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*UJ-62-50-802	John Womack	--	--	100	2	U	20	--	--	N	N	Abandoned.
* 803	Robert Walea	J. B. Jordan	1940	105	2	U	16	--	--	N	N	
* 804	H. D. Womack	J. C. Mosier	1954	800?	2	M	21	--	--	J,E, 1/2	D,S	
* 805	John Womack	--	1941	11	36	U	19	4.5	May 2, 1941	N	N	Dug well. Abandoned.
* 806	Acie Noguess	--	--	110	1	U	18	--	--	N	N	
* 901	L. L. Parker	George Glidden	--	98	2	U	13	--	--	N	N	Screened from 95 ft to bottom.
902	J. C. Mosier	J. C. Mosier	1953	100	4	U	13	12.4	Oct. 15, 1962	J,G	S	Screened from 85 ft to bottom.
* 903	George Glidden	George Glidden	1921	214	4,2	--	14	6.9	Apr. 3, 1941	N	N	Reported to flow 1 gpm when drilled.
* 904	do	do	1941	566	2	M	13	--	--	J,E, 1-1/2	N	Screened from 556 ft to bottom. Reported flowed in September 1941.1/
905	Little Cypress High School	-- Nich	1959	475	4	M	13	--	--	J,E	P	Supplies water for school.
906	Little Cypress Elementary School	J. C. Mosier	1953	475	4	M	14	--	--	J,E, 5	P	Do.
* 907	Stark-Brown	George Glidden	1940	108	2	U	16	--	--	N	N	Screened from 98 ft to bottom.
* 51-101	J. D. Nobles	J. D. Nobles	1941	21	1	U	13	10 10.1	Apr. 1941 Jan. 18, 1963	J,E, 1/3	D,S	Screened from 18 ft to 20 ft. Sand from 4 ft to 20 ft.
* 102	Sabine River Authority	W. Adcock	1936	175	3	U	26	9.3 18.6	May 2, 1941 Jan. 21, 1963	A	D,Ind	Screened from 165 ft to bottom.
* 401	Sam Trussel	J. C. Mosier	1962	420	2	M	15	25	1962	J,E, 1/3	D	
402	W. J. Hanson	--	1940?	23?	1	U	14	--	--	J,E, 1/3	D	Driven well.
* 403	John Jansen	George Glidden	--	229	2	--	22	7	Apr. 1941	N	N	Screened from 219 ft to bottom.
* 404	J. S. Ellis	J. S. Ellis	1940	20	2	U	8	5	1940	N	N	Water level reflects changes in stage of Sabine River.
* 405	Powell Lumber Co.	--	1940	22	1	U	16	--	--	N	N	Screened from 20 ft to bottom.
406	Sun Oil Co.	Sun Oil Co.	1938	1,006	--	--	22	--	--	N	N	Stratigraphic test.
701	Texas Portland Cement Co. well 1	Layne-Texas Co.	1955	505	14,8	M	10	20 25	1955 1959	T,E, 20	Ind	Screened from 442 to 492 ft.

See footnotes at end of table.

Table 3.--Records of wells in Orange and Jefferson Counties--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Diameter of well (in.)	Water-bearing unit	Altitude of land surface (ft)	Water level: Below land-surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
UJ-62-51-702	Texas Portland Cement Co. well 2	Layne-Texas Co.	1955	505	14,8	M	11	20 32.6	Oct. 1957 Oct. 29, 1962	T,E, 40	Ind	Screened from 436 to 486 ft.
703	Miller-Vidor well 1	Pan-American Production Co.	1945	3,200	--	--	5	--	--	--	--	Oil test.
* 704	Southern Pacific RR	Layne-Texas Co.	1928	419	12,6	M	16	35.7	Oct. 11, 1962	J,E, 2	P,Ind	Casing: 12-in. to 340 ft. Screened from 359 to 418 ft.
705	George S. Colhoun	--	1959?	--	--	U	--	--	--	--	--	Dug well. Sand pit.
706	Phillips Chemical Co. well 2	Layne-Texas Co.	1962	502	--	M	12	34.6	Oct. 12, 1962	T,G	P,Ind	
* 707	Phillips Chemical Co. well 1	do	1962	505	--	M	14	35.4	do	T,E	P,Ind	Casing: 12-in. to 406 ft. Screened from 428 to 488 ft.
708	Tracy Bland	Jack's Water Well Service	1958	400	2	M	13	--	--	J,E	D	
709	do	J. C. Mosier	1954	90	2	U	11	11.6	Oct. 8, 1962	N	N	Observation well.
710	T. W. Gibbons	do	1951	94	2	U	15	17.8	Oct. 12, 1962	J,E, 1/2	D	
711	Lutcher-Moore	Magnolia Petroleum Co.	1952	9,297	--	--	5	--	--	--	--	Oil test.2/
712	Southern Pacific RR Co.	--	1912	797	8,6	M	15	.9	Feb. 12, 1941	N	N	Casing: 8-in. to 537 ft, 6-in. of 195 ft. Screened from 732 ft to bottom.1/
713	do	Layne-Bowler Co.	1905	435	8	M	16	1.0	do	N	N	1/
* 57-101	A. F. Yeager	Frank Balcar	1919	640	6	M	17	3.8	Mar. 4, 1941	N	N	Reported to flow when drilled.
102	M. A. Stephenson	M. A. Stephenson	1937	114	2	U	17	12.9 8.8	Mar. 28, 1941 Mar. 13, 1963	N	N	Screened from 102 ft to bottom. Obstruction at 57 ft in 1963.
* 103	W. M. Sarver	Paul Acheson	1940	73	1	U	20	--	--	N	N	Cased to 73 ft.
* 104	S. C. Clayton	--	--	19	30	U	18	11.2	Mar. 28, 1941	N	N	Dug well. Reported filled. Old well.
201	Lutcher-Moore well 1	Atlantic Refining Co.	1945	9,750	--	--	17	--	--	--	--	Oil test.2/
* 202	Southern Pacific RR Co.	Paul Acheson	1940	138	4	U	15	--	--	N	N	Screened from 130 ft to bottom.
* 203	Lutcher & Moore Lumber Co.	-- Posey	1923	740	8	M	18	2.6 31.2	Apr. 5, 1941 Mar. 13, 1963	J,E, 1	D,S	
204	do	--	1925	740	8	M	19	2.8	Apr. 2, 1941	N	N	

See footnotes at end of table.

Table 3.--Records of wells in Orange and Jefferson Counties--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Diameter of well (in.)	Water-bearing unit	Altitude of land-surface (ft)	Water level: Below land-surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*UJ-62-57-205	Lutcher Stark	George Glidden	1940	102	2	U	18	10.4	Mar. 28, 1941	N	N	
301	-- Price well 1	Sun Oil Co.	1954	10,064	--	--	16	--	--	--	--	Oil test.[2]
* 302	John Bertrand	--	1935	35	4	U	16	--	--	N	N	Screened from 15 ft to bottom.
* 401	Texas Eastern Transport Co.	Layne-Texas Co.	1956	481	8,4	M	16	24 32.9	1956 Mar. 1, 1963	T,E, 3	D,Ind	Casing: 8-in. pipe cemented to 440 ft. Screened from 448 to 468 ft.[1]
402	D. A. Patillo well 1	Shell Oil Co.	1949	9,202	--	--	8	--	--	--	--	Oil test.[2]
* 403	Gulf States Utilities Co. well 1	Coastal Water Well Corp.	1961	483	12,8	M	15	30 37	May 1961 Aug. 1962	T,E, 100	Ind	Casing: 12-in. to 422 ft. Screened from 433 ft to bottom
* 404	Gulf States Utilities Co. well 2	do	1961	490	12,8	M	16	30	May 1961	T,E, 100	Ind	Casing: 12-in. to 427 ft. Screened from 430 to 481 ft. Gravel-packed. Reported 20 ft of draw-down after pumping 48 hours at 708 gpm.
405	Gulf States Utilities Co. well 3	do	1961	491	12,8	M	18	30 33.8	June 1961 Feb. 28, 1963	T,E, 100	Ind	Casing: 12-in. to 429 ft. Screened from 430 to 480 ft. Gravel-packed. Reported 20 ft of draw-down after pumping 48 hours at 708 gpm.
406	Gulf States Utilities Co. well 6	do	1961	482	12,8	M	15	30	May 1961	T,E, 100	Ind	Casing: 12-in. to 423 ft. Screened from 430 to 480 ft. Gravel-packed. Reported 21 ft of draw-down after pumping 48 hours at 708 gpm.
* 407	Gulf States Utilities Co. well 4	do	1961	490	12,8	M	6	17 24.2	July 1961 Feb. 28, 1963	T,E, 100	Ind	Casing: 12-in. to 319 ft. Screened from 320 to 370 ft. Gravel-packed. Reported 31 ft of draw-down after pumping 48 hours at 708 gpm.
* 408	Gulf States Utilities Co. well 5	do	1961	473	12,8	M	6	17	June 1961	T,E, 100	Ind	Casing: 12-in. to 335 ft. Screened from 343 to 383 ft. Gravel-packed. Reported 58 ft of draw-down after pumping 48 hours at 708 gpm.
* 409	H. A. Cutler	do	1950	698	16,8	M	13	11 29.8	1950 Feb. 28, 1963	T,G	N	Powered by tractor. Last used in 1960. 75 ft of screen between 550 and 640 ft. 16-in. under-reamed gravel-packed. Irrigated 200 acres of rice in 1958, 180 acres in 1959.[1]
* 410	Earl Hollis	H. H. Burr	1954	530	2,1	M	14	25	1954	J,E	D	Screened from 420 ft to bottom.
* 411	G. E. Stephenson	J. B. Jordan	1940	70	1	U	3	--	--	N	N	
* 412	C. A. Hollis	Cub Clayton	1931	73	2	U	17	12.2 11.2	Apr. 1, 1941 Mar. 13, 1963	N	N	Sand from 53 ft to bottom.
* 413	C. K. Akers	-- Peveto	--	44	48	U	6	5.2	Apr. 1, 1941	N	N	Dug well abandoned in about 1959. Old well.
* 414	W. A. Peveto	J. B. Jordan	1940	105	3,2	U	10	--	--	N	N	Sand from 95 ft to bottom. Abandoned in 1948.
* 415	do	do	1940	112	2	U	10	6.8	Apr. 1, 1941	N	N	Sand from 95 ft to bottom. Abandoned.

See footnotes at end of table.

Table 3.--Records of wells in Orange and Jefferson Counties--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Diameter of well (in.)	Water-bearing unit	Altitude of land surface (ft)	Water level: Below land-surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*UJ-62-57-501	Florida Gas Corp.	Layne-Texas Co.	1958	445	8,4	M	16	21 30.3	1958 Mar. 1, 1963	T,E	Ind	Casing: 8-in. to 397 ft. Screened from 405 to 435 ft. Gravel-packed. Reported 19 ft of draw-down when pumping 138 gpm. Temp. 73°F.[1]
* 502	The Texas Co.	George Glidden	1929	528	10,6	M	9	22.7	Mar. 7, 1963	J,E	P	Screened from 478 ft to bottom. Flowed in September 1941. Supplies water for Bessie Heights Camp. Observation well.
503	Southern Petroleum Co. well 1	Shell Oil Co.	1947	9,078	--	--	16	--	--	N	N	Oil test.[2]
504	G. K. Akers well 5	Gulf Oil Co.	1949	8,902	--	--	5	--	--	N	N	Do.
505	-- Stark well 1	Phillips Petroleum Corp.	1940	7,014	--	--	2	--	--	N	N	Do.
* 506	Lutcher Stark	Luther Patterson	1940	505	4	M	1	+12.2	Sept. 6, 1941	J,E, Flows	Ind	Supplies water for oil field on Phillips Petroleum Corp. lease.
* 507	C. E. Reese	J. B. Jordan	1940	110	2	U	17	--	--	N	N	
* 508	Langham Estate	--	1916	16	36	U	18	5.0	May 3, 1941	N	N	Dug well.
601	Ben Walles well 1	J. C. Means, Jr.	1952	9,922	--	--	13	--	--	N	N	Oil test.[2]
* 602	J. O. Allen	--	1911	17	42	U	17	11.6	Apr. 3, 1941	N	N	Dug well. Abandoned in 1941.
* 603	Pan-American Production Co.	--	1920	14	30	U	10	6.2	do	N	N	Dug well. Abandoned in 1947.
* 604	K. F. Hollis	--	1918?	16	36	U	15	7.6 6.7	Apr. 3, 1941 Mar. 14, 1963	N	N	Dug well. Unused.
* 605	Paul Cormier Development Co.	Cormier Drilling Co	1959	489	4	M	14	21	1959	J,E, 2	P	Screened from 469 ft to bottom. Supplies water for subdivision.
606	Lon Garrison	--	--	800	4	M	13	--	--	N	N	Oil test. Drilled to 1,500 ft, plugged back to 800 ft. Well 836 in U. S. Geological Survey Water-Supply Paper 335, 1914.
* 701	Henry Houseman	-- Darden	1944	520	2	M	5	18.4	Feb. 28, 1963	J,E	D,S	Reported to flow in 1947.
* 702	Pipkin Ranch	Johnnie Pipkin	1920	113	3	U	6	2.6	Apr. 4, 1941	N	N	Screened from 105 ft to bottom.
* 801	Lutcher Stark	The Texas Co.	1933	523	7	M	1	3.5 15.5	Apr. 5, 1941 Mar. 7, 1963	J,E	Ind	Casing: 7-in. to 456 ft. Screened from 457 ft to bottom.[1]
* 802	J. S. Polk "B"	Luther Patterson	1940	500	5	M	1	--	--	N	N	Flowed in September 1941. Screened from 417 ft to 448 ft. Abandoned and plugged.[1]
* 901	Gulf States Utilities Co. well 1	Coastal Water Well Corp.	1960	684	10,6	M	9	19	Jan. 1960	T,E, 25	Ind	Casing: 10-in. to 570 ft. Screened from 575 to 625 ft. Gravel-packed.[1]

See footnotes at end of table.

Table 3.--Records of wells in Orange and Jefferson Counties--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Diameter of well (in.)	Water-bearing unit	Altitude of land surface (ft)	Water level: Below land-surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
UJ-62-57-902	Gulf States Utilities Co. well 2	Coastal Water Well Corp.	1960?	468	4	M	7	--	--	T,E, 3	P,Ind	Casing: 4-in. to 458 ft. Screened from 458 ft to bottom.
* 903	Gulf States Utilities Co. well 3	do	1960	464	10,6	M	4	40 57	Aug. 1962	T,E,	P,Ind	Casing: 10-in. to 443 ft. Screened from 445 to 463 ft. Gravel-packed. Reported discharge 175 gpm when drilled.[1]
* 904	Gulf States Utilities Co. well 4	do	1960	480	10,6	M	10	--	--	T,E	P,Ind	Casing: 10-in. to 432 ft. Screened from 432 to 455 ft. Gravel-packed. Reported discharge 250 gpm when drilled.[1]
* 905	Gulf States Utilities Co. well 5	do	1960	464	10,6	M	8	49.0	Feb. 25, 1963	T,E, 30	P,Ind	Casing: 10-in. to 420 ft. Screened from 422 to 461 ft. Gravel-packed. Reported discharge 250 gpm when drilled.[1]
* 906	W. H. Stark Estate	--	--	15	4	U	8	2.1	Apr. 3, 1941	N	N	
58-101	-- Seemel well 1	Sun Oil Co.	1955	3,023	--	--	8	--	--	--	--	Oil test.[2]
* 102	R. J. Rhodes	Joe Hathaway	1915	630	6	--	18	4.3 15.4	Feb. 14, 1941 Dec. 4, 1959	N	N	Reported flow of 140 gpm when drilled. Obstruction at 35 ft in March 1963. Observation well.
103	J. Bland well 2	Lucus-Dishman	--	3,135	--	--	14	--	--	--	--	Oil test.[2]
104	Harmon Gas Unit well 1	Northwest Oil Co.	1960	3,088	--	--	--	--	--	--	--	Do.
* 105	John Seemel	George Glidden	1938	607	2	M	12	--	--	J,E	D,S	Estimated flow 2 gpm in February 1941.
* 106	F. J. DeMary	--	--	82	--	U	12	--	--	N	N	
* 107	Southern Pacific RR	Joe Hathaway	1910	679	9	M	13	4.9	June 21, 1941	N	N	Casing: 9-in. to 628 ft. Reported flow 60 gpm when drilled. Estimated flow 15 gpm in 1941.
108	Cottom Estate	Jones Water Well Service	1957	412	1	M	13	29.6	Mar. 18, 1963	N	N	Screened from 408 ft to bottom.
201	McLewis-Orangefield Independent School District	--	1958	180?	4	U	12	--	---	J,E	P	Supplies water for McLewis School.
* 202	Ed Worster	--	1934	432	2	M	11	+ 3.0	Sept.18, 1941	J,E	D,S	Estimated flow 6 gpm in 1941.
* 203	F. T. Peveto	George Glidden	1940	610	2	M	14	+ 2.2	Sept.20, 1941	N	N	Estimated flow 1 gpm in 1941.
* 204	Allen W. Leveto	J. C. Mosier	1949	709	2	M	13	--	--	J,E	D,S	Screened from 699 ft to bottom.
* 205	Mrs. J. W. Hilton	George Glidden	1940	107	2	U	14	--	--	N	N	Screened from 95 ft to bottom.
301	H. J. Lutcher Stark well 3	Layne-Texas Co.	1954	602	6,4	M	5	36	1962	T,E, 10	D,S, Irr	Original well drilled to 682 ft, and completed in 1962 well reworked and plugged back to 602 ft. Screened from 570 to 600 ft. Gravel-packed.

See footnotes at end of table.

Table 3.--Records of wells in Orange and Jefferson Counties--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Diameter of well (in.)	Water-bearing unit	Altitude of land surface (ft)	Water level: Below land-surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*UJ-62-58-302	Southern Pacific RR Co.	--	--	10	60	U	16	0.5	Mar. 26, 1941	N	N	Dug well. Reported filled and abandoned in 1962
* 303	Orange Products Co.	Layne-Texas Co.	1940	715	10,8	M	9	2.4 32.7	June 2, 1941 Dec. 3, 1959	T,E, 20	Ind	Casing: 10-in. to 145 ft. Screened from 658 to 698 ft. Flowing in 1941. Reported discharge 341 gpm in 1962.1/
* 304	Orange County Water Control & Improvement District No.2	do	1954	719	14,8	M	10	32.9 43.5	Dec. 3, 1959 Oct. 19, 1962	T,E, 60	P	Screened from 626 to 706 ft. Gravel-packed. Reported 8 ft of drawdown after pumping 614 gpm.
* 305	City of Orange well 8	do	1961	725	16,8	M	11	33 36.2	1961 Jan. 17, 1963	T,E, 75	P	Casing: 16-in. to 510 ft. Screened from 520 to 610 ft. Gravel-packed. Reported drawdown 28 ft after pumping 24 hours at 754 gpm.1/
306	Spooner Addition Water Co.	-- Darden	1959	573	4,3	M	13	--	--	J,E, 5	P	Screened from 552 ft to bottom. Supplies water for Spooner subdivision.
307	do	Paul Acheson	1941?	570	2	M	13	--	--	J,E, 2	P	Supplies water for Spooner subdivision.
* 308	do	do	1944	570?	4	M	13	--	--	J,E, 3	P	Do.
* 309	do	-- Darden	1957	630?	4,3	M	13	--	--	J,E, 5	P	Do.
* 310	Orange Motel	Pete Gunstream	1948	579	3,2	M	12	--	--	J,E, 1	P	Screened from 567 ft to bottom.
311	J. J. Molley	-- Darden	1954?	630	4,2	M	8	--	--	J,E, 1	D,Irr	
312	do	do	1954	990	4,2	M	8	32.6	Oct. 18, 1962	N	N	Screened from 968 ft to bottom. Reported salty water
* 313	Tom Lowe	Joe Hathaway	--	790	4	M	17	3.0	Feb. 18, 1941	N	N	Reported to flow until 1920.
* 314	George Willy	George Glidden	1938	760	2	M	14	2.0	Apr. 2, 1941	N	N	Screened from 750 ft to bottom.
* 315	E. W. Brown Estate	do	1936	562	3	M	15	--	--	N	N	Screened from 550 ft to bottom.
* 316	E. R. Odom	W. R. Banker	1932	804	6	M	16	.8 10.7	June 26, 1941 May 15, 1950	N	N	Casing: 6-in. to 762 ft. Screened from 762 ft to bottom.1/
* 317	H. Davison	Paul Acheson	1940	179	2	U	15	--	--	N	N	Screened from 143 ft to 149 ft.
* 318	E. W. Brown, Jr.	--	--	600?	6	M	15	.3	Feb. 11, 1941	N	N	Reported to flow when drilled in 1941.
* 319	do	--	--	765	6	M	16	2.1	do	N	N	Estimated flow 15 gpm in 1941.
* 320	J. W. Nelson	Paul Acheson	1940	163	2	U	12	7.2	Mar. 27, 1941	N	N	Screened from 155 ft to bottom.

See footnotes at end of table.

Table 3.--Records of wells in Orange and Jefferson Counties--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Diameter of well (in.)	Water-bearing unit	Altitude of land surface (ft)	Water level: Below land-surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*UJ-62-58-321	M. C. Inman	Layne-Louisiana	1935	691	4	M	10	3.7	Apr. 7, 1941	N	N	Casing: 4-in. to 667 ft. Screened from 667 ft to 687 ft. Estimated flow 2 gpm in 1941.[1]
* 322	Orange Country Club	--	--	662	6,4	M	14	--	--	T,E	D,Irr	Casing: 4-in. to 542 ft. Estimated flow 15 gpm in 1941.
* 323	E. W. Brown, Jr.	--	1940	116	2	U	14	--	--	N	N	
401	Lutcher Moore Lumber Co.	Sun Oil Co.	1947	9,002	--	--	13	--	--	--	--	Oil test.[2]
* 402	Orangefield Independent School District	Simmons Water Well Service	1961	535	4	M	15	31	1961	J,E	P	Screened from 515 ft to bottom. Supplies water for high school.[1]
403	do	Amelia Drilling Co.	1954	480	6,4	M	15	23.3	Feb. 7, 1963	N	N	Screened from 460 ft to bottom. Unused.
404	do	--	1958	400?	4	M	12	--	--	J,E	P	
* 406	Orangefield Water Works	-- Darden	1955?	540	2	M	13	24	1962	J,E, 2	P	Screened from 519 ft to bottom.
* 407	do	Paul Acheson	1946	567	2	M	10	24	1962	J,E	D	Screened from 546 ft to bottom.
* 408	Orange Petroleum Corp.	--	--	640	6	M	11	--	--	N	N	Estimated flow 3 gpm in 1941. Abandoned before 1962.
* 409	J. W. Phillips Water System	Sun Oil Co.	1923	659	6	M	11	29	Sept. 1962	J,E	P	Flowed in 1941. Screened from 564 to 651 ft.
410	Orangefield Recreation Park	H. H. Burr	1957	120	4	U	5	5.4	Mar. 18, 1963	N	N	Abandoned owing to high iron content in water.
411	do	-- Darden	1962	450?	4,2	M	5	23.4	do	J,E	P	Screened on bottom.
* 412	Lee Hager	--	--	600?	8	M	4	+ 8.0 22.8	June 28, 1941 Mar. 18, 1963	J,G	N	Estimated flow 2 gpm in 1941. On Gulf Oil Co. lease. Observation well.
* 413	W. P. McGuire	Jim Sutton	1927	600?	4	M	9	+ 5.3	June 28, 1941	N	N	Estimated flow 2 gpm in 1941.
414	Paul Cornier	-- Darden	1961	197	4	U	3	3.5	Mar. 18, 1963	J,E	D	Owner reports gas in water.
* 415	do	--	--	700	4	M	10	+ 3.2	July 4, 1941	J,E	Ind	Estimated flow 5 gpm in 1941.
* 416	Oscar Chesson	Brady & Smith	1928?	855	6	M	6	25.1	Mar. 18, 1963	N	N	Estimated flow 20 gpm in 1941. On Continental Oil Co. lease.
* 417	Orangefield High High School	Paul Acheson	1940	122	2	U	13	--	--	N	N	Screened from 104 ft to bottom. No sand found in test hole between 112 and 350 ft.
418	Lutcher Moore Lumber Co.	Northwest Oil Co.	1960	2,853	--	--	9	--	--	--	--	Oil test.

See footnotes at end of table.

Table 3.--Records of wells in Orange and Jefferson Counties--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Diameter of well (in.)	Water-bearing unit	Altitude of land surface (ft)	Water level: Below land-surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*UJ-62-58-419	John Brunette	B. J. Jones	1937	470	2	M	6	--	--	N	N	Screened from 458 ft to bottom. Estimated flow 2 gpm in 1941.
* 420	Henry Bland	George Glidden	1927	471	3	M	8	--	--	N	N	Estimated flow 3/4 gpm in 1941.
* 421	Mrs. Allie Chesson	--	--	500?	2	M	13	--	--	N	N	
* 422	Emiline La Fleur	Paul Acheson	1940	170	2	U	16	12.2	Mar. 28, 1941	N	N	Screened from 164 ft to bottom. Sand from 150 ft to bottom.
501	H. F. Banker Unit well 1	Superior Oil Co.	1948	8,368	--	--	11	--	--	--	--	Oil test.[3]
502	-- Winfree well 3	Placid Oil Co.	1948	7,900	--	--	12	--	--	N	N	Do.
503	E. W. Brown, Jr. well 1	Pan-American Petroleum Corp.	1958	8,600	--	--	9	--	--	N	N	Do.
504	-- Phares well 1	Scurlock Oil Co.	1962	8,669	--	--	5	--	--	N	N	Do.
* 505	George Clark	J. B. Jordan	1939	535	2	M	10	5.8	May 16, 1950	N	N	Estimated flow 2 gpm in 1941.
506	Joe Bailey	R. M. Tannahill	1941	560	2	M	6	7.5	July 1, 1941	N	N	Do.
507	Sam Johnson	J. B. Jordan	1940	103	1	U	12	--	--	N	N	Screened from 95 ft to bottom.
* 508	Dave Young	Paul Acheson	1940	75	1	U	10	--	--	N	N	Screened from 71 ft to bottom.
* 509	W. H. Harvey Estate	-- Depew	1925	460	4	M	11	--	--	N	N	Estimated flow 2 gpm in 1941.
* 510	Sabine Packing Co.	--	--	584	6	M	9	--	--	N	N	Estimated flow 10 gpm in 1941.
* 511	E. W. Brown Estate	--	--	711	--	M	8	--	--	N	N	Do.
* 512	do	--	--	600	2	M	8	4.7	Sept.18, 1941	N	N	Estimated flow 20 gpm in 1941.
* 601	do	--	--	600	3	M	11	2.3 29.5	June 21, 1941 Dec. 2, 1959	N	N	Estimated flow 5 gpm in 1941. Observation well.
* 602	do	--	--	700	5	M	13	1.0 43.3	June 23, 1941 Apr. 2, 1963	J,E	D,S	Reported flowed intermittently in 1941. Observation well.
* 603	W. H. Stark Estate	--	--	356	5	M	7	4.5	Sept.19, 1941	N	N	Observation well.
* 604	Spencer Chemical Co.	Layne-Texas Co.	1953	707	8,4	M	7	15	1953	T,E	P,Ind	Casing: 8-in. to 513 ft. Screened from 633 ft to bottom. Gravel-packed. Reported discharge 226 gpm with 11 ft of drawdown when drilled.
* 605	Spencer Chemical Co. well 4	do	1959	717	16,8	M	7	29	1959	T,E, 60	Ind	Casing: 8-in. to 594 ft. Screened from 604 ft to bottom. Gravel-packed. Reported discharge 781 gpm with 25 ft of drawdown when drilled.

See footnotes at end of table.

Table 3.--Records of wells in Orange and Jefferson Counties--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Diameter of well (in.)	Water-bearing unit	Altitude of land-surface (ft)	Water level: Below land-surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*UJ-62-58-606	Spencer Chemical Co. well 3	Layne-Texas Co.	1958	710	8,4	M	7	27	1958	T,E, 15	Ind	Casing: 8-in. to 510 ft. Screened from 630 ft to bottom. Gravel-packed. Reported discharge 170 gpm with 12 ft of drawdown when drilled.
* 607	W. H. Stark Estate	--	--	600?	6	M	8	29.6	Dec. 2, 1959	N	N	Flowing in 1941. Observation well, casing plugged in 1959.
* 608	Allied Chemical & Dye Corp.	Layne-Texas Co.	1953	736	20,12	M	8	22	1953	T,E, 150	Ind	Casing: 20-in. to 519 ft. Screened from 620 to 735 ft. Gravel-packed. Reported discharge 2,513 gpm with 35 ft of drawdown when drilled.
* 609	DuPont Sabine River Works well 103.3	do	1946	726	16,10	M	11	33	Sept. 1959	T,E,	Ind	Casing: 16-in. to 507 ft. Screened from 634 to 723 ft. Gravel-packed. Reported discharge 1,775 gpm with 107 ft of drawdown when drilled.
610	DuPont Sabine River Works well 103-3.1	do	1946	715	3	M	10	35	do	J,A	N	Used for quality and water level observation.
* 611	DuPont Sabine River Works well 103-2	do	1946	715	8,4	M	10	37 45	Sept. 1959 Feb. 1963	J,A	N	Drilled to 954 ft, plugged back to 715 ft. Used for quality and water level observation.
* 612	DuPont Sabine River Works well 103-4	do	1949	735	20,12	M	9	32	Mar. 1959	T,E, 250	Ind	Casing: 20-in. to 622 ft. Screened from 630 to 720 ft. Gravel-packed. Reported discharge 2,500 gpm when drilled.
613	DuPont Sabine River Works well 103-1.1	do	1946	723	3	M	10	37	Sept. 1959	J,A	N	Drilled to 751 ft, plugged back to 723 ft. Used for quality and water level observation.
* 614	DuPont Sabine River Works well 103-1	do	1945	726	16,10	M	9	37	June 1959	T,E, 100	Ind	Reported discharge 1,000 gpm when drilled. Gravel-packed.
* 615	Firestone Tire & Rubber Co. well 1	do	1957	--	18,10	M	9	27	1957	T,E, 60	Ind	Casing: 18-in. to 474 ft. Screened from 611 ft to bottom. Gravel-packed. Reported discharge 1,023 gpm with 23 ft of drawdown when drilled.
* 616	Spencer Chemical Co.	do	1954	718	16,8	M	7	17	1954	T,E, 60	Ind	Casing: 16-in. to 489 ft. Screened from 596 ft to bottom. Gravel-packed. Reported discharge 760 gpm with 10 ft of drawdown when drilled.
617	DuPont Employee's Recreation Area	Jones Water Well Service	1961	629	4,2	M	6	--	--	J,E, 2	P	
618	DuPont Sabine River Works	Texas Water Wells Inc.	1961	717	4	M	5	34	Dec. 1962	J,A	N	Screened from 637-642, 657-662, 677-682, 697-702 ft. Has 2-in. pipe with packer set at 692 ft, and is used to observe lower and 3 upper sections, separately for quality and water level observations.
619	Marvin Perkins	J. C. Mosier	1956	386	2	M	10	29.0	Apr. 2, 1963	N	N	Screened from 378 to 384 ft. Abandoned.
620	H. C. Wilkinson	-- Darden	1959	215	2	U	11	9.7	do	N	N	

See footnotes at end of table.

Table 3.--Records of wells in Orange and Jefferson Counties--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Diameter of well (in.)	Water-bearing unit	Altitude of land surface (ft)	Water level: Below land-surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
UJ-62-58-621	John Henriksen	-- Darden	1955	110	2,1	U	10	10.0	Apr. 2, 1963	J,E, 1/3	N	Screened from 102 to 106 ft.
622	-- Hawkins	--	--	16	4	U	11	5.1	do	J,E, 1/3	N	
* 623	Cabot Corp.	J. C. Mosier	1962	460	4	M	13	--	--	J,E, 5	Ind	Screened from 440 ft to bottom.
* 624	E. W. Brown Estate	Chris Geyer	1907	578	6	M	15	2.1	June 23, 1941	N	N	Estimated flow 1 gpm 4 ft below ground in 1941. Well 841 in U. S. Geological Survey Water-Supply Paper 335, 1914.
* 625	do	do	1907	462	8,4	M	12	.5	Sept.19, 1941	N	N	Well 840 in U. S. Geological Survey Water-Supply Paper 335, 1914.
* 626	H. S. Lutcher Stark	Layne-Texas Co.	1954	620	6,4	M	15	24 41.6	1954 Apr. 2, 1963	T,E, 5	D,S	Casing: 6-in. to 567 ft. Screened from 570 to 600 ft.
* 627	W. H. Stark Estate	--	--	600	4,2	M	15	--	--	N	N	Reported obstruction at 12 ft in 1963.
* 628	do	--	--	600	5	M	15	--	--	N	N	
* 629	Firestone Tire & Rubber Co.	Layne-Texas Co.	1960	700	16,10	M	6	31	1960	T,E, 60	P,Ind	Casing: 16-in. to 590 ft. Screened from 595 to 680 ft. Gravel-packed. Reported 26 ft of drawdown after pumping 24 hours at 1,018 gpm.
* 630	J. H. Foreman	--	--	720	2	M	7	6.2	Sept.18, 1941	N	N	Estimated flow 5 gpm in 1941.
631	Firestone Tire & Rubber Co.	Layne-Texas Co.	1963	708	16	M	6	33	Apr. 1963	T,E	Ind	Drilling when inventoried.
* 701	The Texas Co. well 2	--	1925	704	10,8	M	11	2.2	Feb. 18, 1941	T,E	Ind	Screened from 614 to 690 ft. Observation well.
* 702	Orange County Water Control & Improvement District well 3	Coastal Water Well Corp.	1955	700	14,8	M	10	12 27.5	1955 Feb. 25, 1963	T,E, 40	P	Screened from 600 to 672 ft. Gravel-packed. Reported discharge 599 gpm when drilled.
* 703	The Texas Co. Hatton well 1	--	1909	705	10	M	14	2.9	Dec. 16, 1941	T,E	Ind	Reported flow 400 gpm when drilled. Supplies water for The Texas Co. refinery at Port Arthur. Observation well. Pumping sand February 1963.[1]
* 704	J. R. Davis	Humble Oil & Refining Co.	--	700?	5	M	11	+ 2.4	July 1, 1941	N	N	Estimated flow 5 gpm in 1941. Old well.
* 705	Prairie View School	--	1935	385	2	M	10	+ 1.7	June 30, 1941	N	N	Estimated flow 5 gpm in 1941.
* 706	W. E. Crumpler	-- Bettison	1937	480	3	M	6	+ 6.7	July 1, 1941	N	N	Estimated flow 10 gpm in 1941.
* 707	W. F. Rachal	--	--	725	2	M	10	--	--	N	N	Estimated flow 3 gpm in 1941. Old well.

See footnotes at end of table.

Table 3.--Records of wells in Orange and Jefferson Counties--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Diameter of well (in.)	Water-bearing unit	Altitude of land surface (ft)	Water level: Below land-surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*UJ-62-58-801	E. I. DuPont	Layne-Texas Co.	1952	765	4	M	9	9.9 32.7	Apr. 1952 Apr. 4, 1963	J,A	N	Screened from 742-763 ft. Drilled to 914 ft plugged back to 765 ft. Used for quality and water level observation.
* 802	E. W. Brown, Jr.	J. C. Mosier	1956	250	4,2	U	6	--	--	J,E, 1	D,S	
* 803	E. W. Brown Estate	G. D. Froust	1939	194	4,2	U	4	--	--	N	N	Screened from 184 ft to bottom.
* 804	do	Frank Balcar	1936	638	6,4	M	6	7.5	June 21, 1941	N	N	Screened from 604 ft to bottom. Estimated flow 5 gpm in 1941.[1]
* 805	Ruby Young	-- Young	1928	22	6	U	8	5.2	Apr. 3, 1941	N	N	
* 806	H. P. Williams	Tidewater Oil Co.	--	900	10	M	9	--	--	N	N	Drilled to 5,000 ft as oil test. Plugged back to 900 ft and used as water well. Casing perforated at 725 ft. Flowing in 1941.
* 807	John Richard	Paul Acheson	1940	97	1	U	11	--	--	N	N	Screened from 93 ft to bottom.
* 808	E. W. Brown Estate	--	1932	620	4,2	M	6	--	--	N	N	Measured flow 9 gpm in 1941.
* 901	W. H. Stark Estate	Joe Hathaway	1914	600	4	M	4	9.0	Sept.18, 1941	N	N	
902	E. W. Brown, Jr.	John Mecom	1960	9,625	--	M	6	--	--	--	--	Oil test.[2]
* 903	E. W. Brown Estate	--	--	630	6	M	5	--	--	N	N	Estimated flow 40 gpm in 1941.
* 904	do	--	--	600	4	M	5	--	--	N	N	Estimated flow 10 gpm in 1941.
* 905	do	--	--	600	4	M	4	--	--	N	N	Estimated flow 25 gpm in 1941.
* 906	do	Tidewater Oil Co.	--	694	6	M	4	9.5 1.7	Sept.18, 1941 Apr. 15, 1949	N	N	Estimated flow 5 gpm in 1941.
* 59-101	City of Orange well 7	Coastal Water Well Corp.	1958	735	20,14	M	10	33 40.3	1958 Jan. 15, 1962	T,E, 150	P	Casing: 20-in. to 552 ft. Screened from 555 to 666 ft. Gravel-packed. Reported to discharge 3,500 gpm with drawdown of 80 ft when drilled.
* 102	City of Orange	Layne-Texas Co.	1924	685	16,8,6	M	9	+ 3.1 39.9	Mar. 26, 1941 Jan. 17, 1962	T,E, 50	N	Screened from 326 ft to bottom. Estimated flow 30 gpm one-half ft above ground level. Pumped 422 gpm with 9 ft of drawdown in 1941. Not used in 1962.[1]
* 103	do	Coastal Water Well Corp.	1945	688	20,12	M	9	32.3 41.0	Dec. 4, 1959 May 21, 1963	T,E, 75	P	Casing: 20-in. to 554 ft. Screened from 565 to 685 ft. Gravel-packed. Pump test made in May 1963. Measured discharge 1,970 gpm after pumping 22 hours with a drawdown of 71 ft.
* 104	Gulf States well 5	Layne-Texas Co.	1941	749	16,8	M	8	+ 1.4	Sept.22, 1941	T,E, 50	P	Casing: 16-in. to 578 ft. Screened from 613 to 734 ft. Leased by the City of Orange.

See footnotes at end of table.

Table 3.--Records of wells in Orange and Jefferson Counties--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Diameter of well (in.)	Water-bearing unit	Altitude of land surface (ft)	Water level: Below land-surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*UJ-62-59-105	Gulf States Utilities Co. well 2	--	1924	755	16,10, 8	M	9	39.2	Jan. 17, 1962	N	N	Casing: 16-in. to 99 ft. Screened from 672 to 737 ft. Observation well.[1]
* 106	Gulf States Utilities Co. well 4	--	--	750	8,6	M	8	+ 1.9	Feb. 7, 1941	T,E, 75	P	Screened from 630 ft to bottom. Leased by the City of Orange.
* 107	Gulf States Utilities Co.	Layne-Texas Co.	1943	745	20,18, 10	M	10	39.2	May 20, 1963	T,E, 75	P	Reported to flow in 1943. Pump test made in May 1963. Measured discharge 825 gpm after pumping 22 hours with a drawdown of 36 ft.
108	Orange Pulp & Paper Mills, Inc. well 2	Layne-Louisiana	1944	725	8	M	5	27.5	Jan. 14, 1960	T,E, 100	Ind	Reported discharge 1,000 gpm. Gravel packed.
* 109	Orange Pulp & Paper Mills, Inc.	--	--	675	10	M	5	--	--	T,E, 50	Ind	Estimated flow 150 gpm in 1941. Old well.
* 110	Orange Products Co.	--	--	650	6	M	3	--	--	N	N	Estimated flow 10 gpm in 1941. Well destroyed by 1963.
* 111	Orange Pulp & Paper Mills, Inc.	--	--	600?	8	M	5	--	--	N	N	Estimated flow 100 gpm in 1941. Well destroyed by 1963.
* 112	do	--	--	600?	6	M	5	--	--	N	N	Estimated flow 50 gpm in 1941. Well destroyed by 1963.
113	do	Layne-Bowler Co.	1911	725	24,12	M	7	--	--	N	N	Reported to have a flow of 800 gpm through a 12-in. screen from 582 ft to bottom when drilled. Abandoned.[1]
* 114	W. H. Stark Estate	--	--	686	--	M	8	--	--	N	N	Estimated flow 10 gpm in 1941.
115	H. J. Lutcher Stark Sangri La well 1	Layne-Texas Co.	1948	610	6,4	M	7	11	1948	T,E, 10	D,S, Irr	Screened from 570 ft to bottom. Reported discharge 150 gpm when drilled.
* 116	do	do	1954	602	6,4	M	6	24	1954	T,E, 5	D,S, Ind	Original well drilled to 677 ft, screened from 630 to 660 ft. In 1962 well was plugged back to 602 ft, and converted to water well. Screened from 570 ft to 600 ft.
* 117	Gulf States Utilities Co.	--	--	650?	8	M	8	39.0	May 22, 1963	N	N	Static water level slightly above surface in 1941.
* 118	W. H. Stark Estate	George Glidden	1924	600	3	M	8	--	--	N	N	Estimated flow 1 gpm in 1941.
* 119	George Colburn	do	1939	608	4	M	9	+ 5.3	Apr. 2, 1941	N	N	Screened from 588 ft to bottom. Estimated flow 30 gpm in 1941.
* 120	Lutcher Stark	--	--	600	6	M	9	+ 2.0	June 20, 1941	T,E	D	Estimated flow 5 gpm in 1941. Supplies water for swimming pool.

See footnotes at end of table.

Table 3.--Records of wells in Orange and Jefferson Counties--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Diameter of well (in.)	Water-bearing unit	Altitude of land surface (ft)	Water level: Below land surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
*UJ-62-59-121	F. H. Farwell	--	--	650?	--	M	8	--	--	N	N	Estimated flow 1 gpm in 1941.
* 122	Curtis School College	--	1904	500?	3	M	7	+ 5.4	May 26, 1941	N	N	Estimated flow 5 gpm in 1941.
401	Marathon Oil Co.	Sollay Bros.	1957	580	4,2	M	5	--	--	T,E, 3	Ind	Screened from 555 to 575 ft.
402	DuPont Sabine River Works	Jones Water Well Service	1961	715	4,2	M	5	--	--	J,E, 5	P,Ind	Screened from 695 ft to bottom.
403	Lutcher Moore Lumber Co.	The Ohio Oil Co.	1951	8,999	--	M	5	--	--	--	--	Oil test.[2]
* 404	W. J. Skeeler	--	1940	730	2	M	10	--	--	N	N	Estimated flow 5 gpm in 1941.
* 405	Cove School	John Bland	1915	756	3	M	9	--	--	N	N	Do.
* 406	F. A. Lutcher Estate	--	--	650?	4	M	9	+ 1.9	Sept.22, 1941	N	N	Estimated flow 1 gpm in 1941.
* 407	do	--	--	650?	4	M	9	+ 2.0	do	N	N	Estimated flow 30 gpm in 1941. Old well.
* 408	do	--	--	650?	6	M	9	--	--	N	N	Estimated flow 15 gpm in 1941. Old well.
409	Lutcher & Moore Lumber Co.	--	1911	734	24,11, 9	M	7	--	--	N	N	Casing: 24-in. to 40 ft, 11-in. to 635 ft, and 9-in. to 59 ft. Screened from 546 to 659 ft, and 675 to 726 ft.[1]
* 410	do	--	--	650?	8	M	5	--	--	N	N	Estimated flow 2 gpm in 1941.
* 411	do	--	--	650?	6	M	6	+ 4.9	Sept.22, 1941	N	N	Estimated flow 1 gpm in 1941.
* 412	Texas Creosoting Co.	--	1918	620	6	M	6	--	--	N	N	Estimated flow 5 gpm in 1941.
* 413	Lutcher & Moore Lumber Co.	Layne-Bowler Co.	1911	750	8	M	4	+ 7.4	Sept.22, 1941	N	N	Screened from 608 to 743 ft. Estimated flow 2 gpm in 1941. Reported flow of 490 gpm when drilled.[1]
* 414	do	--	1918	670	8	M	4	--	--	N	N	Estimated flow 2 gpm in 1941.
* 415	City of Orange	--	--	650	6	M	5	+ 7.7	June 2, 1941	N	N	Estimated flow 25 gpm in 1941.
501	E. W. Brown, Jr.	Ohio Oil Co.	1950	9,490	--	M	5	--	--	N	N	Oil test. In Calcasieu Parish, La.[2]
701	Du Pont Sabine River Plant	Layne-Texas Co.	1952	823	4	M	5	7	May 1952	J,A	N	Screened from 803 to 814 ft. One foot of pipe has 1-in. torch slotted from 822 to 823 ft. Used for quality and water level observation.
PT-63-01-201	City of Groves	do	1959	546	6,4	M	9	24.2	Feb. 5, 1963	T,-	N	Screened from 520 to 540 ft. Drilled to 602 ft, plugged back to 546 ft. Unused.
*UJ-63-02-101	C. H. Gardiner	J. C. Mosier	1959	560	2	M	3	12	1962	J,E, 1/2	D	Screened from 548 ft to bottom.

See footnotes at end of table.

Table 3.--Records of wells in Orange and Jefferson Counties--Continued

Well	Owner	Driller	Date completed	Depth of well (ft)	Diameter of well (in.)	Water-bearing unit	Altitude of land surface (ft)	Water level: Below land surface datum (ft)	Water level: Date of measurement	Method of lift	Use of water	Remarks
UJ-63-02-301	Du Pont Sabine River Works	Layne-Texas Co.	1952	858	4	M	5	8.1 27.3	Apr. 1952 Mar. 14, 1963	J,A	N	Screened from 836 to 847 ft. One foot of 1-in. torch slotted pipe from 855 to 856 ft. Test drilled to 963 ft, plugged back to 825 ft. Used for quality and water level observation.
302	E. W. Brown, Jr.	J. C. Mosier	1959	216	2	U	4	5	1959	J,E	S	
03-301	Du Pont Sabine River Works	Layne-Texas Co.	1952	965	4	M	3	10 27.5	May 1952 Mar. 14, 1963	J,A	N	Screened from 943 to 954 ft. Test drilled to 1,042 ft, plugged back to 965 ft.

1/ For drillers logs of wells in Orange and Jefferson Counties see Table 4.
2/ Electric logs in files of Texas Water Commission.
* For analyses of water from wells in Orange and Jefferson Counties see Table 5.

Table 4.--Drillers logs of wells in Orange and Jefferson Counties

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)

Well UJ-61-56-104

Owner: B. H. Thibodeaux. Driller: Jones Water Well Service.

Clay, hard --------------	33	33	Shale, blue ----------	48	174
Sand, white -------------	3	36	Sand, fine -----------	27	201
Clay, blue --------------	38	74	Sand, water ----------	17	218
Sand, fine, white -------	52	126			

Well UJ-61-56-108

Owner: Donald F. Porter. Driller: Jones Water Well Service.

Clay, hard --------------	28	28	Clay, blue -----------	25	145
Sand, medium ------------	22	50	Sand, fine -----------	18	163
Formation, mixed --------	40	90	Sand, coarse, water --	15	178
Sand, coarse ------------	30	120			

Well UJ-61-56-113

Owner: Elmo Root. Driller: Jones Water Well Service.

Clay --------------------	9	9	Sand, coarse ---------	38	47

Well UJ-61-56-302

Owner: Fred Pastal. Driller: Jones Water Well Service.

Soil, sandy, black ------	12	12	Sand, coarse, white --	79	140
Sand, white -------------	16	28	Rock, sand -----------	1	141
Clay, blue --------------	33	61	Sand, coarse, dark ---	11	152

Well UJ-61-56-307

Owner: J. F. Arrington. Driller: Jones Water Well Service.

Clay, sandy, gray -------	12	12	Clay, soft, blue -----	80	210
Sand, white -------------	16	28	Sand, fine, blue -----	80	290
Clay, blue --------------	32	60	Clay, blue -----------	50	340
Sand, coarse, water -----	70	130	Sand, coarse, water --	27	367

Table 4.--Drillers logs of wells in Orange and Jefferson Counties--Continued

Well UJ-61-56-311

Owner: Earl B. Landry. Driller: Jones Water Well Service.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay --------------------	14	14	Clay, gray -----------	8	32
Sand, fine --------------	10	24	Sand, water ----------	15	47

Well UJ-61-56-312

Owner: J. C. Winger. Driller: Jones Water Well Service.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil, sandy -------------	9	9	Sand, fine, blue -----	84	296
Clay, hard --------------	17	26	Sand, water, fine, medium	48	344
Clay, blue --------------	44	70	Clay, hard, blue -----	46	390
Sand, coarse, water -----	97	167	Sand, water, coarse --	12	402
Clay, hard, blue --------	45	212			

Well UJ-61-56-313

Owner: Sidney Andrews. Driller: Jones Water Well Service.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil, sandy -------------	26	26	Sand and clay, blue, mixed --------------	75	235
Clay, blue --------------	13	39	Sand, fine -----------	125	360
Sand, coarse ------------	121	160	Sand, coarse, water --	18	378

Well UJ-61-56-504

Owner: R. J. Hoffman. Driller: Jones Water Well Service.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay, yellow ------------	20	20	Rock -----------------	1	140
Clay, blue --------------	52	72	Sand, coarse, water --	10	150
Sand, coarse, water -----	67	139			

Well UJ-61-56-603

Owner: S. L. Maddoax. Driller: Jones Water Well Service.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay --------------------	8	8	Clay, blue -----------	15	96
Sand, fine --------------	13	21	Sand, water ----------	41	137
Clay, blue --------------	23	44	No record ------------	39	176
Sand, coarse, water -----	37	81	Sand, coarse, water --	16	192

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)

Well UJ-61-56-604

Owner: H. R. Smith. Driller: Jones Water Well Service.

Clay, yellow ------------	18	18	Clay, blue -----------	12	132
Sand, fine, white -------	6	24	Sand, coarse, water --	15	147
Clay, blue --------------	24	48	Clay, blue -----------	42	189
Shell, oyster -----------	13	61	Sand, fine, blue -----	31	220
Sand, coarse, white -----	59	120	Sand, coarse, water --	17	237

Well UJ-61-56-605

Owner: Bell Oil Co. Driller: Jones Water Well Service.

Clay, hard --------------	20	20	Sand, coarse, water --	87	147
Sand, fine --------------	14	34	Clay, streaked, blue -	123	270
Clay, blue --------------	26	60	Sand, water ----------	24	294

Well UJ-61-56-606

Owner: Lee Whitmire. Driller: Jones Water Well Service.

Clay --------------------	18	18	Sand, fine, blue -----	78	289
Sand, fine --------------	10	28	Sand, fine, water ----	33	322
Clay, blue --------------	39	67	Clay, blue -----------	48	370
Sand, coarse, water -----	24	91	Sand, clay, mixed ----	82	452
Clay, blue --------------	6	97	Rock -----------------	2	454
Sand, coarse, water -----	50	147	Sand, coarse, water --	14	468
Clay, streaked blue -----	64	211			

Well UJ-61-56-907

Owner: Vidor Independent School District. Driller: Jones Water Well Service.

Clay, gray --------------	18	18	Clay, blue -----------	89	222
Sand, fine, white -------	7	25	Sand, clay, mixed ----	93	315
Clay, blue --------------	35	60	Sand, fine, water ----	55	370
Sand, coarse, water -----	73	133	Sand, coarse, water --	50	420

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)

Well UJ-61-56-911

Owner: Jones Water Well Service. Driller: Jones Water Well Service.

Clay, gray --------------	20	20	Clay, blue -----------	76	218
Sand, fine, white -------	6	26	Sand, clay, mixed ----	132	350
Clay, blue --------------	32	58	Sand, fine, water ----	100	450
Sand, coarse, water -----	84	142	Sand, coarse, water --	36	486

Well UJ-61-56-912

Owner: A. L. Chesser. Driller: Jones Water Well Service.

Clay --------------------	19	19	Sand, water ----------	35	329
Sand, fine --------------	7	26	Clay, blue -----------	57	386
Clay, blue --------------	25	51	Sand, clay, blue, streaked -----------	75	461
Sand, coarse, water -----	98	149	Sand, fine, water ----	20	481
Shale, blue -------------	39	188	Sand, coarse, water --	26	507
Clay, sand, mixed, blue -	106	294			

Well UJ-61-64-207

Owner: Bill McDonald. Driller: Jones Water Well Service.

Sand --------------------	48	48	Sand, coarse, water --	30	160
Clay, blue --------------	12	60	Clay, blue -----------	180	340
Sand, coarse, water -----	60	120	Sand, fine, blue -----	80	420
Clay, blue --------------	10	130	Sand, coarse, water --	10	430

Well UJ-61-64-305

Owner: Luther Keaster. Driller: Jones Water Well Service.

Clay, gray --------------	24	24	Sand, fine, white ----	40	260
Shale, blue -------------	35	59	Sand, clay, mixed, blue	80	340
Sand, coarse, water -----	77	136	Sand, fine, blue -----	115	455
Clay, blue --------------	84	220	Sand, coarse, water --	17	472

Table 4.--Drillers logs of wells in Orange and Jefferson Counties--Continued

Well UJ-61-64-306

Owner: H. J. & W., Inc. Driller: Jones Water Well Service.

	Thickness (feet)	Depth (feet)
Sand, surface	2	2
Clay	23	25
Sand, red	110	135
Clay, blue	55	190
Sand, clay, mixed	60	250
Sand, clay, mixed	160	410
Sand, fine	80	490
Sand, medium	30	520
Gravel	35	555

Well UJ-61-64-401

Owner: City of Beaumont. Driller: Layne-Texas Co.

	Thickness (feet)	Depth (feet)
Sand, coarse	53	53
Clay, yellow and white	23	76
Sand, fine	10	86
Clay, sandy	11	97
Clay, blue	232	329
Sand	20	349
Clay, sandy	28	377
Sand	36	413
Clay	27	440
Sand	36	476
Shale, sandy	18	494
Shale, tough	20	514
Sand	14	528
Shale	100	628
Sand	150	778
Shale	8	786
Sand, streaks	100	886

Well PT-61-64-506

Owner: Mobil Oil Refinery. Driller: Texas Water Wells, Inc.

	Thickness (feet)	Depth (feet)
Rotary to ground	4	4
Surface	3	7
Clay	24	31
Sand, fine	3	34
Sand, clay streaks	64	98
Sand, gray	50	148
Clay	255	403
Sand, fine, hard	54	457
Shale	51	508
Sand, fine, hard	45	553
Shale, sand streaks	41	594
Sand, fine, hard	39	633
Shale	29	662
Sand, very hard	171	833
Shale, sandy	63	896
Shale	12	908

Table 4.--Drillers logs of wells in Orange and Jefferson Counties--Continued

Well PT-61-64-508

Owner: Gulf States Utilities Co. Driller: Coastal Water Wells, Inc.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Sand	15	15	Shale	40	390
Gumbo	30	45	Sand	50	440
Sand	15	60	Shale	40	480
Gumbo	13	73	Sand	80	560
Shale	87	160	Shale, sandy	240	800
Sand	100	260	Shale, gummy	800	1,600
Shale	60	320	Sand, fine	12	1,612
Sand	30	350			

Well UJ-62-49-504

Owner: G. L. Linscomb. Driller: Jones Water Well Service.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil, sandy	11	11	Clay, blue	47	71
Clay	10	21	Sand, coarse, water	25	96
Sand, fine	3	24			

Well UJ-62-49-601

Owner: D. E. Cohenour. Driller: Coastal Water Wells Corp.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil, surface	4	4	Shale, hard, sticky	83	320
Gumbo	76	80	Sand	29	349
Sand, coarse	15	95	Gumbo	6	355
Shale, sandy	6	101	Sand, fine	80	435
Shale, sticky	91	192	Sand, coarse	152	587
Shale, hard, brittle	45	237	Sand and gravel	71	658

Well UJ-62-49-702

Owner: K. D. Home Builders Driller: Jones Water Well Service.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay, yellow	20	20	Clay, blue	33	61
Sand, fine	8	28	Sand, coarse, water	73	134

Well UJ-62-49-702--Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay, blue and sand streaks ---------------	55	189	Sand, coarse, water --	31	220

Well UJ-62-49-703

Owner: James P. Wilson. Driller: Jones Water Well Service.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay, hard --------------	24	24	Clay, yellow, sand streaks ------------	105	320
Sand, fine --------------	6	30	Clay, blue -----------	90	410
Clay, blue --------------	30	60	Sand, fine, blue -----	275	685
Sand, coarse, little clay	84	144	Sand, coarse, water --	18	703
Clay, blue --------------	71	215			

Well UJ-62-49-704

Owner: J. D. Maines. Driller: Jones Water Well Service.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay, brown -------------	22	22	Clay, blue -----------	68	215
Clay, blue --------------	27	49	Sand, fine, blue -----	81	296
Sand, water -------------	45	94	Sand, fine, water ----	40	336
Clay, blue --------------	4	98	Clay, blue -----------	75	411
Sand, water -------------	19	117	Sand, fine, water ----	163	574
Clay, blue --------------	8	125	Sand, coarse, water --	22	596
Sand, water -------------	22	147			

Well UJ-62-50-201

Owner: Heard Bros. Driller: Coastal Water Wells.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil, surface -----------	3	3	Sand -----------------	8	108
Clay --------------------	12	15	Shale ----------------	27	135
Quicksand ---------------	5	20	Sand, fine -----------	81	216
Gumbo -------------------	26	46	Shale, sticky --------	14	230
Quicksand ---------------	50	96	Shale, hard ----------	10	240
Shale -------------------	4	100	Shale, brittle -------	14	254

Table 4.--Drillers logs of wells in Orange and Jefferson Counties--Continued

Well UJ-62-50-201--Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Sand	4	258	Sand and shale	45	423
Shale, sandy	8	266	Sand, good	23	446
Sand, fine	34	300	Sand, fair	22	468
Shale, sandy	7	307	Sand, fine	34	502
Sand	38	345	Sand, good	58	560
Wood, decayed log	3	348	Sand, coarse, gravel	10	570
Sand	30	378	Gravel	20	590

Well UJ-62-50-403

Owner: Kansas City and Southern RR. Driller: George Glidden.

Cinders	2	2	Gumbo, blue	6	58
Clay, yellow	24	26	Sand	32	90
Sand, fine	2	28	Sand, coarse	20	110
Gumbo, blue	7	35	Sand, fine	30	140
Sand	17	52			

Well UJ-62-50-504

Owner: A. L. Hutchins. Driller: -- Hathaway.

Soil, top	2	2	Gumbo	14	354
Clay, red	16	18	Sand and shale	32	386
Sand	20	38	Sand and boulders	156	542
Gumbo	38	76	Gumbo	38	580
Sand	40	116	Shale, sandy	10	590
Gumbo	6	122	Gumbo, boulders	38	628
Sand and boulders	11	133	Sand	78	706
Gumbo	14	147	Gumbo	19	725
Sand and boulders	86	233	Sand and boulders	30	755
Gumbo	78	311	Gumbo	15	770
Shale and gumbo	20	331	Sand, gravel and boulders	56	826
Sand	9	340	Gumbo	5	831

Table 4.--Drillers logs of wells in Orange and Jefferson Counties--Continued

Well UJ-62-50-904

Owner: George Glidden. Driller: George Glidden.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay --------------------	14	14	Gumbo, blue ----------	141	355
Sand, fine -------------	5	19	Sand and boulders ----	15	370
Clay --------------------	19	38	Gumbo, blue ----------	129	499
Sand, fine -------------	11	49	Packsand, hard -------	8	507
Gumbo, blue ------------	56	105	Gumbo, pink ----------	13	520
Sand, white ------------	34	139	Sand, white ----------	45	565
Gumbo, blue ------------	66	205	Gumbo, blue ----------	1	566
Sand, white ------------	9	214			

Well UJ-62-51-712

Owner: Southern Pacific Co. Driller: --

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay, red --------------	21	21	Sand, coarse, gray ---	20	296
Quicksand --------------	17	38	Sand, hard -----------	188	484
Clay, blue -------------	25	63	Sand, loose ----------	87	571
Sand, fine, white -------	50	113	Sand, hard -----------	70	641
Gumbo, blue ------------	22	135	Gumbo, blue ----------	33	674
Sand, coarse, gray ------	18	153	Sand, white ----------	20	694
Sand, fine, white -------	23	176	Gumbo ----------------	11	705
Gumbo, blue ------------	17	193	Sand, hard -----------	87	792
Sand, fine, blue --------	34	227	Gumbo, blue ----------	5	797
Gumbo, blue ------------	49	276			

Well UJ-62-51-713

Owner: Southern Pacific RR Co. Driller: Layne-Bowler Co.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay --------------------	76	76	Clay, sandy ----------	16	292
Sand --------------------	34	110	Sand, blue -----------	90	382
Clay, blue --------------	140	250	Clay, blue -----------	8	390
Sand, white -------------	26	276	Sand, water-bearing --	45	435

Table 4.--Drillers logs of wells in Orange and Jefferson Counties--Continued

Well UJ-62-57-401

Owner: Texas Eastern Transport Co. Driller: Layne-Texas Co.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Topsoil ----------------	4	4	Sand -----------------	85	385
Shale and clay ----------	46	50	Shale ----------------	16	401
Sand and gravel, fine ---	72	122	Shale and sandy shale	17	418
Shale ------------------	8	130	Sand, shaly, fine ----	22	440
Sand and logs ----------	70	200	Sand, good -----------	41	481
Shale, blue -------------	100	300			

Well UJ-62-57-409

Owner: H. A. Cutler. Driller: Coastal Water Wells Co.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Topsoil ----------------	3	3	Shale, sandy ---------	41	321
Clay, black ------------	21	24	Sand ----------------	12	333
Sand ------------------	11	35	Shale, sandy ---------	31	364
Gumbo, blue ------------	23	58	Shale, sticky --------	30	394
Sand, white ------------	27	85	Sand, fine ----------	15	409
Shale, sandy -----------	20	105	Sand ----------------	74	483
Sand ------------------	35	140	Shale ---------------	33	516
Log -------------------	2	142	Sand ----------------	61	577
Sand ------------------	7	149	Shale ---------------	8	585
Shale -----------------	13	162	Sand, coarse --------	58	643
Shale, sandy -----------	103	265	Shale ---------------	29	672
Shale, hard ------------	15	280	Sand, fine ----------	26	698

Well UJ-62-57-501

Owner: Florida Gas Corp. Driller: Layne-Texas Co.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Topsoil ----------------	2	2	Sand, clay layers ----	96	146
Clay, sand ledges -------	34	36	Clay, sand layers ----	179	325
Sand ------------------	14	50	Sand, clay layers ----	11	336

Table 4.--Drillers logs of wells in Orange and Jefferson Counties--Continued

Well UJ-62-57-501--Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Sand, clay layers -------	14	350	Sand ----------------	6	393
Sand, clay layers -------	16	366	Clay ----------------	3	396
Clay -------------------	15	381	Sand, good ----------	49	445
Sand and clay ----------	6	387			

Well UJ-62-57-801

Owner: Luther Stark. Driller: The Texas Co.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface ----------------	13	13	Sand ----------------	19	241
Sand -------------------	23	36	Clay ----------------	24	265
Clay -------------------	7	43	Sand and boulders ----	37	302
Sand -------------------	35	78	Clay ----------------	55	357
Clay -------------------	97	175	Sand ----------------	30	387
Sand and boulders -------	30	205	Clay ----------------	64	451
Clay -------------------	17	222	Sand and boulders ----	72	523

Well UJ-62-57-802

Owner: J. S. Polk "B". Driller: Luther Patterson.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface, marsh ----------	25	25	Shale ---------------	328	426
Sand and mud ------------	35	60	Sand, water ----------	20	446
Sand -------------------	38	98	Shale ---------------	54	500

Well UJ-62-57-901

Owner: Gulf States Utilities Co. Driller: Coastal Water Wells Corp.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Topsoil ----------------	28	28	Clay, sandy ----------	23	277
Clay -------------------	40	68	Sand, fine, hard -----	15	292
Sand -------------------	20	88	Clay ----------------	40	332
Clay -------------------	29	117	Sand ----------------	5	337
Shale ------------------	117	234	Clay ----------------	45	382
Sand, fine, hard --------	20	254	Shale, sandy ---------	31	413

Table 4.--Drillers logs of wells in Orange and Jefferson Counties--Continued

Well UJ-62-57-901--Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Sand, shale streaks -----	28	441	Sand -----------------	126	684
Clay --------------------	117	558			

Well UJ-62-57-903

Owner: Gulf States Utilities Co. Driller: Coastal Water Wells Corp.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Topsoil ----------------	12	12	Shale ----------------	29	297
Sand -------------------	3	15	Clay -----------------	89	386
Clay -------------------	47	62	Shale ----------------	15	401
Sand and gravel ---------	29	91	Clay -----------------	26	427
Clay -------------------	86	177	Sand -----------------	6	433
Shale ------------------	17	194	Clay -----------------	12	445
Clay -------------------	74	268	Sand -----------------	19	464

Well UJ-62-57-904

Owner: Gulf States Utilities Co. Driller: Coastal Water Wells Corp.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Topsoil ----------------	10	10	Shale ----------------	74	294
Sand -------------------	4	14	Clay -----------------	92	386
Clay -------------------	46	60	Shale ----------------	38	424
Sand and gravel ---------	24	84	Clay -----------------	7	431
Clay -------------------	84	168	Sand -----------------	24	455
Shale, sandy ------------	24	192	Clay -----------------	25	480
Clay -------------------	28	220			

Well UJ-62-57-905

Owner: Gulf States Utilities Co. Driller: Coastal Water Wells Corp.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Topsoil ----------------	8	8	Shale ----------------	43	227
Sand -------------------	9	17	Shale ----------------	153	380
Clay -------------------	36	53	Clay -----------------	41	421
Sand and gravel ---------	24	77	Sand -----------------	43	464
Clay -------------------	107	184			

Table 4.--Drillers logs of wells in Orange and Jefferson Counties--Continued

Well UJ-62-58-303

Owner: Orange Products Co. Driller: Layne-Texas Co.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil and clay	42	42	Sand, fine, hard and clay	10	264
Sand	68	110	Clay, sandy, hard	27	291
Clay	5	115	Shale, sandy	9	300
Sand, fine and clay	19	134	Shale, soft	30	330
Sand, fine to coarse	18	152	Shale, sandy	35	365
Sand, fine	12	164	Gumbo	9	374
Clay, soft	6	170	Shale	176	550
Clay, blue and gumbo	69	239	Sand	150	700
Clay and sand	7	246	Shale, blue	15	715
Clay	8	254			

Well UJ-62-58-305

Owner: City of Orange. Driller: Layne-Texas Co.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil	2	2	Shale	42	259
Clay	5	7	Shale, sandy, streaks of sand	28	287
Clay and sandy clay	20	27	Shale	78	365
Shale and shell	20	47	Sand	5	370
Shale	9	56	Shale	30	400
Shale and wood	14	70	Shale, sandy	18	418
Shale	7	77	Shale and sandy shale	22	440
Sand, coarse, white	46	123	Shale	30	470
Shale	11	134	Shale, sandy	8	478
Shale and sandy shale	20	154	Shale	12	490
Shale, sandy, streaks of sand	34	188	Sand, fine, gray	75	565
Shale	21	209	Sand, good	10	675
Shale, sandy, and streaks of sand	8	217	Shale	50	725

Table 4.--Drillers logs of wells in Orange and Jefferson Counties--Continued

Well UJ-62-58-316

Owner: E. R. Odom. Driller: W. R. Banker.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface ----------------	22	22	Gumbo ----------------	25	443
Clay, sandy, red --------	33	55	Sand -----------------	20	463
Shale, gummy ------------	39	94	Gumbo ----------------	62	525
Sand --------------------	41	135	Sand -----------------	93	618
Gumbo, soft -------------	69	204	Packsand -------------	59	677
Shale, sandy ------------	46	250	Gumbo ----------------	51	728
Sand --------------------	20	270	Sand, water ----------	74	802
Gumbo, hard -------------	34	304	Gumbo ----------------	2	804
Packsand, hard ----------	114	418			

Well UJ-62-58-321

Owner: M. G. Inman. Driller: Layne-Louisiana.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Topsoil -----------------	6	6	Gumbo, hard ----------	94	394
Quicksand ---------------	5	11	Shale ----------------	59	453
Clay, sandy -------------	13	24	Sand, fine, black ----	163	616
Gumbo -------------------	51	75	Shale, sticky --------	28	644
Sand, water, white ------	100	175	Sand, coarse and gravel	45	689
Gumbo, hard -------------	89	264	Gumbo ----------------	2	691
Shale -------------------	36	300			

Well UJ-62-58-402

Owner: Orangefield Independent School District. Driller: Simmons Water Well Service.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Shale, blue -------------	35	35	Sand -----------------	15	185
Sand --------------------	90	125	Shale ----------------	15	200
Clay --------------------	15	140	Sand -----------------	15	215
Sand --------------------	15	155	Shale ----------------	15	230
Shale -------------------	15	170	Sand -----------------	15	245

Table 4.--Drillers logs of wells in Orange and Jefferson Counties--Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Well UJ-62-58-402--Continued					
Shale	95	340	Clay	10	410
Sand	10	350	Sand	15	425
Shale	15	365	Clay	15	440
Sand	35	400	Sand, water	95	535

Well UJ-62-58-701

Owner: The Texas Co. Driller: --

Soil and clay	12	12	Shale	24	307
Sand	48	60	Gumbo	63	370
Clay, soft, blue	8	68	Shale	21	391
Sand	35	103	Gumbo	24	415
Gumbo, soft	37	140	Shale and gravel	25	440
Sand, hard	10	150	Gumbo and gravel	172	612
Gumbo	24	174	Packsand, hard	43	655
Sand, hard	38	212	Sand, coarse	35	690
Gumbo	71	283	Gumbo	14	704

Well UJ-62-58-703

Owner: The Texas Co. Driller: --

Soil	2	2	Sand	25	240
Clay	16	18	Gumbo	166	406
Quicksand	42	60	Sand and gravel	61	467
Sandstone, hard	6	66	Gumbo, soft	79	546
Sand	24	90	Sand and gravel	64	610
Clay	17	107	Rock	1	611
Sand and gravel	20	127	Gravel, hard	28	639
Clay	23	150	Sand and gravel	52	691
Gumbo	50	200	Soapstone	5	696
Sand and soapstone	15	215	Gumbo	9	705

Table 4.--Drillers logs of wells in Orange and Jefferson Counties--Continued

Well UJ-62-58-804

Owner: E. W. Brown Estate. Driller: Frank Balcar.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay, yellow ------------	50	50	Clay ----------------	119	340
Shale ------------------	55	105	Shale, blue ----------	120	460
Clay and shale ----------	75	180	Gumbo and shale, blue	120	580
Sand -------------------	41	221	Sand ----------------	58	638

Well UJ-62-59-102

Owner: City of Orange Driller: Layne-Texas Co.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay -------------------	60	60	Sand, coarse ---------	25	349
Sand -------------------	53	113	Gumbo ---------------	91	440
Clay -------------------	3	116	Shale, sandy ---------	40	480
Sand -------------------	47	163	Gumbo ---------------	50	530
Sand, coarse -----------	7	170	Sand, fine, hard -----	110	640
Gumbo ------------------	154	324	Sand, coarse ---------	45	685

Well UJ-62-59-104

Owner: Gulf States Utilities Co. Driller: Layne-Texas Co.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Surface ----------------	10	10	Shale, soft ----------	144	323
Clay -------------------	19	29	Gumbo ---------------	89	412
Clay and sand layers ----	24	53	Sand, "salt and pepper"	66	478
Sand, coarse, white -----	73	126	Shale, soft ----------	73	551
Shale, sandy ------------	20	146	Sand, good -----------	196	747
Sand, fine, white -------	33	179	Shale ---------------	2	749

Well UJ-62-59-105

Owner: Gulf States Utilities Co. Driller: --

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Clay -------------------	50	50	Gumbo ---------------	220	403
Sand -------------------	35	85	Sand, fine, hard -----	32	435
Clay -------------------	13	98	Sand, fine -----------	10	445
Sand -------------------	85	183	Shale ---------------	35	480

Table 4.--Drillers logs of wells in Orange and Jefferson Counties--Continued

Well UJ-62-59-105--Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Gumbo -------------------	60	540	Sand, some gravel ----	30	670
Sand, fine --------------	61	601	Gravel ---------------	30	700
Sand --------------------	39	640	Gravel, coarse -------	55	755

Well UJ-62-59-113

Owner: Orange Pulp and Paper Mills, Inc. Driller: Layne-Bowler.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil --------------------	1	1	Gumbo ----------------	45	347
Clay --------------------	8	9	Sand -----------------	12	359
Quicksand ---------------	6	15	Gumbo ----------------	49	408
Clay --------------------	26	41	Sand -----------------	37	445
Gumbo -------------------	79	120	Gumbo ----------------	120	565
Sand --------------------	42	162	Sand -----------------	156	721
Gumbo -------------------	120	282	Gumbo ----------------	4	725
Sand --------------------	20	302			

Well UJ-62-59-115

Owner: H. J. Stark. Driller: Layne-Texas Co.

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil --------------------	2	2	Shale and sand streaks	99	422
Clay and sandy clay -----	63	65	Sand, fair -----------	38	460
Sand, loose -------------	104	169	Shale and sandy shale	83	543
Shale and sand, coarse --	65	234	Sand, broken ---------	27	570
Shale -------------------	89	323	Sand -----------------	40	610

Well UJ-62-59-409

Owner: Luther & Moore Lumber Co. Driller: --

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Soil --------------------	3	3	Sand -----------------	79	160
Clay --------------------	42	45	Gumbo ----------------	176	336
Sand --------------------	19	64	Sand, hard -----------	38	374
Gumbo -------------------	17	81	Gumbo ----------------	21	395

Table 4.--Drillers logs of wells in Orange and Jefferson Counties--Continued

	Thickness (feet)	Depth (feet)		Thickness (feet)	Depth (feet)
Well UJ-62-59-409--Continued					
Sand, hard	94	489	Sand, hard	185	734
Gumbo	60	549			
Well UJ-62-59-413					
Owner: Luther & Moore Lumber Co.			Driller: Layne-Bowler.		
Shell	3	3	Gumbo	160	453
Shell and clay	7	10	Packsand, hard	42	495
Sand	48	58	Gumbo	103	598
Wood	5	63	Packsand, hard	109	707
Sand	21	84	Gravel	40	747
Gumbo	107	191	Gumbo, hard	3	750
Sand	102	293			

Table 5.--Chemical analyses of water from wells in Orange County

(Analyses are in parts per million except specific conductance, pH, percent sodium, sodium adsorption ratio, and residual sodium carbonate.)

Water-bearing unit: M, "Middle" aquifer; L, "Lower" aquifer; U, "Upper" aquifer.

Well	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
UJ-61-56-101	220	Nov. 30, 1962	U	21	0.09	5.0	1.0	*83		200	0.0	22	0.8	0.0	--	231	17	92	8.8	2.95	375	7.2
110	100	Mar. 5, 1941	U	--	--	--	--	--	--	258	2	92	--	--	--	--	a/ 94	--	--	--	--	--
115	700?	do	L	--	--	--	--	--	--	460	2	445	--	--	--	--	a/ 44	--	--	--	--	--
	--	Nov. 30, 1962	L	14	.78	11	3.1	*498		469	.0	520	1.8	.0	--	1,280	40	96	34	6.88	2,220	7.5
116	800?	Mar. 5, 1941	L	--	--	--	--	--	--	411	2	88	--	--	--	--	a/ 38	--	--	--	--	--
301	458	Feb. 15, 1963	M	--	--	--	--	--	--	271	--	117	--	--	--	--	41	--	--	3.62	777	7.3
304	65	Apr. 4, 1941	U	--	--	1.6	7.5	*17		67	2	10	--	b/	--	71	35	--	--	--	--	--
305	46	Nov. 28, 1962	U	26	14	3.0	1.2	*22		30	3.0	23	.1	.0	--	93	12	79	2.8	.24	140	5.3
306	79	Apr. 4, 1941	U	--	--	.4	3.9	*18		37	2	17	--	b/	--	59	17	--	--	--	--	--
312	402	Feb. 15, 1963	M	18	--	9.5	2.1	*144		264	.0	90	.8	.0	--	407	32	91	11	3.69	679	7.4
313	378	do	M	--	--	--	--	--	--	300	--	106	--	--	--	--	45	--	--	4.02	777	7.4
402	460	Sept.26, 1941	M	19	.06	13	3.6	*507		450	2	550	1.5	.0	--	1,318	48	--	--	--	--	--
403	460	Dec. 16, 1941	M	--	--	109	21	*414		220	2	798	--	b/	--	1,452	358	--	--	--	--	--
405	1,470	Feb. 14, 1941	L	--	--	--	--	--	--	--	2	17,500	--	--	--	--	a/ 960	--	--	--	--	--
406	740	Before 1908	L	--	--	17	4.0	--	--	--	--	527	--	--	--	1,335	--	--	--	--	--	--
		Sept.26, 1941	L	24	.12	16	4.8	*506		436	2	565	1.0	.0	--	1,334	60	--	--	--	--	--
502	600?	Apr. 6, 1941	L(?)	--	--	3.6	8.8	*203		342	2	145	--	b/	--	530	45	--	--	--	--	--
506	167	Apr. 4, 1941	U	--	--	14	3.9	*141		299	3	79	--	.0	--	388	52	--	--	--	--	--
507	432	Feb. 15, 1963	M	--	--	--	--	--	--	290	--	130	--	--	--	--	58	--	3.59	3.59	841	6.9
601	160	Sept.17, 1941	U	--	--	3.2	3.4	*32		85	3	13	.2	b/	--	97	22	--	--	--	--	--
602	462	Feb. 14, 1963	M	18	--	8.5	2.0	*137		292	.0	60	.8	.0	--	385	29	91	11	4.21	624	7.3
603	192	Feb. 15, 1963	U	23	.32	20	5.4	*128		311	.0	66	.6	.0	--	405	72	79	6.6	3.66	665	7.2
605	294	Feb. 14, 1963	?	18	--	10	3.4	*134		282	.0	68	.9	.0	--	388	39	88	9.3	3.84	637	7.1
606	468	do	M	22	--	3.5	.8	*99		220	.0	32	1.0	.0	--	273	12	95	12	3.36	434	7.4
607	80	Apr. 4, 1941	U	--	--	.4	2.7	*14		24	10	9	--	b/	--	48	12	--	--	--	--	--

See footnotes at end of table.

Table 5.--Chemical analyses of water from wells in Orange County--Continued

Well	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
†UJ-61-56-901	410	June 28, 1960	M	23	0.06	8.0	2.0	194	1.2	240	0.0	185	0.8	0.0	0.00	548	28	93	16	3.37	961	7.2
		Nov. 30, 1962	M	23	.15	7.8	1.8	*196		236	.0	182	.8	.0	--	527	27	94	16	3.33	936	7.0
		Dec. 29, 1962	M	23	.08	10	3.1	217	1.3	258	.0	215	.8	2.0	--	599	38	92	15	3.37	1,070	7.7
902	475	Dec. 26, 1962	M	--	--	--	--	--	--	--	--	262	--	--	--	--	--	--	--	--	1,550	--
		Dec. 28, 1962	M	20	.15	22	5.9	354	2.1	292	.7	435	.7	1.8	--	986	80	90	17	3.20	1,800	7.6
907	420	Mar. 8, 1963	M	31	--	3.5	.9	*96		204	.0	36	.9	.0	--	268	10	94	12	3.10	423	7.2
909	180	Mar. 19, 1963	U	24	--	9.0	3.0	*96		240	1.4	30	.8	.0	--	282	35	86	7.1	3.24	471	6.7
910	400	do	M	--	--	--	--	--	--	203	--	93	--	--	--	--	9	--	--	3.15	611	7.2
911	486	Mar. 8, 1963	M	--	--	--	--	--	--	264	--	92	--	--	--	--	17	--	--	3.99	684	7.5
912	507	Mar. 7, 1963	M	--	--	--	--	--	--	219	--	64	--	--	--	--	13	--	--	3.33	532	7.8
913	30	Mar. 19, 1963	U	18	--	27	6.7	*25		113	10	32	.1	.0	--	175	95	36	1.1	.00	302	6.1
914	57	Apr. 4, 1941	U	--	--	64	7.5	*27		226	18	32	--	b/	--	260	190	--	--	--	--	--
915	102	do	U	--	--	16	2.7	*38		104	10	28	.0	b/	--	146	52	--	--	--	--	--
916	64	Mar. 26, 1941	U	--	--	83	10	*49		293	3	82	--	b/	--	371	251	--	--	--	--	--
917	143	do	U	--	--	22	3.2	*72		134	18	68	--	b/	--	249	67	--	--	--	--	--
918	120	do	U	--	--	35	8.0	*70		134	49	79	.0	b/	--	307	120	--	--	--	--	--
64-101	130	Mar. 5, 1963	U	--	--	--	--	--	--	430	--	408	--	--	--	--	346	--	--	.13	1,490	6.7
201	136	Mar. 6, 1963	U	--	--	--	--	--	--	43	--	110	--	--	--	--	159	--	--	.00	695	5.7
202	30	Mar. 26, 1941	U	--	--	4.0	5.6	*6.9		12	8	21	.0	b/	--	52	33	--	--	--	--	--
		Mar. 5, 1963	U	--	--	--	--	--	--	11	--	22	--	--	--	--	17	--	--	.00	106	6.1
203	125	Mar. 26, 1941	U	--	--	1.6	3.2	*19		37	2	18	--	b/	--	62	17	--	--	--	--	--
		Mar. 5, 1963	U	--	--	--	--	--	--	35	--	32	--	--	--	--	32	--	--	.00	156	5.9
204	35?	do	U	--	--	--	--	--	--	16	--	47	--	--	--	--	33	--	--	.00	209	6.1
206	161	Mar. 6, 1963	U	--	--	--	--	--	--	67	--	47	--	--	--	--	26	--	--	.58	268	6.9
207	430	do	M	27	--	16	4.4	*446		302	.0	550	1.1	.0	--	1,190	58	94	25	3.79	2,170	7.0
302	521	Nov. 30, 1962	M	22	.15	17	4.3	325	1.9	277	.0	385	.6	.0	--	892	60	92	18	3.34	1,620	7.1
304	400	Feb. 6, 1963	M	24	--	8.2	2.7	*281		289	.4	285	1.1	.0	--	759	32	95	22	4.11	1,330	7.0
305	472	Mar. 6, 1963	M	28	--	3.0	.8	*145		224	.0	100	1.0	.0	--	400	11	97	19	3.45	660	7.2
306	545	Mar. 7, 1963	M	26	.04	10	3.1	*369		290	1.2	425	.8	.8	--	979	38	95	26	3.99	1,770	7.3

See footnotes at end of table.

Table 5.--Chemical analyses of water from wells in Orange County--Continued

Well	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
UJ-61-64-307	200	Mar. 26, 1941	U	--	--	10	4.4	*128		262	8	69	--	b/	--	348	43	--	--	--	--	--
308	105	do	U	--	--	18	6.8	*94		128	29	101	--	b/	--	312	74	--	--	--	--	--
309	128	do	U	--	--	38	13	*155		153	117	170	0.0	b/	--	591	148	--	--	--	--	--
310	135	do	U	--	--	13	10	*89		165	29	74	--	b/	--	296	76	--	--	--	--	--
311	151	do	U	--	--	16	6.8	*88		214	17	48	.4	b/	--	281	69	--	--	--	--	--
312	144	do	U	--	--	19	9.2	*90		171	23	83	--	b/	--	308	86	--	--	--	--	--
313	20	Mar. 4, 1941	U	--	--	--	--	--	--	9	8	12	--	32	--	--	a/ 56	--	--	--	--	--
507	249	Mar. 5, 1963	M(?)	--	--	--	--	--	--	241	--	1,690	--	--	--	--	479	--	--	0.00	5,370	7.3
62-49-102	69	Apr. 29, 1941	U	--	--	15	5.1	*120		85	8	170	--	b/	--	360	58	--	--	--	--	--
106	40	do	U	--	--	113	90.0	*697		6	82	1,410	.50	106	--	2,500	650	--	--	--	--	--
204	80?	Sept.17, 1941	U	--	--	20	8.5	*94		98	12	139	.40	b/	--	322	85	--	--	--	--	--
503	117	Mar. 27, 1941	U	--	--	34	19	*56		201	13	74	--	b/	--	295	162	--	--	--	--	--
504	96	Mar. 19, 1963	U	--	--	--	--	--	--	188	--	81	--	--	--	--	146	--	--	.16	606	6.5
601	658	May 25, 1960	M	71	--	8.2	4.7	40	3.1	84	4.4	40	--	.2	0.20	213	40	67	2.7	.58	268	6.5
603	18	Sept.17, 1941	U	--	--	24	37	*124		6	23	185	--	240	--	636	213	--	--	--	--	--
606	100	May 1, 1941	U	--	--	29	12	*130		146	10	195	--	b/	--	452	123	--	--	--	--	--
702	220	Mar. 12, 1963	U	25	--	9.0	4.0	*102		256	5.4	30	.8	1.0	--	303	39	85	7.1	3.42	500	7.1
703	703	do	M	--	--	--	--	--	--	294	--	718	--	--	--	--	55	--	--	3.72	2,650	7.1
704	596	do	M	29	--	1.2	.0	*83		175	.0	27	.4	.0	--	227	3	98	21	2.81	348	7.3
705	18	Mar. 26, 1941	U	--	--	6.0	5.6	*35		31	.35	37	--	b/	--	134	38	--	--	--	--	--
706	194	do	U	--	--	4.0	4.4	*93		250	1	17	--	b/	--	242	28	--	--	--	--	--
707	65	Mar. 28, 1941	U	--	--	c/	3.2	*19		18	2	26	--	b/	--	59	13	--	--	--	--	--
708	105	Mar. 27, 1941	U	--	--	14	4.6	*42		104	13	32	--	b/	--	157	53	--	--	--	--	--
801	105	do	U	--	--	6.0	5.6	*30		67	8	28	--	b/	--	111	38	--	--	--	--	--
802	172	do	U	--	--	6.0	4.4	*91		244	1	20	.5	b/	--	243	33	--	--	--	--	--
		Mar. 1963	U	--	--	--	--	--	--	250	--	23	--	--	--	--	34	--	--	3.42	448	7.2
803	98	Mar. 27, 1941	U	--	--	30	20	*84		171	96	71	--	b/	--	385	157	--	--	--	--	--

See footnotes at end of table.

Table 5.--Chemical analyses of water from wells in Orange County--Continued

Well	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
UJ-62-49-901	20	May 1, 1941	U	--	--	12	2.7	*19		18	12	38	--	4.0	--	97	42	--	--	--	--	--
902	580	Sept.19, 1941	M	--	--	11	3.6	*43		1,161	2	28	--	b/	--	145	42	--	--	--	--	--
903	85	Mar. 27, 1941	U	--	--	2.8	8.0	*108		195	19	67	--	b/	--	301	40	--	--	--	--	--
50-103	91	May 1, 1941	U	--	--	--	--	--	--	98	2	70	--	b/	--	--	--	--	--	--	--	--
104	113	do	U	--	--	14	3.9	*45		110	4	40	--	b/	--	161	52	--	--	--	--	--
201	590	May 23, 1960	M	48	--	7.8	3.9	33	2.5	81	4.4	28	--	.2	0.05	168	36	65	2.4	0.62	225	6.2
204	165	Sept.17, 1941	U	--	--	6.8	2.4	*35		85	2	22	--	b/	--	113	27	--	--	--	--	--
204	165	Feb. 1963	U	--	7.9	--	--	--	--	102	--	43	--	--	--	--	30	--	--	1.07	316	5.9
401	354	Feb. 6, 1963	M	41	.66	6.0	2.2	*36		107	.0	10	0.2	.0	--	159	24	77	3.2	1.27	201	6.3
403	140	Apr. 10, 1941	U	--	--	15	10	*107		153	25	115	--	b/	--	347	81	--	--	--	--	--
406	216	Feb. 8, 1963	M	22	.13	9.0	4.4	*80		223	.2	22	.4	.0	--	256	41	8.1	5.4	2.84	410	6.8
407	425	Sept.17, 1941	M	50	1.0	12	3.6	*36		115	2.0	18	.1	.5	--	192	45	--	--	--	--	--
		Feb. 8, 1963	M	55	--	10	3.3	*35		106	.8	18	.2	.0	--	190	38	66	2.5	.97	235	6.2
501	108	May 2, 1941	U	--	--	--	--	--	--	177	12	42	--	b/	--	--	--	--	--	--	--	--
502	500?	Mar. 21, 1963	M	--	--	--	--	--	--	103	--	27	--	--	--	--	48	--	--	.73	250	6.4
503	102	Feb. 12, 1941	U	--	--	--	--	--	--	--	2	26	--	--	--	--	a/ 44	--	--	--	--	--
		Mar. 21, 1963	U	--	--	--	--	--	--	100	--	30	--	--	--	--	38	--	--	.88	256	6.2
505	114	Sept.17, 1941	U	--	--	13	3.6	*33		104	2	22	.3	b/	--	125	47	--	--	--	--	--
607	15	May 2, 1941	U	--	--	--	--	--	--	18	5	82	--	b/	--	--	--	--	--	--	--	--
701	782	Sept.20, 1941	M	--	--	15	4.9	*139		134	2	174	1.0	b/	--	402	58	--	--	--	--	--
705	700?	Sept.17, 1941	M	50	1.1	10	4.4	*200		207	2	215	.8	.5	--	586	43	--	--	--	--	--
706	115	May 1, 1941	U	--	--	35	12	*123		134	6	205	--	b/	--	447	138	--	--	--	--	--
801	449	Feb. 7, 1963	M	54	.64	10	2.5	*48		141	.2	17	.3	.0	--	201	35	75	3.5	1.61	280	6.5
802	100	Apr. 7, 1941	U	--	--	15	10	*107		165	47	93	--	b/	--	353	81	--	--	--	--	--
803	105	Apr. 4, 1947	U	--	--	34	19	*75		195	23	100	--	b/	--	347	162	--	--	--	--	--
804	800?	Mar. 21, 1963	M	42	--	4.5	1.8	*217		183	.2	240	.7	.2	--	596	18	96	22	2.63	1,040	6.5
805	11	May 2, 1941	U	--	--	19	12	*57		73	31	92	.3	b/	--	247	98	--	--	--	--	--

See footnotes at end of table.

Table 5.--Chemical analyses of water from wells in Orange County--Continued

Well	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
UJ-62-50-806	110	Apr. 4, 1941	U	--	--	23	17	*86		214	29	76	--	b/	--	336	125	--	--	--	--	--
901	98	Apr. 3, 1941	U	--	--	17	10	*82		201	61	26	--	b/	--	295	86	--	--	--	--	--
903	214	Apr. 1, 1941	U	--	--	47	24	*174		232	60	94	0.1	b/	--	713	215	--	--	--	--	--
904	566	Dec. 16, 1941	M	15	0.28	8.3	35	*208		348	2	141	.6	0.0	--	550	35	--	--	--	--	--
907	108	Apr. 3, 1941	U	--	--	30	20	*85		171	151	32	--	.0	--	402	157	--	--	--	--	--
51-101	21	May 2, 1941	U	--	--	20	20	*19		18	2	64	--	82	--	216	132	--	--	--	--	--
		Jan. 18, 1963	U	29	.14	6.0	3.6	*20		33	19	18	.1	.0	--	112	30	59	1.6	0.00	146	5.6
102	175	May 2, 1945	U	--	--	16.0	7.5	*57		195	4	20	.3	1.5	--	202	70	--	--	--	--	--
		Jan. 21, 1963	U	25	.10	16.0	5.3	*58		200	3.4	13	.4	.0	--	226	62	67	3.2	2.04	353	7.1
401	420	Jan. 18, 1963	M	34	.03	14	3.8	*51		166	2.4	16	.3	.2	--	216	51	69	3.1	1.71	303	6.9
403	229	Apr. 10, 1941	?	--	--	7.2	2.0	*58		146	3	21	--	b/	--	163	26	--	--	--	--	--
404	20	May 2, 1941	U	--	--	--	--	--	--	12	27	87	--	b/	--	--	--	--	--	--	--	--
405	22	do	U	--	--	6.4	2.7	*23		24	4	36	--	2.4	--	87	27	--	--	--	--	--
704	419	Sept.20, 1941	M	50	.01	11	3.6	*66		176	2	28	.1	.2	--	248	42	--	--	--	--	--
707	503	Oct. 31, 1962	M	45	.54	10	3.1	64	2.1	169	1.8	24	.5	.0	--	242	38	77	4.5	2.01	332	6.7
57-101	640	Mar. 4, 1962	M	--	--	--	--	--	--	300	2	510	--	--	--	--	70	--	--	--	--	--
103	73	Mar. 26, 1941	U	--	--	4.0	5.6	*11		43	1	15	--	b/	--	58	33	--	--	--	--	--
104	19	Mar. 28, 1941	U	--	--	4.4	5.4	*15		12	7	34	--	b/	--	72	33	--	--	--	--	--
202	138	do	U	--	--	7.2	9.2	*89		153	49	52	--	b/	--	281	56	--	--	--	--	--
203	740	Sept.17, 1941	M	37	.34	2.2	.8	*106		188	2	58	.4	.0	--	299	9	--	--	--	--	--
		Mar. 13, 1963	M	36	--	1.0	.0	*108		179	.0	64	.5	.0	--	298	2	99	33	2.88	480	7.0
205	102	Mar. 28, 1941	U	--	--	6.4	6.8	*63		122	22	42	.0	b/	--	200	44	--	--	--	--	--
302	35	do	U	--	--	131	55	*84		153	517	52	--	b/	--	914	554	--	--	--	--	--
401	481	Mar. 1, 1963	M	31	--	3.0	.6	*110		178	.0	72	.5	.0	--	305	10	96	15	2.72	502	7.5
403	483	Feb. 28, 1963	M	34	--	2.0	.7	*93		163	.0	54	.4	.0	--	264	8	96	14	2.51	423	7.3
404	483	do	M	--	--	--	--	--	--	198	--	182	--	--	--	--	32	--	--	2.61	932	7.0
407	372	Mar. 7, 1963	M	33	--	3.0	.8	*113		202	.2	63	.7	.0	--	315	11	96	15	3.10	509	7.3
408	385	Feb. 28, 1963	M	--	--	--	--	--	--	238	--	43	--	--	--	--	11	--	--	3.68	498	7.5

See footnotes at end of table.

Table 5.--Chemical analyses of water from wells in Orange County--Continued

Well	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
UJ-62-57-409	643	May 25, 1960	M	26	--	7.5	3.5	297	1.5	243	0.2	345	--	0.0	0.18	800	33	95	22	3.32	1,470	7.5
410	430	Nov. 30, 1962	M	29	0.09	.8	.0	*77		152	.0	31	0.4	.0	--	213	2	99	24	2.45	340	7.3
411	70?	Apr. 4, 1941	U	--	--	19	14	*74		122	35	90	--	b/	--	292	103	--	--	--	--	--
412	73	Apr. 1, 1941	U	--	--	2.0	4.4	*67		55	3	86	--	b/	--	189	23	--	--	--	--	--
413	44	do	U	--	--	4.0	5.6	*63		55	20	74	--	b/	--	194	33	--	--	--	--	--
414	105	do	U	--	--	7.2	2.0	*23		55	12	14	--	b/	--	85	26	--	--	--	--	--
415	112	do	U	--	--	28	15	*133		153	128	117	.0	b/	--	496	134	--	--	--	--	--
501	445	Mar. 1, 1963	M	32	--	2.2	.8	*82		174	.0	30	.5	.0	--	234	9	95	12	2.68	361	7.2
502	528	Sept.16, 1941	M	--	--	4.8	3.6	*102		195	2	60	.7	b/	--	396	27	--	--	--	--	--
506	505	Apr. 1, 1941	M	--	--	c/	2.0	*108		250	2	26	--	b/	--	261	--	--	--	--	--	--
507	110	Apr. 3, 1941	U	--	--	21	24	*100		122	97	118	--	b/	--	420	150	--	--	--	--	--
508	16	do	U	--	--	7.2	3.2	*29		31	27	30	--	b/	--	113	32	--	--	--	--	--
602	17	do	U	--	--	20	12	*79		37	17	134	--	41	--	321	97	--	--	--	--	--
603	14	do	U	--	--	6.4	6.8	*96		31	17	135	--	25	--	301	44	--	--	--	--	--
604	16	do	U	--	--	42	34	*204		92	121	295	.1	90	--	831	246	--	--	--	--	--
605	489	Mar. 14, 1963	M	40	--	1.8	.5	*70		145	.0	27	.3	.0	--	211	7	96	12	2.25	306	6.9
701	450?	Feb. 28, 1963	M	33	--	3.0	1.1	*124		276	.4	35	1.8	.2	--	343	12	96	16	4.28	529	7.2
702	113	Apr. 4, 1941	U	--	--	6.0	1.5	*60		37	8	81	--	.0	--	175	21	--	--	--	--	--
801	523	Apr. 5, 1941	M	--	--	5.2	2.0	*95		232	2	26	--	b/	--	244	21	--	--	--	--	--
		Mar. 7, 1963	M	34	--	1.5	.6	*96		212	.0	28	.7	.0	--	265	6	97	17	3.35	410	7.5
802	500	Dec. 16, 1941	M	38	6.9	5.8	2.2	*80		174	2	37	.6	.0	--	261	24	--	--	--	--	--
901	630	Feb. 20, 1963	M	--	--	--	--	--	--	213	--	690	--	--	--	--	116	--	--	1.17	2,440	7.0
903	464	Feb. 25, 1913	M	--	--	--	--	--	--	248	--	67	--	--	--	--	14	--	--	3.78	590	7.2
904	458	do	M	28	--	2.0	1.3	*108		220	.0	44	.7	.0	--	294	10	96	15	3.40	479	7.1
906	15?	Apr. 3, 1941	U	--	--	16	12	*116		43	39	129	--	101	--	434	87	--	--	--	--	--
58-102	630	Sept.19, 1941	--	--	--	8.8	2.4	*54		122	2	34	--	b/	--	161	32	--	--	--	--	--
105	607	Feb. 14, 1941	M	--	--	--	--	--	--	--	2	20	--	--	--	--	a/ 42	--	--	--	--	--

See footnotes at end of table.

Table 5.--Chemical analyses of water from wells in Orange County--Continued

Well	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
UJ-62-58-106	82	Feb. 14, 1941	U	--	--	--	--	--	--	246	100	70	--	--	--	--	a/198	--	--	--	--	--
107	679	Sept.20, 1941	M	49	0.08	85	2.8	*117		164	2	106	0.2	0.2	--	375	38	--	--	--	--	--
202	432	Apr. 3, 1941 Mar. 15, 1963	M M	-- --	-- --	4.4 --	2.7 --	*75 --	 --	195 275	2 --	16 22	-- --	b/ --	-- --	196 --	22 25	-- --	-- --	-- 4.01	-- 473	-- 7.3
203	610	Apr. 3, 1941	M	--	--	14	6.1	*37		140	2	16	--	b/	--	144	59	--	--	--	--	--
204	709	Mar. 21, 1963	M	55	--	8.0	3.0	*48		128	.4	21	.3	.0	--	199	32	76	3.7	1.45	269	6.4
205	107	Apr. 8, 1941	U	--	--	10	6.8	*16		85	9	6	--	--	--	90	54	--	--	--	--	--
302	10	Apr. 2, 1941	U	--	--	62	21	*142		330	117	114	--	b/	--	618	243	--	--	--	--	--
303	719	Oct. 16, 1940 Dec. 16, 1941	M M	45 46	7.8 .69	19.1 14	5.0 4.6	*182 *166		210 196	5.4 2	204 178	-- .3	-- .0	-- --	679 508	-- 54	-- --	-- --	-- --	-- --	-- --
304	719	July 13, 1960 Apr. 2, 1963	M M	50 49	.07 1.2	16 16	5.4 5.4	167 *169	2.9 	189 188	.0 .2	196 195	.3 .4	.0 .0	-- --	531 527	62 62	85 86	9.2 9.3	1.86 1.84	927 910	7.0 7.3
‡ 305	622	Sept.15, 1961 May 21, 1963 May 22, 1963	M M M	50 -- 46	1.4 -- .60	18 -- 22	6 -- 8.0	*95 -- *189	 -- 	171 182 184	1 -- .4	97 200 245	-- -- .3	-- -- .0	-- -- --	343 -- 601	71 -- 88	-- 82 82	-- -- 8.8	-- 1.34 1.26	570 1,240 1,040	7.3 6.8 6.8
308	570	do	M	--	--	--	--	--	--	176	--	162	--	--	--	--	86	--	--	1.16	989	6.9
309	650?	do	M	--	--	--	--	--	--	198	--	290	--	--	--	--	116	--	--	.93	1,410	7.2
310	579	do	M	--	--	--	--	--	--	154	--	50	--	--	--	--	64	--	--	1.24	539	6.8
313	790	Feb. 18, 1941	M	--	--	--	--	--	--	--	2	39	--	--	--	--	a/ 38	--	--	--	--	--
314	1,000	Apr. 2, 1941	M	--	--	19	9.2	*273		232	1	345	.6	b/	--	762	86	--	--	--	--	--
315	562	do	M	--	--	18	4.4	*64		153	7	49	--	b/	--	217	63	--	--	--	--	--
316	804	June 26, 1941	M	--	--	--	--	--	--	250	2	475	--	.0	--	--	a/ 57	--	--	--	--	--
317	179	Mar. 27, 1941	U	--	--	19	10	*124		275	29	73	--	1.0	--	391	91	--	--	--	--	--
318	600?	Sept.17, 1941	M	--	--	6.8	3.6	*64		165	2	58	.5	b/	--	216	32	--	--	--	--	--
319	765	Feb. 11, 1941	M	--	--	--	--	--	--	243	2	265	--	--	--	--	a/ 86	--	--	--	--	--
320	163	Mar. 27, 1941	U	--	--	25	9.2	*105		244	37	63	.0	.0	--	359	101	--	--	--	--	--
321	691	Apr. 8, 1941	M	--	--	20	6.8	*242		195	2	314	--	b/	--	681	79	--	--	--	--	--
322	662	Feb. 11, 1941	M	--	--	--	--	--	--	--	3	46	--	--	--	--	a/ 56	--	--	--	--	--
323	116	Apr. 3, 1941	U	--	--	17	14	*83		128	47	89	--	b/	--	313	98	--	--	--	--	--

See footnotes at end of table.

Table 5.--Chemical analyses of water from wells in Orange County--Continued

Well	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
UJ-62-58-402	535	Feb. 7, 1963	M	50	0.11	1.2	0.7	*78		149	0.2	38	0.2	0.0	--	249	6	97	14	2.32	350	7.0
406	540	Mar. 18, 1963	M	--	--	--	--	--	--	165	--	67	--	--	--	--	11	--	--	2.48	465	7.1
407	567	do	M	--	--	--	--	--	--	182	--	154	--	--	--	--	12	--	--	2.74	779	7.2
408	640	Sept.19, 1941	M	--	--	15	4.7	*164		195	2	178	--	b/	--	460	a/ 57	--	--	--	--	--
409	659	do	M	--	--	12	3.6	*147		195	2	144	--	b/	--	405	45	--	--	--	--	--
		Mar. 15, 1963	M	--	--	--	--	--	--	188	--	172	--	--	--	--	20	--	--	2.68	837	7.1
412	600?	Feb. 17, 1941	M	--	--	--	--	--	--	--	2	214	--	--	--	--	a/ 24	--	--	--	--	--
413	600?	do	M	--	--	--	--	--	--	--	2	238	--	--	--	--	a/ 33	--	--	--	--	--
415	700	do	M	--	--	--	--	--	--	--	2	170	--	--	--	--	a/ 32	--	--	--	--	--
		Mar. 18, 1963	M	--	--	--	--	--	--	212	--	340	--	--	--	--	35	--	--	2.77	1,390	7.0
416	856	Feb. 17, 1941	M	--	--	--	--	--	--	226	2	335	--	--	--	--	a/ 50	--	--	--	--	--
417	112	Mar. 28, 1941	U	--	--	123	70	*220		305	537	186	.1	b/	--	1,286	593	--	--	--	--	--
419	470	do	M	--	--	c/	4.4	*103		250	1	25	--	b/	--	256	18	--	--	--	--	--
420	471	do	M	--	--	.8	.7	*102		232	1	24	.6	b/	--	243	5	--	--	--	--	--
421	500?	do	M	--	--	c/	2.0	*125		171	2	97	--	b/	--	310	8	--	--	--	--	--
422	170	do	U	--	--	6.0	5.6	*159		348	22	54	--	.5	--	418	38	--	--	--	--	--
505	535	Mar. 1, 1941	M	--	--	--	--	--	--	214	2	310	--	--	--	--	a/ 46	--	--	--	--	--
508	75	Mar. 28, 1941	U	--	--	138	86	*149		323	389	249	.0	b/	--	1,171	698	--	--	--	--	--
509	460	Apr. 2, 1941	M	--	--	1.2	2.0	*88		201	2	24	.4	b/	--	216	11	--	--	--	--	--
510	584	Sept.17, 1941	M	--	--	27	4.9	*57		146	2	64	--	b/	--	227	88	--	--	--	--	--
511	711	Feb. 19, 1941	M	--	--	--	--	--	--	--	2	96	--	--	--	--	a/ 44	--	--	--	--	--
512	600?	Sept.18, 1941	M	--	--	6.4	1.2	*139		201	2	111	--	b/	--	359	21	--	--	--	--	--
601	600?	Mar. 1, 1941	M	--	--	--	--	--	--	178	2	47	--	--	--	--	a/ 44	--	--	--	--	--
602	700	Feb. 18, 1941	M	--	--	--	--	--	--	--	2	111	--	--	--	--	a/ 56	--	--	--	--	--
		Apr. 2, 1963	M	--	--	--	--	--	--	183	--	111	--	--	--	--	32	--	--	2.36	640	7.4
603	356	Dec. 16, 1941	M	20	.13	14	5.7	*173		356	2	100	.3	.0	--	490	58	--	--	--	--	--
604	707	Apr. 14, 1963	M	--	--	--	--	--	--	188	--	151	--	--	--	--	28	--	--	2.52	769	7.3
605	717	do	M	42	--	3.5	1.5	*126		182	.0	98	.4	.0	--	360	14	95	15	2.69	593	7.2

See footnotes at end of table.

Table 5.--Chemical analyses of water from wells in Orange County--Continued

Well	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
UJ-62-58-606	710	Apr. 14, 1963	M	--	--	--	--	--	--	187	--	87	--	--	--	--	14	--	--	2.78	554	7.2
607	600?	Apr. 12, 1941	M	--	--	4.8	0.7	*102		214	1	43	--	b/	--	257	15	--	--	--	--	--
608	736	June 24, 1963	M	41	--	3.8	1.1	*116		202	.0	70	0.5	0.0	--	331	14	95	13	3.03	520	7.6
609	726	June 29, 1963	M	40	--	4.8	1.5	*112		200	.8	67	.4	.0	--	324	18	93	11	2.92	512	7.3
611	703	June 1945	M	43	0.46	7.4	2.8	*95		194	2	51	1.0	.8	--	300	30	--	--	--	531	8.0
	820	do	M	--	--	22	9.2	*692		281	2	965	--	2.8	--	1,830	93	--	--	--	--	--
	883	do	M	--	--	27	10	*820		288	2	1,170	--	2.5	--	2,230	108	--	--	--	--	--
	941	do	M	--	--	66	27	*1,310		309	2	2,030	--	2.2	--	3,596	276	--	--	--	--	--
612	735	June 29, 1963	M	41	--	6.2	2.1	*135		202	.0	107	.4	.0	--	391	24	92	12	2.83	633	7.4
614	726	Nov. 2, 1945	M	41	.34	8.5	2.5	*103		198	.4	66	.2	0	--	326	32	--	--	--	513	7.9
616	718	Apr. 4, 1963	M	--	--	--	--	--	--	185	--	238	--	--	--	--	40	--	--	2.23	1,020	6.9
623	460	Apr. 2, 1963	M	27	--	4.8	1.6	*86		218	.0	19	.4	.0	--	258	19	91	8.6	3.20	448	7.4
624	578	Feb. 19, 1941	M	--	--	--	--	--	--	224	2	17	--	--	--	--	a/ 20	--	--	--	--	--
625	462	Dec. 16, 1941	M	45	.12	5.7	2.0	*88		180	2	45	.2	.1	--	277	22	--	--	--	--	--
626	620	Apr. 13, 1963	M	43	--	9.8	3.2	*90		166	.0	68	.5	.0	--	314	38	84	6.3	1.97	541	6.6
627	600?	Apr. 2, 1941	M	--	--	5.2	2.0	*136		183	2	117	--	b/	--	352	21	--	--	--	--	--
628	600?	do	M	--	--	8.0	4.4	*64		159	3	32	--	b/	--	189	38	--	--	--	--	--
630	720	Sept.18, 1941	M	--	--	14	4.7	*105		250	2	52	--	b/	--	301	53	--	--	--	--	--
701	704	Feb. 18, 1941	M	--	--	--	--	--	--	--	2	170	--	--	--	--	a/ 52	--	--	--	--	--
		Feb. 18, 1963	M	33	--	3.5	1.4	*179		194	.0	172	.5	.0	--	484	14	96	21	2.89	846	7.4
702	700	July 13, 1960	M	34	.08	2.0	.5	135	1.0	225	.0	83	.4	.0	--	372	7	97	22	3.55	610	7.4
		Feb. 25, 1963	M	34	--	3.0	1.2	*138		222	.0	92	.5	.0	--	378	12	96	17	3.39	631	7.1
703	705	May 1, 1940	M	37	2.6	3.6	.7	--	--	202	.5	172	--	--	--	--	--	--	--	--	--	--
		Sept.17, 1940	M	38	.0	4.0	1.1	*168		202	2	150	.3	.2	--	463	14	--	--	--	--	--
		Feb. 18, 1963	M	--	5.6	--	--	--	--	262	--	103	--	--	--	--	87	--	--	2.55	765	6.6
704	700?	July 1, 1941	M	--	--	--	--	--	--	209	2	60	--	.0	--	--	a/ 14	--	--	--	--	--
705	385	Feb. 18, 1941	M	--	--	--	--	--	--	256	2	32	--	--	--	--	a/ 26	--	--	--	--	--
706	480	Sept.20, 1941	M	19	.09	5.3	1.5	*141		310	2	48	.8	.0	--	376	19	--	--	--	--	--
707	725	Mar. 1, 1941	M	--	--	--	--	--	--	240	2	75	--	--	--	--	a/ 14	--	--	--	--	--
§ 801	--	Apr. 21, 1952	M	--	--	30	9.2	*878		292	0	1,260	--	--	--	2,668	112	94	36	2.55	--	8.2

See footnotes at end of table.

Table 5.--Chemical analyses of water from wells in Orange County--Continued

Well	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
UJ-62-58-802	250	Apr. 4, 1963	U	--	--	--	--	--	--	354	--	665	--	--	--	--	356	--	--	0.00	2,530	7.0
803	194	Feb. 18, 1941	U	--	--	--	--	--	--	360	2	665	--	--	--	--	a/ 338	--	--	--	--	--
804	638	Sept.18, 1941	M	--	--	11	4.9	*144		232	2	120	--	b/	--	396	48	--	--	--	--	--
805	22	Apr. 13, 1941	U	--	--	7.2	6.8	*33		37	18	32	--	27	--	142	44	--	--	--	--	--
806	900	Mar. 1, 1941	M	--	--	--	--	--	--	278	2	915	--	--	--	--	a/ 122	--	--	--	--	--
807	97	Mar. 28, 1941	U	--	--	134	59	*270		348	369	350	--	b/	--	353	576	--	--	--	--	--
808	620	Apr. 2, 1941	M	--	--	5.6	3.2	*115		189	1	85	--	b/	--	303	57	--	--	--	--	--
901	600?	do	M	90	0.04	4.3	1.9	*135		206	2	100	0.3	.0	--	449	18	--	--	--	--	--
903	630?	Sept.18, 1941	M	--	.15	18	7.3	*363		250	2	465	.8	b/	--	1,015	75	--	--	--	--	--
904	600?	do	M	--	.20	13	3.6	*377		256	2	462	.7	b/	--	1,020	47	--	--	--	--	--
905	600?	do	M	--	.20	10	7.3	*462		256	2	600	.5	b/	--	1,247	55	--	--	--	--	--
906	694	do	M	42	.01	3.4	.9	*124		190	2	87	.4	.0	--	354	12	--	--	--	--	--
§ 59-101	735	June 1958	M	285	.7	13	2	*124		195	.2	106	--	--	--	496	40	--	--	--	637	--
102	685	Apr. 12, 1941	M	51	.39	9.2	3.0	*92		168	2.2	52	--	.4	--	293	35	--	--	--	--	--
103	688	May 21, 1963	M	50	--	9.0	2.8	*96		176	.2	68	.5	.0	--	314	34	86	7.2	2.21	495	7.7
104	749	Apr. 12, 1941	M	48	.34	8.6	2.0	*105		198	1.6	67	--	.3	--	335	30	--	--	--	--	--
105	755	Feb. 11, 1941	M	--	--	--	--	--	--	--	2	74	--	--	--	--	a/ 38	--	--	--	--	--
106	750	do	M	--	--	--	--	--	--	--	2	112	--	--	--	--	a/ 40	--	--	--	--	--
107	745	Apr. 13, 1944	M	--	--	--	--	--	--	200	--	61	--	--	--	--	a/ 63	--	--	--	--	--
		May 21, 1963	M	44	--	7.2	2.2	*140		218	.6	107	.8	.0	--	409	27	92	12	3.03	660	7.4
109	675	Feb. 8, 1941	M	--	--	--	--	--	--	178	2	106	--	--	--	--	a/ 52	--	--	--	--	--
110	650?	Feb. 11, 1941	M	--	--	--	--	--	--	--	2	152	--	--	--	--	a/ 75	--	--	--	--	--
111	600?	Dec. 16, 1941	M	45	.54	10	3.4	*102		178	2	79	.4	.0	--	335	39	--	--	--	--	--
112	600?	Feb. 8, 1941	M	--	--	--	--	--	--	--	2	90	--	--	--	--	a/ 56	--	--	--	--	--
114	686	Feb. 11, 1941	M	--	--	--	--	--	--	--	2	42	--	--	--	--	a/ 48	--	--	--	--	--
116	602	Apr. 13, 1963	M	--	--	--	--	--	--	163	--	29	--	--	--	--	41	--	--	1.85	343	7.1

See footnotes at end of table.

Table 5.--Chemical analyses of water from wells in Orange County--Continued

Well	Depth of well (ft)	Date of collection	Water-bearing unit	Silica (SiO_2)	Iron (Fe)	Calcium (Ca)	Magnesium (Mg)	Sodium (Na)	Potassium (K)	Bicarbonate (HCO_3)	Sulfate (SO_4)	Chloride (Cl)	Fluoride (F)	Nitrate (NO_3)	Boron (B)	Dissolved solids	Hardness as $CaCO_3$	Percent sodium	Sodium adsorption ratio (SAR)	Residual sodium carbonate (RSC)	Specific conductance (micromhos at 25°C)	pH
UJ-62-59-117	650?	Feb. 11, 1941	M	--	--	--	--	--	--	--	2	52	--	--	--	--	a/ 38	--	--	--	--	--
		Apr. 13, 1944	M	--	--	--	--	--	--	206	--	104	--	--	--	--	51	--	--	--	--	--
118	600?	Apr. 4, 1941	M	--	--	6.4	2.7	*141		195	2	120	0.5	b/	--	369	27	--	--	--	--	--
119	608	Sept.16, 1941	M	47	0.48	13	3.6	*92		180	2	70	.1	0.0	--	327	48	--	--	--	--	--
120	600?	Sept.22, 1941	M	--	--	18	1.2	*78		171	2	56	--	b/	--	239	51	--	--	--	--	--
121	650?	Feb. 11, 1941	M	--	--	--	--	--	--	--	2	23	--	--	--	--	a/ 32	--	--	--	--	--
122	500?	Feb. 8, 1941	M	--	--	--	--	--	--	--	2	24	--	--	--	--	a/ 34	--	--	--	--	--
404	730	Feb. 19, 1941	M	--	--	--	--	--	--	--	2	64	--	--	--	--	a/ 34	--	--	--	--	--
405	756	Sept.20, 1941	M	--	--	13	2.4	*98		207	2	58	.3	b/	--	275	42	--	--	--	--	--
406	650?	Feb. 10, 1941	M	--	--	--	--	--	--	--	2	28	--	--	--	--	a/ 26	--	--	--	--	--
407	650?	do	M	--	--	--	--	--	--	--	2	76	--	--	--	--	a/ 34	--	--	--	--	--
408	650?	Dec. 16, 1941	M	43	.40	7.1	2.4	*82		178	2	41	.4	.0	--	266	28	--	--	--	--	--
410	650?	Feb. 10, 1941	M	--	--	--	--	--	--	--	2	59	--	--	--	--	a/ 32	--	--	--	--	--
411	650?	Dec. 16, 1941	M	40	.49	4.2	1.4	*86		192	2	66	.4	.0	--	316	16	--	--	--	--	--
412	620	Feb. 10, 1941	M	--	--	--	--	--	--	196	2	52	--	--	--	--	a/ 38	--	--	--	--	--
413	750	Sept.22, 1941	M	--	--	8.8	4.9	*93		207	2	51	.4	.0	--	262	42	--	--	--	--	--
414	670?	do	M	--	--	52	18	*362		226	2	570	--	b/	--	1,115	203	--	--	--	--	--
415	650?	Sept.16, 1941	M	--	--	12	7.3	*138		183	2	147	.4	b/	--	397	60	--	--	--	--	--
63-02-101	560?	Apr. 4, 1963	M	--	--	--	--	--	--	136	--	1,180	--	--	--	--	219	--	--	0.00	3,310	7.8

a/ Soap hardness.
b/ Less than 20 ppm.
c/ Less than 5 ppm.
* Sodium and potassium calculated as sodium (Na).
† Well 61-56-901 Manganese (Mn), 0.02; Phosphate (PO_4), 0.32.
‡ Analyzed by Microbiology Service Lab., Houston, Texas.
§ Analyzed by Curtis Laboratories.